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Soft Constitutions:
Co-Producing Neuro-Innovation and Society in the US, EU, and OECD

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Abstract

Technoscientific innovation has become a ubiquitous *leitmotiv* for public policies in the 21st century. Yet, the overt embrace of innovation on the part of public institutions also poses new governance challenges to ensure that new knowledge and technologies contribute to socially beneficial ends. Over the last decades, "soft law" instruments – i.e. non-binding norms and principles for the ethical or responsible governance of innovation – have emerged as an increasingly prominent approach to mediate the relationship between innovation and social values and concerns while also avoiding some of the pitfalls of traditional regulation.

In this thesis, I draw on scholarship in the field of Science and Technology Studies (STS) to propose a co-productionist reading of "soft law" as both an epistemic and normative governance device that reconciles imperatives to innovate for the public good with imperatives to protect it in politically legitimate ways. In particular, I investigate the making of "soft law" instruments for the governance of emerging neuro-technologies in the US, EU, and OECD. Through a comparative analysis of three flagship initiatives in neuro-innovation – the US BRAIN initiative, the EU's Human Brain Project, and the OECD's Neurotechnology and Society Project – my thesis reveals considerable differences in the way political communities produce norms and principles for the governance of emerging technologies. In the US, normative questions about the social implications of neuro-innovation are settled primarily by "Neuroethics" experts that are envisioned to make neurotechnology safe for economic exploitation and social wellbeing while also reasserting long-held liberal imaginations of individualized responsibility and authoritative science. In contrast, the EU's "Responsible Research and Innovation" approach makes a deliberative effort to consult citizens' directly and to strengthen democratic legitimacy through the collectivization and pluralization of governance decisions. At the OECD, an international organization, member-states embrace a vision of harmonized innovation governance across different jurisdictions to strengthen common values and enable inclusive global markets via commitment to "Responsible Innovation" frameworks. These local settlements produce specific forms of knowledge in each context regarding what socially desirable neuro-innovation is and how it ought to be governed. Conversely, these novel forms of knowledge help settle controversies about neuro-innovation in keeping with socially and culturally situated understandings of the appropriate relationship between democracy, science, and technology.

I propose the concept of "soft constitutions" to capture this powerful modality for disciplining political collectives concerning their relationship to innovation. Through this lens, the production, performance, and settlement of soft law regimes exhibits binding effects on public reasoning about the place of innovation in modern democracies: it effectively defines what socially desirable innovation is, which governance arrangements are appropriate to achieve it, and whose right and responsibility it is to put it into practice. These "soft constitutions" grant authority to certain actors and knowledge claims over others to speak on behalf of the public interest, with important implications for the distribution of power, risks, and benefits in contemporary societies.

Zusammenfassung

Technologische Innovation ist ein allgegenwärtiges politisches Leitmotiv des 21. Jahrhunderts. Die Proklamation von Innovationsimperativen seitens öffentlicher Institutionen stellt jedoch auch neue Herausforderungen an ihre Steuerung, um sicherzustellen, dass neues Wissen und neue Technologien zu gesellschaftlich wünschenswerten Zielen beitragen. In den letzten Jahrzehnten wurden „soft law" Instrumente – d.h. rechtlich unverbindliche Normen und Prinzipien für die ethische oder verantwortungsvolle Governance von Innovation – als zunehmend prominenter Ansatz aufgenommen, um das Verhältnis zwischen Innovation und gesellschaftlichen Werten und Bedürfnissen zu vermitteln und gleichzeitig die Fallstricke traditioneller Regulierung zu vermeiden.

Diese Dissertation stützt sich auf die im Bereich der Science and Technology Studies (STS) entwickelten Konzepte der „Co-produktion" und schlägt vor, „soft law" als sowohl epistemisches als auch normatives Steuerungsinstrument zu verstehen, das öffentliche Innovationsimperative in Einklang mit dem Wohle der Allgemeinheit bringt. Insbesondere untersuche ich die Entwicklung dieser weichen Gesetzgebung im Bereich von Neurowissenschaft und Neurotechnologie. Durch eine vergleichende Analyse von drei Flaggschiff-Initiativen für Neuro-innovation – der US-amerikanischen BRAIN Initiative, dem Human Brain Project in der EU, und dem Neurotechnology and Society Projekt der OECD – zeigt meine Dissertation erhebliche Unterschiede in der Art und Weise auf, wie politische Gemeinschaften Normen für die Governance von Innovation hervorbringen. In den USA werden normative Fragen zu den sozialen Dimensionen der Neuro-innovationc in erster Linie von „Neuroethik" Experten entschieden, die die Neurotechnologie für wirtschaftliches Wachstum und soziales Wohlergehen stabilisieren und gleichzeitig lang gehegte liberale Vorstellungen von individueller Verantwortung in der Steuerung von Wissenschaft und Technologie bekräftigen. Im Gegensatz dazu unternimmt der „Responsible Research and Innovation" Ansatz in der EU einen deliberative Versuch, Bürger direkt zu konsultieren und die demokratische Legitimität von Neuro-innovation durch die Kollektivierung und Pluralisierung von Governance-Entscheidungen zu stärken. Bei der OECD, einer internationalen Organisation, erreichen Mitgliedsstaaten eine Vision harmonisierter „Responsible Innovation" Governance, die gemeinsame Werte stärken und die Integration globaler Märkte vorantreiben soll. Diese lokalen Konfigurationen produzieren spezifische Formen von Wissen darüber, was gesellschaftlich erwünschte Neuro-innovation ist und wie sie im Einklang mit gesellschaftlichen Werten gesteuert werden sollte. Umgekehrt tragen diese neuartigen Wissensformen dazu bei, Kontroversen um Neuro-innovation mit sozial und kulturell situierten Verständnissen des angemessenen Verhältnisses von Demokratie, Wissenschaft und Technologie zu schlichten.

Ich schlage das Konzept der „weichen Verfassungen" vor, um diese mächtige Modalität zur Disziplinierung politischer Kollektive im Bezug auf ihre Beziehung zur Innovation zu erfassen. Diese Linse zeigt auf, wie die Produktion und Regulierungskraft von „soft law" Regimen verbindliche Auswirkungen auf die öffentliche Imagination über den Stellenwert von Innovation in modernen Demokratien hat: sie definiert nicht nur, was gesellschaftlich wünschenswerte Innovation ist, sondern auch, welche Governance-Instrumente geeignet sind, um diese zu erreichen. „Weiche Verfassungen" verleihen bestimmten Akteuren und Wissensansprüchen gegenüber anderen die Autorität, im Namen des öffentlichen Interesses zu sprechen, mit wichtigen Auswirkungen auf die Verteilung von Macht, Risiken, und Vorteilen hinsichtlich Wissenschaft und Technologie in modernen Gesellschaften.

For Ana

"A Greek philosopher who lived more than two thousand years ago believed that philosophy had its origin in man's sense of wonder. Man thought it was so astonishing to be alive that philosophical questions arose of their own accord.

It is like watching a magic trick. We cannot understand how it is done. So we ask: how can the magician change a couple of white silk scarves into a live rabbit?

A lot of people experience the world with the same incredulity as when a magician suddenly pulls a rabbit out of a hat which has just been shown to them empty.

In the case of the rabbit, we know the magician has tricked us. What we would like to know is just how he did it.

But when it comes to the world it's somewhat different. We know that the world is not all sleight of hand and deception because here we are in it, we are part of it. Actually, we are the white rabbit being pulled out of the hat.

The only difference between us and the white rabbit is that the rabbit does not realize it is taking part in a magic trick. Unlike us. We feel we are part of something mysterious and we would like to know how it all works."

(Jostein Gaarder, Sophie's World)

The first book that sparked my interest in philosophy was "Sophie's World" which I received from my mother for my 10th birthday, a phantastic journey of a young girl encountering the great philosophers of human history. Ever since, I have been intrigued by how the magic tricks work that make us experience reality in particular and often diverging ways, and where we may end when following this question all the way down the rabbit holes that the rich history of philosophy has to offer. This PhD thesis is but a modest attempt in asking the question of how it all works, modest because I only pose such question to a tiny fractal of the rabbit's body; yet it feels like I have completed a long great journey since I breathlessly read "Sophie's world" more than 20 years ago. I dedicate this dissertation to my mother, who has inspired my thinking in ways that stretch well beyond philosophy.

Acknowledgements

Writing a PhD thesis is first and foremost an exercise in self-disciplining, requiring seclusion with your mind and materials. The many relationships and encounters built over the time of research and writing often need to be sacrificed for solitude, a task that is particularly challenging for social 'aficionados' like myself. Yet, throughout the process of bringing your thoughts on paper, you continue the dialogues in silence that once inspired you to write a PhD and relentlessly pushed you for not giving it up. One of my joys in academic work has always been thinking together – these moments when out of the many perspectives and experiences of different people a new thought is born. I've enjoyed many of such moments with lots of different people over the last years, of which only a partial list can be acknowledged here.

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From Munich to Boston, I encountered a number of new colleagues and friends within the Science and Democracy Network, and the Harvard STS program in particular. Sheila Jasanoff and the fellows group of 2018-2019 generously hosted me to deepen my co-productionist thinking and writing and to present and discuss my work with like-minded scholars as well as with intellectual sparring partners. Tess Doezema was not only a much-needed guide in discovering American culture, but also the world of co-production, and continues to be a wonderful partner in thinking and dreaming about the many ways our knowledge could be brought to bear in this world. Kasper Schiœlin has been an early enthusiast for questioning the making of ethics and society in science and technology policy and collaborating on research, as well as a great friend with whom work never feels like work. Steven Hilgartner, Silke Beck and Pierre Delvenne gave generous feedback and time for discussing arguments and observations throughout the dissertation.

Much of the empirical research for this thesis would not have been possible without the invitation by David Winickoff to participate in the BNCT Working Party's project on Neurotechnology and Society. Participating in the group's deliberations and discussions was both a unique research opportunity and professional experience that deeply shaped my thinking on and engagement with science and technology governance. I thank Dominique Guellec for his support of the project and Hermann Garden for receiving me with open arms within the group.

My training in STS at Maastricht University has allowed me to develop a robust foundation for pursuing my PhD, and the long-standing mentorship of Wiebe Bijker always provided a feeling of continuity in the often-times discontinuous pathways that academic life entails. A deep friendship with Annapurna Mamidipudi has been productive of many discussions and debates about the merits of co-production, the state of STS as a field, and the struggles of translating research agendas across contexts, repeatedly provoking me to question my situated perspective.

Last but not least, I want to thank my family and friends for their encouragement, advice, and enduring love throughout the many years of writing my dissertation: Nils and the whole Frahm family, Max, Gaspar, and Jessi, Ariane and Torsten, Felix and Ines, Christiane and Lutz, Lilly and Flo, Doro and Nikos, Marie, and many others. I could not have completed this thesis without you.

Table of Contents

List of Figures

1. Introduction

The 29th of September 2021 marked a historical moment in the public imagination of innovation in neuroscience and -technology. For the first time, "neurorights" – "new human rights that protect mental privacy and integrity of people from neurotechnology abuses"[1] – were explicitly introduced in a national Constitution. The country where this momentous introduction took place was not the US, China or an EU member state – arguably those regions with greatest investments in neuro-innovation. Rather, it was the Republic of Chile, that southernmost country of the world with a long and troubled history of technology and politics[2] that decided to include a provision on neurorights in a 2020 national referendum intended to break with its Constitution installed under the military regime of Augusto Pinochet forty years earlier. Voiced vehemently during several months of public unrest on the streets of Santiago de Chile that preceded the referendum, it was particularly the legacy of Pinochet's transferal of powers to the private sector in matters of public concern[3] that citizens demanded to be reformed: "We won't stop until a new Constitution is created and Pinochet's heritage is left behind", one of the protestors raged in an interview[4]. Yet the introduction of "neurorights" in one sweep with broader legal reforms also aimed at settling future challenges and opportunities that might arise for the Chilean state and its citizens. Introduced by the "Commission for Future Challenges", the "neurorights" proposal defined novel rights and responsibilities vis-à-vis emerging knowledge and technologies that could affect sensitive topics, such as privacy, surveillance, court judgments, and social and distributive justice, and hence, protection of the public good for all Chileans in the future. As Chile's President Sebastián Piñera hailed the process,

> This reform will open the doors and define the path to reach a great constitutional agreement that this solid, legitimate and shared institutional framework gives us to encounter as a country the grand challenges of the present and the magnificent opportunities of the future.[5]

[1] Boletín N° 13.828-19'.
[2] Eden Medina, *Cybernetic Revolutionaries: Technology and Politics in Allende's Chile* (Cambridge, MA, USA: MIT Press, 2011).
[3] Privatization of the public sector and public goods in Chile has a long history dating back to the 1970s and Augusto Pinochet's military junta, who was advised by Chicago-school economists on how to turn back the nationalist measures installed under socialist president Salvador Allende and set up an economically effective and productive authoritarian regime. Amongst others, Chile is one of the few countries in the world that has privatized water. But also its pension scheme, energy, education and transportation are mostly provided by private enterprises.
[4] Fernanda Paúl, '"No Vamos a Parar": La Voz de 4 Manifestantes En Chile (y Qué Tan Factible Es Que Se Cumplan Sus Demandas)'. "Yo no voy a parar de protestar hasta que se cree una nueva constitución y se termine con la herencia de Pinochet." My translation.
[5] Leonardo Niño, 'Piñera promulgó la reforma para realizar el plebiscito constitucional en Chile', *France 24*, 23 December 2019, sec. america-latina."Esta reforma abre las puertas y define el camino para lograr un gran acuerdo constitucional que nos dé ese marco institucional sólido, legítimo y compartido para poder enfrentar como país los formidables desafíos del presente y las magníficas oportunidades del futuro." My translation.

Described by its most enthusiastic supporter senator Guido Girardi as a "politically transversal frontier initiative" with "worldwide support"[6], the "neurorights" draft had been prepared by a group of international experts in neuroscience and bioethics lead by Spanish neuroscientist Rafael Yuste. As one of the initiators of the US BRAIN initiative and pioneer of optical brain imaging techniques in neuroscience, Yuste was an early advocate of settling "ethical priorities for neurotechnologies and AI"[7], including the amendment of the Universal Declaration of Human Rights with new provisions for safeguarding human brains against their possible misuse through novel neurotechnologies. His vision did not make it as far as to the United Nations, yet its uptake in the constitutional reform process of Chile was an unprecedented and widely noted escalation in the debate about the ethical, social, and legal ramifications of neuroscience and neurotechnology. For the first time, neurorights were the subject of public reasoning on and imagination of collectively desirable futures at the constitutional level, and Chile at the helm of a global vanguard: "we are a small country with a big voice…and we're at the top of an international discussion", Senator Carolina Goic proudly commented the proposal[8].

The two "neurorights" bills agreed to by the Chilean Senate, one to protect the integrity and privacy of mental behavior and data, the other to regulate the development, research, and advancement of neurotechnologies for the benefit of society, fundamentally inscribed future innovations in brain research and related fields such as AI into the state's legal apparatus. Concluding a series of Articles ranging from the right to informed consent, the prohibition of tools and treatments that diminish individual agency, to the restriction of data-use derived from the brain, Article 9 of the legislative proposal proclaimed that "the State will promote the development of beneficial research, promoting opportunities for science and technology, especially within the framework of socially desirable neurotechnologies and neurosciences, undertaken in the public interest and good."[9] The draft's last article furthermore declared as a relevant task of the state to ensure "the promotion and equitable access to advances in neurotechnology and neuroscience"[10]. Together, the articles made the provision of innovative neurotechnologies to Chilean citizens and their promotion in the individual and public interest a constitutional task of the present and future state and its laws.

"Reasoning and the objects of reasoning are constituted together"[11], Sheila Jasanoff and others have elegantly summed up a vast literature in Science and Technology Studies (STS) concerned with

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6 La Tercera, 'Histórica Norma: Chile Será El Primer País Que Tendrá Una Ley de Neuroderechos', *La Tercera,* 22 September 2021.
7 Rafael Yuste et al., 'Four Ethical Priorities for Neurotechnologies and AI', *Nature* 551, no. 7679 (1 November 2017): 159–63.
8 Republica de Chile Senado, 'Neuroderechos: aprueban ideas matrices destacando la dignidad humana - Senado - República de Chile', *Republica de Chile Senado*, 16 December 2020.
9 'Boletín N° 13.828-19'. Artículo 9 "El Estado propenderá por el desarrollo de investigación beneficiosa, promoviendo oportunidades para la ciencia y tecnología, en especial en el marco de la neurotecnologías y neurociencias socialmente deseables, emprendidos en el interés y bien público." My translation.
10'Boletín N° 13.828-19'. Artículo 10 "El Estado velará por la promoción, acceso equitativo a los avances en neurotecnología y neurociencia." My translation.
11 Benjamin J. Hurlbut, Sheila Jasanoff, and Krishanu Saha, 'Constitutionalism at the Nexus of Life and Law', *Science, Technology, & Human Values* 45, no. 6 (1 November 2020): 4.

the co-production of normative and epistemic order in liberal democracies. The "constitutional moment"[12] for neuro-innovation in Chile exemplifies their important insights that "revolutions in our understanding of what life is burrow so deep into the foundations of our social and political structures that they necessitate, in effect, a rethinking of law at the constitutional level"[13]. By delineating the boundaries of "socially desirable neurotechnologies and neurosciences", the proposal for "neurorights" also constituted advancements in neuro-innovation as a vital object of concern – and opportunity – for the state's promotion of the public good, social justice, and individual liberty. The specific forms through which Chile reasoned on the desirability of advancements in neuroscience and -technology furthermore reflect how these processes of co-production occur in unexpected and creative, yet historically and culturally contingent ways[14]. The recognition of neuroscience and -technology in Chile as reasonable and desirable means of catering to the public interest, for example, relied on long-held utopias of economic and technological governance through cybernetics envisioned by socialist president Salvador Allende to guard the state from political abuse that so violently took the country over during Pinochet's authoritarian rule[15]. The possibility of dictatorship, in turn, still reverberated in the relatively young democracy, provoking not only the reform of the national Constitution and its public guarantees, but also the anticipatory embrace of "neurorights" as safeguards against possible political and economic misuse of technoscientific discovery and development.

Transformations that aim to break up prior commitments to social, epistemic, and material order, such as those proposed by the visionary vanguards of "neurorights", cannot simply re-order its elements but need to mobilize "vocabularies and practices already given and transmitted from the past"[16] to gain legitimacy and traction in political culture. A remarkable case of how a small group of experts could shape the formation of new socio-technical norms for a whole democracy, reasoning on the inclusion of legal provisions with particular focus on neurotechnologies within the Chilean constitutional referendum relied on long-held legal commitments – amongst others, on an already constitutive role designated to science and technology for the state (Article 11), to the protection of private life (Article 4), and to the right to physical and psychological integrity of the person (Article 1) enshrined in the Chilean "Carta Magna" of 1980[17]. It linked the prohibition of interference with the human brain through

[12] Bruce Ackerman, *We the People, Volume 1: Foundations* (Belknap Press, 1993).
[13] Sheila Jasanoff, ed., *Reframing Rights: Bioconstitutionalism in the Genetic Age*, Basic Bioethics (Cambridge, MA, USA: MIT Press, 2011), 3.
[14] Sheila Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States* (Princeton University Press, 2005).
[15] Eden Medina, 'Designing Freedom, Regulating a Nation: Socialist Cybernetics in Allende's Chile', *Journal of Latin American Studies* 38, no. 3 (2006): 571–606.
[16] Stephen Hilgartner, 'Capturing the Imaginary: Vanguards, Visions and the Synthetic Biology Revolution', in *Science and Democracy: Making Knowledge and Making Power in the Biosciences and Beyond*, ed. Stephen Hilgartner, Clark Miller, and Rob Hagendijk (London: Routledge, 2015), 50.
[17] Constitute Project, 'Chile's Constitution of 1980 with Amendments through 2012', April 2022; Meritxell Freixas, 'La Asamblea Constituyente de Chile presenta el borrador de la nueva carta magna', *ElDiario*, 17 May 2022, sec. Internacional.

neurotechnologies to the Sanitary Code No. 725 codified by law in 1967[18], and gave neuronal data the same status as data of other human organs by relying on law No. 19.451 already under the vigilance of the state[19].

Beyond recourse to past legal achievements, experts and policymakers enrolled citizens and their representatives into the proposal by constructing dark visions of a neurotechnologically informed future arising without the installment of legal provisions in the present, as well as by juxtaposing them to the many benefits to be derived from neuro-innovation as a result from its constitutional codification. As Yuste explained in an interview, "neurotechnology can be frightening if one thinks of the dystopic scenarios of science-fiction, but for every dystopic scenario there are 10 beneficial scenarios", adding that he sees "the incorporation of neurotechnology for the good of humanity as a new Renaissance"[20]. For such a Renaissance to come to fruition, the vanguards argued, innovation in neuroscience and -technology should not be left to tech companies like Elon Musk's 'Neuralink' alone[21], but sustained by public support of neurotechnological development for the good of society. The legislative proposal thus achieved to ground the uptake of "neurorights" in the country's historically grown ways of public reasoning on science and technology, while at the same time introducing neuro-innovation as a new object in the public's imagination of desirable futures. The constitutional rise of "neurorights" in Chile exemplifies how science and technology, and the law and the state, are always made at once[22] and through culturally embedded forms of reasoning on the role and relationship between knowledge, technology and norms in the fulfilment of the common good[23].

To date, Chile's embrace of "neurorights" at the constitutional level remains the exception, not the rule, for how emerging neuroscience and -technology is governed within and among jurisdictions. Public debates about innovation rarely rise to the level of constitutional amendments, and novel legislations or regulations for neuro-innovation have not been introduced in most of the countries investing in neuroscience and its translation into tangible technologies for health and beyond. As one policy expert confirmed in an interview, most of the new technological devices targeting the human brain, whether for medical or consumer purposes, are not expected to be treated in the exceptionally 'hard' ways that the Chilean republic has pioneered: "It's not going to be a whole new regulatory approach, it will fit into our regulatory structure. From a regulatory point of view, [neurotechnologies are] not exceptional"[24]. Rather, emerging neurotechnologies across the board are governed by 'soft'

[18] See Article 10 (2) of the legislative proposal for the incorporation of Neurorights, 'Boletín N° 13.828-19'.
[19] See Article 7 of the legislative proposal for the incorporation of Neurorights, 'Boletín N° 13.828-19'.
[20] France 24, '"Neuroderechos", Apuesta Pionera de Chile Para Legislar El Futuro', *France 24*, 28 April 2021.
[21] Javier Salas, 'Por Qué Hay Que Prohibir Que Nos Manipulen El Cerebro Antes de Que Sea Posible', *EL PAIS*, 12 February 2020. My translation.
[22] As Sheila Jasanoff has summarized the "idiom" of co-production: "Knowledge and its material embodiments are at once products of social work and constitutve of forms of social life; society cannot function without knowledge any more than knowledge cannot exist without appropriate social supports." *States of Knowledge: The Co-Production of Science and the Social Order* (Routledge, 2004), 2–3.
[23] Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*.
[24] Interview Nr. 4, January 2017

guidelines, principles, and instruments that promise nimble, flexible, and custom-tailored responses to emerging ethical, legal, and social issues which are argued to be more effective than cumbersome political and legal processes.

Co-producing neuro-innovation and society in the US, EU and OECD

In this thesis, I develop the argument that *soft laws* for the governance of neuro-innovation crafted in three different contexts – the United States, the European Union (EU), and the Organisation for Economic Co-operation and Development (OECD) – can be read as quasi-legal texts that mediate the relationship between science, technology, citizens and the state in similarly fundamental ways as the constitutional reform process instantiated in Chile in the summer of 2021. I propose that the increasing turn to *soft law* – i.e., to legally non-binding norms and principles for the ethical or responsible governance of innovation – itself represents a constitutional reconfiguration whereby the locus of public reasoning about this complex relationship is shifted outside the premises of capital-C constitutions. While not subject to judicial or parliamentary review and largely devoid of legally binding powers, the soft principles and rules developed in these contexts enacted powerful processes that co-produce neuro-innovation pathways with specific forms of public reasoning regarding what socially desirable neuro-innovation is and how it ought to be governed toward the common interest. Moreover, these *soft laws* were embedded in each jurisdiction's historically and culturally situated ways of socio-technical ordering yet were also key for the introduction of new objects and forms of reasoning within policymaking. In three in-depth case studies on the making of *soft law* for the US BRAIN initiative, the EU's Human Brain Project, and the OECD's Neurotechnology and Society project, I show how different regimes of public reasoning emerged from this co-productionist dynamic: a liberal regime of "Neuroethics" in the US in which the governance of neuro-innovation is *individualized* to its producers and consumers; a republican regime of "Responsible Research and Innovation" in the EU that *collectivized* the steering of neurotechnologies across European publics; and a liberal-republican regime of "Responsible Innovation" at the OECD aimed at *harmonized* governance of emerging neuroscience and -technology among member-states and beyond.

I suggest that even though these diverging regimes were not codified by constitutional law, they were made credible, to use the words of the Chilean president, as "solid, legitimate and shared institutional framework[s]" envisioned to respond to the challenges of the present and enable the flourishing of societies in the future. As legal scholar Bruce Ackermann has claimed for the "patterns of argument" that underwrite the *hard law* of Constitutions, "these cultural constructions are hardly innocuous", to which he adds that "the challenge is to make their presuppositions self-conscious objects of reflection"[25]. In the following pages, I take up his challenge for the analysis of *soft law* in contemporary science and technology policy and in the governance of neuro-innovation in particular: what patterns of argument gave rise to the settlement of *soft law* around neuro-innovation in the US,

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[25] Ackerman, *We the People, Volume 1: Foundations*, 39.

EU, and OECD? Which cultural presuppositions guided the development of soft principles and norms in each setting, and how were they re-configured by public institutions and their soft instruments of reasoning? And eventually, how can we become more reflexive of these seemingly soft, yet constitutive means for ordering the relationship between technoscientific innovation and society?

The thesis approaches these questions from the perspective of interactional co-production developed in STS, and in particular through comparison of the idiosyncratic ways through which the US, EU, and OECD co-produced public reasoning on neuro-innovation and its desirable governance. By carving out the interplay of knowledge and norms in the constitution of order around emerging neuroscience and -technology, I posit that *soft law* bodies and texts should neither be celebrated as more effective means of technoscientific governance as compared to hard regulations, nor degraded to possessing merely soft moral power in the regulation of innovation. Rather, *soft law* in science and technology governance can be read as having a constitutional character, function, and effect, in that it is critical to the making of epistemic, ontological and normative order around innovation imperatives proclaimed by public institutions since the beginning of the 21st century. In moments of controversy around the introduction of new scientific knowledge and technologies, *soft law* settles constitutive questions with regard to what needs to be regulated within society (e.g., technoscience itself, publics and their attitudes, or scientists and engineers), who gives and gains authority in regulation (e.g., experts, citizens, or markets), how such power should be distributed across society (e.g., by top-down or bottom-up regulation), and how it should be controlled (e.g., through provisions installed to prevent the abuse of power in governance) .

I propose the concept of *soft constitutions* to describe this powerful way of ordering the relationship between science, technology, citizens, and governments, particularly when it comes to imagining how innovation will be subjected to democratic governance in the future, and hence, controlled by societies to serve their interests. This futuring-work enabled by *soft law* bodies and texts can be described as the *constitutional imagination* that is at the heart of contemporary reasoning on innovation and its social desirability, as it conjures a sense of democratic sovereignty over future innovation pathways, while generating legitimacy for investments in scientific and technological investments in the present. While this imagination is grounded in long-held enlightenment ideals of democratic politics and the legitimacy of constitutional government that differ greatly across the jurisdictions analyzed here, it also represents quite a shift in public reasoning on science and technology, which in the past was primarily framed around a *laissez-faire* ideal of scientific and technological development with little space for the agency of citizens in decision-making and governance. The particular historical context in which such a change in logics took place is key, since it permits to situate the analysis of this thesis in broader transformations of scientific, technological, and democratic power.

The turn to innovation *in, with* and *for* society

Policymaking on science, technology and innovation in the 20th century relied on a 'social contract with science' that foresaw public investments in basic research leading linearly to the provision of technoscientific innovation by markets[26]. This progressivist vision of innovation with its techno-optimist overtones continues to hold much sway in current politics and the framing of contemporary public policies but is also subject to reform in response to an arguably rising level of public dissatisfaction with innovation and the role of democratic institutions in their development and governance[27]. As Pfotenhauer and Juhl argued, "for decades, the ideal of innovation has been one of unfettered liberty – something that is left best to unfettered entrepreneurs in unfettered markets who draw upon inventions made by unfettered scientists"[28]. Yet, the crisis years of the early 2000s, and the 2008 financial and economic breakdown in particular challenged ideals of a hands-off approach by the state in innovation processes that favored the self-governance of technoscience and markets over their democratic deliberation and control. Instead of wide-spread technological optimism, an increasing pessimism toward the consequences of ever more rapid technological change was setting in: miraculous cures promised by biotechnology in the late 20th century had neither solved world hunger and disease, nor the loss of biodiversity and environmental degradation, quite the reverse. The spread of digital technologies, believed to enhance the connectedness and democratization of societies, had been monopolized by new powers arising out of the Silicon Valley that fueled the disintegration of public opinion, its reliance on common sense facts, and its capacity of generating truth in liberal democracies[29]. And science as a public resource for making sense and making order in liberal societies had turned into technoscience as a private asset of businesses primarily interested in a return on investment rather than in the provision of knowledge and tools in the common interest[30]. Not only was the authority of science within democratic politics threatened by these developments; innovation in itself became a problem for democracies, their modes of protecting and providing the common good, and their imaginations of desirable futures and means for their collective attainment.

The crisis of market-led innovation felt throughout modern societies during that period was resolved by an increasing emphasis on the function of public institutions in contributing to the development of socially beneficial innovation on the one hand, and to innovative markets and their potential for economic growth on the other. The novel role of public institutions in innovation processes at the turn of the century was reflected, amongst others, in literatures on "National Systems of

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[26] See in particular Vannevar Bush's often cited report "Science, the Endless Frontier" discussed in several parts of this thesis, as well as Pfotenhauer and Juhl's overview of different models for the role of public institutions in the production of innovation (Sebastian Pfotenhauer and Joakim Juhl, 'Innovation and the Political State: Beyond the Facilitation of Technologies and Markets', 2017, 68–94.)

[27] Sheila Jasanoff, *The Ethics of Invention: Technology and the Human Future* (W.W. Norton, 2016); Ulrike Felt and Brian Wynne, 'Taking European Knowledge Society Seriously', 2007.

[28] Pfotenhauer and Juhl, 'Innovation and the Political State: Beyond the Facilitation of Technologies and Markets', 68.

[29] Sheila Jasanoff and Hilton R. Simmet, 'No Funeral Bells: Public Reason in a "Post-Truth" Age', *Social Studies of Science* 47, no. 5 (2017): 751–70.

[30] Kean Birch and Fabian Muniesa, eds., *Assetization: Turning Things into Assets in Technoscientific Capitalism*, Inside Technology (Cambridge, MA, USA: MIT Press, 2020).

Innovation"[31] of the 1990s, on a transformation of science from an autonomous "Mode 1" to "socially distributed, application-oriented and trans-disciplinary" research operating in "Mode 2"[32], and in "Triple Helix" models that described increasing industry-university-government collaborations in the beginning of the 2000s. But beyond rationalization by policymakers and academics, new ideals for a role of the state as a key enabler of innovation widely lacked public legitimacy within modern democratic societies; after all, the "entrepreneurial state"[33] and its "imperative of innovation"[34] seemed to cater primarily to the interests of the global economy rather than to the benefit of its citizens. Whereas "innovation [was] simultaneously heralded for its ability to 'disrupt societies' and 'change the world", policy regimes still continued "pretending that this disruption has nothing to do with the political and social aspects of the state"[35].

Although various frameworks had emerged throughout the second half of the 20th century that aimed to better align the production of knowledge and technologies with society, including Bioethics, Technology Assessment, Public Engagement, or the Precautionary Principle in policymaking, they were largely operating within, and sometimes even undermined by, the broader policy frame of self-regulating scientific and technological systems capable of generating social wellbeing and progress in modern democracies. This logic prompted much critique in STS, for instance, regarding deficit models of the public understanding of science that were underwriting policy frames[36], or the narrowing down of governance questions to "technologies of hubris" focused on the rational calculation of risks and benefits generated by technoscientific innovation[37]. Citizens too were mobilizing increasingly against the politics of innovation pursued by their governments and through global fora, as public protest against the introduction Genetically Modified Organisms (GMO's) in the early 2000s, and ensuing calls for more sustainable and future-oriented policies on climate change manifested. As Jasanoff put it pointedly, scientific and technological governance at the beginning of the 21st century could no longer be concerned with the question "whether the public should have a say in technical decisions, but how to promote more meaningful interaction among policy-makers, scientific experts, corporate producers, and the public"[38]

[31] Bengt-Åke Lundvall, *National Systems of Innovation: Toward a Theory of Innovation and Interactive Learning* (Anthem Press, 2010).
[32] Helga Nowotny, Peter Scott, and Michael Gibbons, 'Introduction: "Mode 2" Revisited: The New Production of Knowledge', *Minerva* 41, no. 3 (2003): 179.
[33] Mariana Mazzucato, 'The Entrepreneurial State', *Soundings* 49 (November 2011).
[34] Sebastian M. Pfotenhauer, Joakim Juhl, and Erik Aarden, 'Challenging the "Deficit Model" of Innovation: Framing Policy Issues under the Innovation Imperative', *Research Policy* 48, no. 4 (1 January 2019): 895–904.
[35] Pfotenhauer and Juhl, 'Innovation and the Political State: Beyond the Facilitation of Technologies and Markets', 79.
[36] Brian Wynne, 'Misunderstood Misunderstanding: Social Identities and Public Uptake of Science', *Public Understanding of Science* 1, no. 3 (7 January 1992): 281–304.
[37] Sheila Jasanoff, 'Technologies of Humility: Citizen Participation in Governing Science', *Minerva* 41, no. 3 (1 September 2003): 223–44.
[38] Jasanoff, 238.

Fixing neuro-innovation with society

The case studies of this thesis provide an opportunity for examining *soft law* as an important instrument in the generation of democratic legitimacy for innovation, especially at a time when the public seems increasingly unwilling to accept public proclamations of innovation's social and economic benefits at face value. The thesis uses as its starting point the observation that traditional 'technological fix' logics whereby policy makers presented technoscientific innovation as *the* solution to social and economic problems have been increasingly put into question in the post-financial crisis years and no longer hold enough currency to support mainstream policy narratives. When the US BRAIN initiative (BI) and the EU's Human Brain Project (HBP) were announced in 2013 as massive public investments in long-term, high-risk neuroscience research that would produce rapid technological solutions for mental health and wellbeing while at the same time unlocking new multi-billion dollar markets, significant controversy ensued. The overt focus on neuro-innovation instead of neuro-science was deeply suspicious to scientific communities that had long advocated greater funding for research on the brain by policymakers. Large resources mobilized for innovation in the field during times of austere public budgets, in their view, was a betrayal of publics both regarding the bold promises of neuroscience's application potential, and in terms of the larger economic agendas that were lurking behind policymakers' support for big neuroscience projects such as the HBP and the BI. While public financing of neuro-innovation had been successfully achieved through the mobilization of visions of a return on investment in the form of economic growth, its contribution to the public good, including the pursuit of basic research on the brain and its functions, remained widely uncertain.

My third research site, the OECD, was facing a different challenge of legitimacy during these years. The organization had been a key driver of policy-narratives on technological and market solutionism across member-states since its very founding in the 1950s, yet its agenda of globalization through techno-economic liberalization was increasingly perceived as part of the problem, rather than an adequate solution, in the crisis aftermath. High-level proclamations about the need to make globalization and technological innovation more inclusive of society made prominent inroads at the OECD and were operationalized, among other places, in the Directorate for Science, Technology and Innovation, which traditionally had taken a strong pro-innovation, econo-centric approach to science and technology policy. In a number of projects, including on "Neurotechnology and Society", one of the major question that the OECD had to figure out for itself was how a growing emphasis on social participation and inclusion could be made plausible as a substantive contribution – instead of a potential barrier or threat – to neuro-innovation and emerging neurotech markets within its member-states.

Three different 'fixes' emerged in my case studies as an answer to these legitimacy challenges – all tied to a promise of greater involvement of society, its values, and needs in the governance of science and technology as a powerful remedy for the resolution of potential problems caused by neuro-innovation in the future. Across all the three settings, shifts towards the proclamation of imperatives to innovate in neuroscience and -technology were accompanied by a ubiquitous embrace of *soft law* as an appropriate instrument in steering their development toward the individual and collective benefit. The co-productionist lens allows to see how such broad-band mobilization of *soft law* differed between the political cultures of these contexts: in the US, soft norms and principles produced by the Presidential Commission for the Study of Bioethical Issues were gradually differentiated into a specialized branch of Neuroethics expertise to tackle issues perceived to arise from research on the human brain and its unique role for human identity and agency. In the EU, soft rules for the governance of neurotechnology were produced through large-scale public engagement activities, first in the form of a 'Meeting of Minds', and later through the inclusion of citizens in the development of recommendations by the HBP's Ethics and Society subproject. And at the OECD, a key transatlantic policy forum for the US and EU, *soft law* on 'responsible' neuro-innovation evolved by way of deliberation among multiple stakeholders, including member-state delegates, experts on the governance of innovation and society, as well as business representatives.

Resembling attempts at constitutional reform in Chile, these culturally and institutionally embedded forms of producing knowledge and norms on the desirable relationship between neuro-innovation and society were grounded in fundamentally different projects of political renewal. Whereas the OECD's turn to socially inclusive innovation governance was inherently tied to attempts of a restoration of multilateralism and economic globalization, the EU's emphasis on public participation in technoscientific development was deeply bound to the ongoing project of European integration, and particularly to the formation of a European public. The emphasis on ethical governance in the US, in turn, worked as crucial support for a shift on America's identity as producer of innovative markets to a new fashioning of the American state with the ability to provide citizens with innovative public goods. In this sense, my case-studies attest that *soft law* plays a crucial role in the imagination of the 'entrepreneurial state', 'innovation union', global 'do-tank'[39], and similar framing endeavors.

Such imagination is fueled, as I argue in the discussion part of this thesis, through the production of 'soft' texts that call the democratic sovereign vis-à-vis future neuro-innovation into being by crafting shared imaginaries of desirable social and technological order attainable through commitments to ethical or responsible innovation governance. Read as documents that allow for, and require, similar interpretive work as 'capital-C' Constitutions, these texts provide powerful visions of how individuals, societies, governments and markets should relate to innovation – for example, through adherence to liberal norms of individual freedom and its minimal regulation by government in the US, to republican ideals of popular sovereignty and social contract in the EU, or to liberal-republican principles of representative government as pre-condition for harmonious international relations at the OECD. The co-productionist "idiom"[40] draws our attention to the simultaneous construction of authoritative imaginations of neuro-innovation enabled by *soft law* texts, which is framed in all my case studies as an

[39] OECD's former Secretary-General Angel Gurría framed the OECD as a "do-tank" rather than a "think-tank" on several occasions, including here: Chris Giles, 'OECD Needs "Rethink" of Priorities at 50', *Financial Times*, 25 May 2011.
[40] Sheila Jasanoff, 'The Idiom of Co-Production', in *States of Knowledge* (Routledge, 2004).

essentially value-neutral activity that becomes a matter of public concern only if and when its pursuit, uptake, and governance is not following the principles settled by soft law bodies and texts. As such, *soft law* forms a key instrument for legitimizing public investments in innovation, which are made credible through the performative and imaginative work of ordering the relationship among emerging technoscience, democratic publics, and their governments.

Reading *soft law* as performative text

Even though I suggest that *soft law* can be read as a constitutional text, there are, of course, important differences to capital 'c' constitutions. In the cases of *soft law* analyzed here, the ordering of neuro-innovation and society is reasoned and practiced through non-judicial bodies and cannot be enforced through legal sanctions but is expected to have "great moral force"[41] on scientific and technological governance. Second, the authors of *soft law* are markedly different from those of 'hard' or constitutional law, not least because the actors proclaiming soft rules and norms for innovation are, by their very nature, neither appointed as judicial authorities nor endowed with judicial power by governments and their constituents. Instead, the bodies tasked with drafting *soft constitutions* throughout my case-studies are composed of actors that fulfil criteria of disinterestedness in neuro-governance (e.g., scientists, professional ethicists, citizen juries, working parties), and that cover those sets of knowledge deemed relevant and legitimate for the settlement of norms and principles that shall guide the development of publicly desirable neuro-innovation (e.g., neuroscience, Bioethics, or STS).

Third and related, the relationship between such actors and their constituents is not necessarily as straightforward as in constitutional law. Amy Guttman, Chair of the Presidential Commission for Bioethics, for example reflected on the group's past work with the statement that "our constituents, our political constituents, were the citizens of the United States and the President representing them; our moral constituents include the whole world, and so that raises a very big issue"[42]. While in the US, an ideal of universal science pours through Guttman's framing of Bioethics' worldwide moral constituents, in the EU, the making of a European *demos* through soft law bodies is attuned to the ideal of socially embedded science. And at the OECD, the coming into being of a harmonized, global public is conjured in tandem with soft recommendations to policymakers on how to govern neuro-innovation 'responsibly'. Again, my case studies reveal substantive variation across the OECD, EU, and US in this regard, as the authorization of particular actors and particular forms of knowledge on part of particular ideas of constituencies for the making of *soft law* is inextricably entangled with their different cultures of conceiving and practicing democracy more generally.

Important for the discussion of similarities across these "civic epistemologies"[43] is their joint

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[41] OECD, 'Recommendation of the Council on Responsible Innovation in Neurotechnology, OECD/LEGAL/0457', 11 December 2019.

[42] Bioethics Library, *PCSBI Meeting Twenty-Six: August 31, 2016 in Philadelphia, PA, Session 2: Reflecting on the Past*, 2017.

[43] Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*.

delegation of rule-making power from judges and courts to those 'softer' actor arrangements speaking on behalf of the public and its interests in innovation. What has been widely described as a shift from government to governance – or to "governing without government"[44] – setting in with neoliberal, market-centered, and New Public Management policies in the late 20th century, has significantly shaped ideas of how the law can advance the wellbeing of societies, particularly with regard to how it ought (not) to regulate scientific knowledge production and its commercial exploitation by the market[45]. The rise of *soft law* within that period seems to evidence an overall "roll back" of hard public regulation of research and development, and even a "roll-out" of market-oriented science and technology policy, both of which are described as the core dynamics of neoliberalization processes[46].

However, I contend that analysis of recent shifts towards *soft law* should not be reduced to arguments that center on the critique of neoliberal ideology and its achievements in expanding the powers of the market vis-á-vis and with the active support of the state's legal means[47]. In the words of Michel Foucault, they could better be understood as the expression of a particular form of liberal *governmentality* that draws as much on techniques of *discipline* through knowledge as on the *dispositif* of the law as "the two things that constitute – in an absolute sense – the general mechanisms of power in our society"[48]. My notion of *soft constitutionalism* in innovation governance acknowledges that science and the law – regardless of its 'hardness' or 'softness' – represent important institutions for creating meaning and exercising power in social collectives and points us to the co-production of knowledge and norms necessary to present the expression of such power as their common interest. Interpretative and constructivist analysis of the claims and discourses advanced by actors in the production of *soft law* is important for better understanding why authority is shifted to soft governance arrangements and principles, and with what kinds of implications for the role of *hard law*.

Anna di Robilant's "Genealogies of Soft Law"[49] provides a fruitful starting point for approaching *soft law* in innovation governance from a constructivist perspective. Tracing the origins of soft law discussions in the EU occurring at the beginning of the 2000s, she identifies two strands of ideas that permeate arguments for or against the introduction of *soft law* in EU governance: one, "of truly venerable age"[50], is a conception of *soft law* grounded in medieval legal pluralism and the "*lex*

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[44] R. A. W. Rhodes, 'The New Governance: Governing without Government', *Political Studies* 44, no. 4 (1996): 652–67; Adrienne Héritier and Dirk Lehmkuhl, 'Introduction: The Shadow of Hierarchy and New Modes of Governance', *Journal of Public Policy* 28, no. 1 (2008): 1–17.

[45] Joshua Barkan, *Corporate Sovereignty: Law and Government under Capitalism* (University of Minnesota Press, 2013).

[46] As Jamie Pecks argues in "Constructions of Neoliberal Reason", neoliberalism is characterized by complex and dynamic relationship between the "roll back" and "roll out" function of the State vis-á-vis the market. (Jamie Peck, *Constructions of Neoliberal Reason* (Oxford University Press, 2010).

[47] Such arguments are, for example, advanced by Stephen Gill and A. Claire Cutler, eds., *New Constitutionalism and World Order* (Cambridge: Cambridge University Press, 2014).

[48] Michel Foucault, *Society Must Be Defended: Lectures at the Collège de France, 1975–76.* (New York: Picador, 2003), 39.

[49] Anna Di Robilant, 'Genealogies of Soft Law', *The American Journal of Comparative Law* 54, no. 3 (July 2006): 499–554.

[50] Robilant, 500.

mercatoria" installed to regulate trade among European merchants; another, slightly more recent, root of *soft law* originates in the "development of a social mode of legal consciousness"[51] in the transition from the 19th to the 20th century. A relevant take-away from her analysis is that recourse to those diametrically opposed views on *soft law* and its benefits vis-à-vis *hard law* "are powerful ideological devices serving widely different professional and political agendas"[52]. She details those agendas as, on the one hand, a "[neo-medievalist] evoking ideas of organic efficiency and autonomy well suited to fit an agenda pursuing market integration and deregulation", and, on the other, a "[social] invoking notions of living law, social law and pluralism, [that] serves an agenda pursuing both social protection and efficient flexibility"[53]. Following her account, *soft law* has gained traction due to the mobilization of both devices in the governance of international relations after the end of the Cold War, which promised not only the democratization of supranational rulemaking to improve its contribution to social welfare, but also the settlement of norms among countries that are responsive and adaptable to the needs and demands of the global market and supportive of its expansion.

Throughout my case studies, a similar observation can be made for the uptake of *soft law* instruments in science and technology policy. Analogous to the re-ordering of politics and trade in medieval Europe, or to the transformations faced by the continent at the dawn of the 20th century, the re-formulation of the public good vis-á-vis innovation at the beginning of the 21st century did not occur without friction. Across the cases that I have analyzed, the policy establishment did not readily accept the new narrative of neuro-innovation for the public benefit without the provision of clear incentives and security on its potential to ensure economic sustainability *and* social stability. Scientists protested largely and loudly against the shift from knowledge to innovation as the provider of the public good and showed great skepticism towards interventions in the freedom of science through the new public-private agenda of directing research towards innovation for 'grand social challenges'. Citizens too would be suspicious towards the turn of governments to invest in innovation rather than in knowledge on their behalf as such imperative implies novel forms of authority shared between public and private sectors – the state and the market – in catering to the public good. And although the renewed interest in innovation by the public sector was welcomed by businesses, they still feared that rising investments in innovation on part of public institutions, accompanied by new forms of technology appraisal and control, could also produce a rise of rules and regulations that could stifle research and development of new products and their dissemination across markets.

The making of *soft law* in this context hence had to accommodate a variety of perspectives and bring them into harmony by creating processes of deliberation that emphasize the flexibility, agility, and openness of outcomes, and that simultaneously speak to the interests of society, markets, and science in innovation. As governance scholars have argued, attaining consensus and stability within such amalgam

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[51] Robilant, 527.
[52] Robilant, 504.
[53] Robilant, 504.

of interests through instruments of *hard law* would have been difficult to achieve; decision-making might prove more effective when working '"in the shadow of hierarchy", i.e., through "legislative threat or inducements"[54]. In fact, such shadow looms in the background of the *soft constitutions* that I analyze in this thesis, for instance, in form of a threat to (de)regulate dual use neurotechnologies at EU level, the fear of scientists to create burdensome regulation in American Non-Human-Primate research, or the OECD's invocation of Responsible Innovation as a means to circumvent legal interference in the diffusion and uptake of innovation in global markets.

Yet, thinking through the categories of hard versus soft law – or hierarchical, top-down government vs. heterarchical, vertical types of governance – with the constructivist sensibility of the co-productionist framework encourages us to look beyond a positivistic understanding of these entities, their assumed boundaries and debatable effectiveness for policy and decision-making. The siting of authority to *soft law*, instead, might be read as a process mobilized for the very construction of such dichotomies that serve as rhetoric and strategic devices for particular actors and their agendas. The making of soft norms for innovation governance is a process that constitutes the 'softness' of the law in performative ways, co-producing not only the meaning of norms, such as 'ethics' or 'responsibility' in innovation, but also their relationship to other forms of (legal, scientific) social regulation. What these terms come to signify in each context is closely related to the agenda actors involved in the construction of *soft constitutions* pursue, such as an ongoing self-governance of science, the translation of science into marketable products, global economic growth enabled by liberalized markets, or a democratization of decision-making on science and technology. Political controversy among such agendas is closed through shifting the debate to processes and bodies of *soft law*[55]. That such consensus is not made in the Supreme Court of the US or in the parliaments of European and OECD member-states, and that it is not codified by novel Constitutions or their amendment is thus is a highly relevant entry-point for any research concerned with the production of soft norms around innovation and their political economy: not in terms of how 'soft' the source of authority of *soft law* bodies and their effects on the social regulation of innovation is, but how actors construct such authority and envision its power in relationship to the binding force of the law. *Coram non judice* – a legal term for denoting the invalidity of declarations of the law without a judge being present to exert such authority – gains a different meaning in this context as it is the very absence of judicial authority that allows to render the proclamation of soft norms an authoritative expression of the public will.

[54] Héritier and Lehmkuhl, 'Introduction: The Shadow of Hierarchy and New Modes of Governance', 1–2.
[55] This argument is also made by Mörth for 'Soft Law and New Modes of EU Governance – A Democratic Problem?' (Darmstadt, 2005), 15.

The chapters ahead

These observations and arguments are developed gradually throughout the ten chapters of this thesis, each of which is structured around the core insights that evolved during my research on the co-production of innovation and society at the US, EU, and OECD. In the next chapter, I will provide an overview of the different soft governance frameworks and instruments that have evolved in policymaking since the 1950s, including Bioethics, Technology Assessment, the Precautionary Principle, and Responsible Research and Innovation. I claim that their rise in public policy was the result of several crises for modern narratives on the self-governance of science and technology, representing progressive solutions to its public legitimacy which sooner or later faced critique themselves with regard to their democratic credibility. I briefly summarize the different perspectives on the legitimacy of soft frameworks and instruments, and in particular, discussions within STS that have problematized the use of *soft law* within science and technology governance – at the expense of a more symmetrical reading when it comes to the work performed by soft governance bodies and texts.

In the second part of this chapter, I trace the origins of *soft law* and discussions around its legitimacy to literatures in jurisprudence and international relations. Similar to the uptake of soft norms and principles in innovation governance, *soft law* emerged as a concept in international relations literatures to capture an increasingly self-governing system of global decision-making, which rested on deliberation among multiple stakeholders and recourse to plural forms of social and economic regulation beyond the use of binding law. I observe that arguments presented in studies of the law for or against the validity of this concept closely resemble discussions in STS, in that they are primarily geared toward either arguing for more flexible and dynamic ways of governing international affairs, or against the pluralization of the law beyond the democratic structures and processes of nation-states. Neither strand of literature is helpful for understanding how *soft law* is made credible within contemporary politics on science and technology, as participants in both discussions enter analysis through an *a-priori* ideal of what the law, democratic government, or their appropriate relationship to science, technology or the global sphere is.

To overcome such asymmetry in analysis, the third chapter argues that different methodological tools are needed to make sense of the construction of *soft law* in science and technology policy, of which STS scholarship has a broad range to offer. After reviewing some of the key theoretical frameworks within STS that have emphasized symmetry in the analysis of controversies on science, technology and society, such as the Strong Program of Scientific Knowledge (SSK), the Social Construction of Technology (SCOT), and Actor-Network Theory (ANT), I suggest that the interactional variant of co-production is particularly useful for approaching the research questions of this thesis. While SSK and SCOT provided important insights with regard to the social shaping of science and technology, they also faced critique for an overt emphasis on the role of social structures and processes in the evolution of scientific and technological systems. ANT, or 'constitutional co-production', in reverse, was key for bringing the material and semiotic dimensions of science and technology development into the view of

STS, yet emphasis on these dynamics also drew attention away from the socio-political forces at play in controversies concerned with the normative desirability of technoscientific innovations. The approach of interactional co-production developed by Jasanoff and others is restoring symmetry among these two approaches, in that it provides a set of concepts that enable analysis to carve out the epistemic, ontological, and normative dimensions of socio-technical change.

Three concepts – civic epistemology, bioconstitutionalism, and socio-technical imaginaries – serve as analytical pointers to the co-production processes set in motion through *soft constitutions* in my case-studies. I discuss their potential in elucidating the nexus between science, technology and *soft law* mobilized in my empirical materials, and specifically the ways through which new forms of reasoning and governance, such as Neuroethics or Responsible Innovation, are accommodated within the institutional trajectories and political cultures of the US, EU and OECD. While the concept of bioconstitutionalism is key for understanding how science and the law interact in the production of ontological and normative categories that order new notions of human life proposed by biology and corollary responsibilities for its protection by public institutions, I suggest that we may be facing the rise of a new form of constitutionalism in contemporary science and technology governance that is concerned with the production of technoscientific order beyond the biological alone.

In the fourth chapter, I describe the methods and materials used in my analysis, as well as some of the challenges and opportunities that I confronted during fieldwork for this thesis. To follow the making of *soft law* within and among the US, EU, and OECD implies acknowledging its multiply-situated nature, both in terms of discourses, actors, and settings involved, and with regard to the links that research establishes between their local micro-practices and the broader worlds that are constructed across settings. Multi-sited ethnography can be fruitfully combined with methods guiding comparative co-productionist analysis, and in particular, its emphasis on the performativity of discourse and practices in science and technology governance. Steven Hilgartner's approach to scientific advisory processes as a form of public drama presents a constructive lens through which the performance of *soft law* bodies and texts can be approached. Whereas deliberations among experts, scientists, citizens or policymakers in the 'backstage' are best approached through ethnographic and participatory observations as well as through narrative interviewing, the 'frontstage' documents produced through *soft law* bodies are telling of the ways actors control information and discourse so as to make it credible to publics.

Here, I also argue that discourse analysis of the performativity of *soft law* texts requires heightened sensitivity by the researcher vis-á-vis seemingly obvious, or taken-for-granted, ideals of democratic politics. While STS has been painstakingly reflexive towards the constructed nature of scientific authority and its power to frame social agency within governance, it often relies on an elusive ideal of democratic politics that is mobilized to argue for greater attention to social agency and inclusion of society in innovation processes. This agenda produces various dilemmas during research on frameworks and instruments that aim to democratize technoscientific governance, as it not only derails attention from their co-productionist dynamics, but also presents a problem for engagement with fields and settings involved in the making of *soft law.* Adherence to ideals of democratization is becoming ever more important for STS to get a hold on public discussions and reasoning on science and technology in society, yet I assert that the acknowledgment of ambiguity and uncertainty with respect to our own 'democratic fictions' is crucial for maintaining a critical stance toward the ways they are taken up and re-configured in contemporary policymaking.

In the fifth to eighth chapter, I apply these theoretical and methodological approaches to the micro-cases of *soft law* production on neuro-innovation in the US, EU, and OECD. In each of the case studies, I first trace the broader logics that have informed policy discourses and practices on the relationship between science, technology, and society since the mid-20th century, and then carve out how they have shifted from technological to social 'fixes' in the early 21st century. By zooming into the backstage processes that underwrite the construction of Neuroethics principles in the US, norms for Responsible Research and Innovation in the EU, and recommendations for Responsible Neurotechnology Innovation at the OECD, I carve out how each setting has ordered what socially desirable neuro-innovation is and how it should be governed for the benefit of society. These processes all have their own intricate ways of deliberation and closure on the normative questions of innovation in neuroscience and -technology, which are reflected in the structure and narrative style of each chapter: in the US case, intimate discussions among members of the Presidential Commission for the Study of Bioethical Issues and the Neuroethics Working Group point us to the authoritative role of expertise in American political culture; in the EU case, citizens get a voice in the 'Meeting of Minds' and the Ethics and Society Subproject's drafting of 'Opinions', who perform a constitutive role for the making of a European public; and at the OECD, claims by participants in workshops and meetings of the Neurotechnology and Society project are key to finding consensus on a joint recommendation for how to harmonize the governance of neuro-innovation across member-states and beyond. As I have been personally involved in the OECD case, this chapter is also informed by my own observations and impressions of the field. Together, the insights gained on these idiosyncratic forms of producing reason on neuro-innovation and society are highly relevant to a co-productionist reading of the frontstage texts produced by each governance arrangement, which I analyze in connection to the different steps of stabilizing soft principles, rules, and recommendations across the case studies.

The ninth chapter discusses and compares these diverging regimes of reasoning and imagining the governance of neuro-innovation in the public interest, both regarding their differences and broader shifts that can be observed across them. After reviewing the unique ways through which the US, EU and OECD have ordered neuro-innovation and society for policymaking, I delineate the constitutional elements of each regime, such as their construction of a self-governing public for neuro-innovation or of the different jurisdictions' identities in which principles for socially inclusive governance of neuro-innovation are settled. I argue that all these *soft constitutions* are key for the production of social values that ought to inform the governance of innovation in parallel with the production of the value that neuro-innovation in itself represents for individuals and societies. This settlement is achieved through closing down interpretive flexibility around what social issues with neuro-innovation will be, how they need to be resolved by greater attention to social norms, needs and expectations, and which benefits and risks might emerge if the social dimensions of neuro-innovation are ignored or included in governance early on. Moreover, each regime is informed by acts of boundary-work between socially desirable and undesirable neuro-innovation that are central to settling what ethical or responsible innovation in neurotechnology is and how it can benefit the common good.

In the second half of this chapter, I posit that credibility for these enactments of *soft constitutions* is achieved through imaginative futuring-work performed in each case. I suggest that soft governance bodies might be conceived as 'visionary vanguards' in that they propose new ideals of socio-technical order in which social control over the pathways of innovation is advanced as essential to desirable futures. To make such visions credible to policy and publics, vanguards, such as those represented by the new field of Neuroethics, embed their ideas in larger, historically grown fictions of democratic self-governance and sovereignty: liberalism in the US, republicanism in the EU, and a liberal-republican approach to global governance in the OECD. Since an important insight of this thesis is that we all too often take ideals of democracy – whether in the liberal or republican tradition – for granted, I elaborate on the heterogeneous *constitutional imaginaries* that are crafted through this work of cultural accommodation at length. This includes tracing different models of legitimate government and social regulation to Enlightenment thinkers, such as Locke, Rousseau, or Kant, and to more recent propositions of democratic organization, such as those advanced by Rawls or Habermas. Reading the processes and texts of my case studies with some of these central texts of political philosophy that have guided the performance of democracy across modern societies is important for understanding broader shifts in conceiving desirable socio-technical order across the case studies of this thesis.

In the conclusion, I reflect on my observations and arguments through asking what the turn to *soft law* in science and technology policy more generally, and in the governance of neuro-innovation particularly, might imply for STS research and engagement with the politics of technoscience. While attempts to deconstruct grand narratives of technological determinism and solutionism have long been at the center of STS analysis, my thesis detects the increasing mobilization of opposite forms of reasoning and imagining how science, technology and society should interact. Here, society and its capacity of democratic self-rule is depicted as a powerful agent in the governance of innovation toward desirable ends – a logic that displays a form of social determinism and democratic solutionism vis-á-vis problems caused by emerging technoscience that is key for reviving imperatives of innovation and legitimizing them in the name of the public. In my research for this thesis, I have become increasingly wary of this new form of fixing innovation with society, as it is not only reductive of alternative ways of social organization and mobilization that are precluded by the democratic fictions I have discussed, but also of alternative futures that may evolve without reliance on technoscientific innovation in the achievement of social order and wellbeing. I propose that in this sense, the emphasis of STS on multiplicity and contingency should be at the heart of a research agenda that symmetrically 'unfixes' both, imperatives of innovation and the rise of imperatives of democracy in science and technology governance.

2. An STS Guide to Soft Law in Science and Technology Governance

To wanderers in the galaxies of science and technology policy, "The Policymaker's Guide to Emerging Technologies" gives a gloomy picture of the state of affairs on planet earth: "*soft law* is eating the world"[56]. As one of the Guide's authors details in an accompanying publication, "we stand at a crossroads in terms of governance approaches for a great many emerging technologies. The era of *hard law* governance appears to be fading and the age of soft law is firmly underway"[57]. Disoriented policymakers might find safe haven, the text suggests, in breaking with the old world of regulating science and technology through the instruments of *hard law.* Instead, they should follow the new star in the governance of innovation – non-binding norms, guidelines, standards, and best practices produced by the multiplicity of stakeholders participating in innovation's universe. In fact, even if still skeptical, they will have no other choice than to jump on the ride. As the Guide warns the travelers, "scholars and policy advocates of quite different ideological dispositions may have reservations about this development, but that is unlikely to keep it from happening"[58].

The governance of emerging science and technology is indeed going through deep transformations. Not only are they pushed into societies at seemingly unprecedented speed and scale, societies' sense of control towards them also seems to become ever more ambiguous, uncertain, and unpredictable. The steady introduction of new ways to see and act on the world's problems through technoscientific means arguably leads to a continuous questioning of long-held notions of the public good, pitting a culture of "moving fast and breaking things"[59] against constitutionally and legally stabilized orders established to protect and provide the common interest. Our innovation era's appeal for dynamic socio-technical change seems incompatible with these dusty and sturdy rules, which are argued to lag far behind the fast pace of technoscientific development. Some posit that *hard law*'s force to regulate innovation toward the public benefit may even be discarded altogether: "the difficulties of attempting to provide certainty in an inherently uncertain landscape like technological development make old models of regulatory rulemaking nearly obsolete" remarks the Policymaker's Guide[60]. According to these commentators, the governance of innovation through *soft law* has numerous advantages compared to its hard regulation. Soft instruments are more flexible in adapting to scientific and technological change, provide more room for negotiation and agreement between stakeholders than the courtroom, allow for experimentation in similar ways as experiments conducted in the lab, and are

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56 Ryan Hagemann et al., 'The Policymaker's Guide to Emerging Technologies' (Niskanen Center, November 2018). Reference to Marc Andreesen's famous article "why software is eating the world", in which he claimed that "over the next 10 years, the battles between incumbents and software-powered insurgents will be epic." 'Marc Andreessen on Why Software Is Eating the World - WSJ'.

57 Ryan Hagemann and Jennifer Huddleston Skees, 'Soft Law for Hard Problems: The Governance of Emerging Technologies in an Uncertain Future' 17 (n.d.): 129. My emphasis.

58 Hagemann and Skees, 129.

59 Jonathan Taplin, *Move Fast and Break Things: How Facebook, Google, and Amazon Cornered Culture and Undermined Democracy* (Little, Brown and Company, 2017).

60 'The Policymaker's Guide to Emerging Technologies', Niskanen Center, 13 November 2018, 5.

not bound to a particular jurisdiction but can travel among countries and enhance international consensus on how to best regulate innovation for the public benefit. On the other side of the spectrum, critics of a contemporary turn to *soft law* consider this form of regulation as having no teeth, supporting the 'ethics washing' of emerging tech and its industries, or simply falling short of any public legitimacy to speak for societies and their interests. As legal scholar Gary Marchant, one of the most vocal proponents of *soft law* for the regulation of AI, recently described with reference to Churchill's famous statement that "democracy is the worst form of government apart from all the others", "soft law is far from a perfect tool to tackle all the challenges presented by embedding AI into our democratic and societal structures". Yet he asserts that "pragmatically, *soft law* may be the worst form of governance, except for all the others"[61].

This chapter traces the discourses and practices that have evolved in science and technology governance with regard to the soft steering of innovation, including discussions and controversies on their democratic desirability and legitimacy: How is *soft law* envisioned as a desirable tool to embed innovation in democratic cultures by scholarship on science and technology policy? What critique has been voiced against its uptake, and which alternatives have been proposed? Where and when did the terminology of *soft law* emerge, and how is it appropriated in the current governance of emerging technologies? In the following, I first review the trajectory and state of the art of soft frameworks and instruments for the governance of science and technology, including literatures in STS concerned with the deconstruction and critique of such frames and techniques of governance as democratically legitimate ways of ordering the relationship between society and innovation. From here, I move to tracing *soft law*'s genealogy in scholarship on International Relations and the law. I conclude the chapter by arguing that discussions in STS and international law share an asymmetrical approach to the nature, function and effects of *soft law* in governance, and propose that a different methodological approach is needed to understand its uptake in science and technology policy.

[61] Gary Marchant, 'Why Soft Law Is the Best Way to Approach the Pacing Problem in AI', *Carnegie Council for Ethics in International Affairs*, 29 September 2021.

2.1 Changing Destinations, Frameworks, and Instruments in the Soft Governance of Science and Technology

Soft governance frameworks and instruments for better aligning emerging science and technology with society have a long trajectory that has evolved in response to particular historical moments, in different ways across countries and institutional settings, and with a multitude of approaches as a result, which often competed with or even superseded each other. Notwithstanding such heterogeneity, literatures concerned with the steering of scientific and technological development with, for, and in society share two important characteristics. First, different regimes that rest on the production of normative guidance, principles, or tools for innovation governance have only recently come to be described as *soft law*, while in the past, they were usually attributed specific labels such as Bioethics, Technology Assessment, and RRI, or more generic tags, such as hybrid, tentative, or experimental forms of science and technology governance. *Soft law* in science and technology policy worked, for much of its record, like a chameleon adapting itself to specific institutional environments and socio-historical contingencies through changing its colors and vocabularies (see Fig. 1).

The joints among those changing ways of approaching, conceptualizing and ordering the relationship between science, technology, and society can be boiled down to the particular features of *soft law*: rules and principles produced to steer the governance of innovation-society relationships are usually not declared by a judge or court and have no legal authority; they rely on the normative power of non-binding rules that are produced by multiple stakeholders beyond the state alone; and they are envisioned to evolve flexibly alongside research and development, rather than imagined as fixed or rigid forms of scientific and technological regulation.

Second, the proliferation of these governance regimes is closely tied to repeated periods of a perceived demise of public trust in and support of science and technology's capacity to steer themselves towards socially desirable ends. As counter-proposals to received policy-views on science and technology as politically autonomous systems vis-á-vis democratic procedures and structures, *soft law* approaches usually gained traction in political culture when the democratic legitimacy of scientific and technological investment coupled with *laissez-faire* regulation was under stress. Since the mid 20th century, new modes for generating knowledge on the potential risks of new knowledge and technology, as well as instruments for better including social values and perspectives in the technocratic cultures of policy-making, have slowly but steadily intervened in the policy regime that stabilized during the post-war years. Over the two World Wars, science and technology became intrinsically attached to the state's apparatus, not only by way of strengthening the public support of and investment of basic research and engineering, but also through supporting governments to present themselves as representative and integer institutions that rest on rational knowledge and technological action[62]. During the immediate

[62] Yaron Ezrahi, 'Science and the Making of Representative Actions and Accountable Actors', in *The Descent of Icarus : Science and the Transformation of Contemporary Democracy* (Cambridge, MA: Harvard University Press, 1990), 41–67.

aftermath of WWII, governments across the world began to institutionalize science policy departments and agendas that were anchored in optimistic, linear narratives of scientific and technological progress and a "necessary division of labour between the initial producers of ideas on the one hand and the ultimate users on the other"[63]. In this period, scientists and engineers were believed to work best for society if left to their own self-regulatory powers, while society was seen at best as a natural beneficiary of science's discoveries and at worst as lacking the knowledge necessary to make informed decisions about its pathways. The 'social contract' with science of that era was primarily geared toward scientific and technological progress as undisputable good for society – a deterministic imagination that has often been criticized for neglecting the social agency at play in the development and introduction of new knowledge and technologies.

Such agency was emphasized over and over again in moments of severe crisis for the democratic legitimacy of social contract ideals, from the adjudication of human experiments and research conducted by the Nazis during WWII, public scrutiny vis-á-vis the industrial-military complex and the nuclear arms race mobilized by countries in the Cold War, to an emphasis on precautionary policies with regard to environmental consequences of new technologies and the pursuit of biomedical experimentation in light of uncertain ethical, legal, and social consequences, to name but a few. Periods of public critique, controversy, or even pessimism with regard to science and technology governance have often caused a "progressive shift in worldview"[64] on how to govern better, with greater foresight, and in harmony with social values and democratic processes. Soft frameworks and instruments advanced during these moments were made credible as progressive solutions to the seemingly outworn regime of traditional science and technology policy in which society figured only as an afterthought – fixing, as I will argue later, the ineffectiveness of governance rationales and devices in generating and securing public legitimacy for innovation imperatives. These fixes sooner or later ran into similar legitimation problems as science and technology policy itself: if and how soft principles, processes and rules can be considered democratically legitimate and representative of society's interests are questions that served as much as a critique of rising *soft law* regimes as they worked as an impetus to continuously change, improve, and expand frames and devices for the governance of emerging science and technology in the name of the public.

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[63] Aant Elzinga, 'Metaphors, Models and Reification in Science and Technology Policy Discourse', *Science as Culture* 13 (March 2004): 105.

[64] Howard P. Segal, 'Technology, Pessimism, and Postmodernism: Introduction', in *Technology, Pessimism, and Postmodernism*, ed. Yaron Ezrahi, Everett Mendelsohn, and Howard Segal (Dordrecht: Springer Netherlands, 1994), 6.

Governance regime	Time period	Institutional setting	Policy rationale
Bioethics	1940s>	Hippocratic Oath, Nuremberg Code, Helsinki Declaration, Belmont Report, Asilomar Conference, UN Charta of Human Rights	Ethical expert assessment of benefits and risks raised by emerging biotechnologies and medicine to the respect for persons and justice; common-morality principles
Ethical, Legal, Social Issues/Aspects	1990s>	NIH, the Human Genome Project	Combining scientific research with ethical, legal, social research for the assessment of emerging technologies
Parliamentary Technology Assessment	1960s - 70s>	U.S. Office of Technology Assessment	Expert assessment of emerging technologies, including forecasting, for policy advice
Participatory and constructive TA		European Technology Assessment Offices	Participatory assessment of scenarios and policy options, including citizens, for parliamentary deliberation
Precautionary Principle	1970s - 1990s>	German parliament, EU, UN	'Better safe than sorry': acting to reduce potential hazards before there is strong proof of harm, often through cost-benefit calculation of (in)action
Responsible Research and Innovation	2000s - 2020s>	NNI, European Commission	Anticipatory, Reflexive, Inclusive and Responsive assessment of emerging technologies, lay citizens as experts and a strong role for social science expertise

Figure 1: Shifting governance regimes for aligning science, technology, and society

With these shared characteristics in mind, let us now turn to the different frameworks and instruments for the governance of science and technology that have stabilized to varying degrees, in different places, and for different historical reasons, in public policy since roughly the 1950s. As this thesis is concerned primarily with the US, EU, and their transatlantic policy forum OECD, I will set aside most of the literatures and approaches developed in other locations, and in particular the rich pool of frameworks mobilized for the strengthening of innovation-society relationships in the so-called Global South. Approaches, such as 'Appropriate', 'Inclusive' or 'Alternative' innovation, were tried and tested in developmental contexts and for 'pro-poor' technologies[65], and I have called elsewhere for further research on these parallel processes and current attempts to move governance frameworks from one context to another[66]. These approaches should not be neglected in the genealogy of soft governance of emerging technologies but it is beyond the limits of this thesis to elaborate them further. A short overview of the different governance frameworks for Global South contexts is provided in Fig. 2.

Governance regime	**Policy Rationale**
Democratic Technology	Producing small-scale technologies in communities.
Appropriate / Alternative Technology	Generating low-cost and low-scale services and products in poor communities.
Grassroot Innovation	Valuating the knowledge of vulnerable sectors of society for generating practice-oriented solutions.
User-driven Innovation	Accelerating innovation processes through engaging intermediate and end-users.
Frugal Innovation	Turning limited resources from a constraint to an advantage, e.g., low-cost innovations for poor markets.
Social Innovation	Targeting communities in innovating practices and social structures.
Inclusive Innovation	Creating of social and economic dynamics of development through the production of 'pro-poor' technology.

Figure 2: A short overview of governance frameworks for innovation and society in the 'Global South'

[65] For an overview of these approaches see Carroll Pursell, 'The Rise and Fall of the Appropriate Technology Movement in the United States, 1965-1985', *Technology and Culture* 34, no. 3 (1993): 629–37.
[66] Annapurna Mamidipudi and Nina Frahm, 'Turning Straw to Gold: Mobilising Symmetry in Responsible Research and Innovation', *Science, Technology and Society* 25, no. 2 (July 2020): 223–39.

Authorizing normative expertise: The birth of Bioethics and its descendants

Bioethics represents one of the earliest, and arguably most prominent, approaches to the regulation of scientific research and technological development through soft social principles and rules. Rooted in the regime of medical ethics that was codified first with the Hippocratic Oath roughly dating back to 400 BC, Bioethics can be interpreted as a steady refinement and expansion of the principle to do good, and not harm, to patients, research subjects, and individuals in the practice of medicine and the pursuit of scientific experiments. Several moments in 20th century history caused Bioethics to evolve and expand its authority and scope, particularly vis-á-vis controversies over human experimentation and the admissibility of intervention in human nature via technoscientific means. To start with, the "*Ärzteprozess*" of the Nuremberg Trials held between 1945 and 1946 marked "a new beginning in the moral tradition of medicine, a beginning that would become Bioethics"[67]. The adjudication of the unprecedented atrocities committed by Nazi doctors and scientists, such as Joseph Mengele, in the name of eugenics during the Second World War gave way to the Nuremberg Code, which settled principles for legitimate medical research and experimentation such as voluntary consent, risk/benefit assessment, and the protection of human subjects participating in experiments. The Nuremberg principles significantly broadened the purview of medical ethics to the ethics of research experiments, which were envisioned as legitimate only when yielding "results for the good of society"[68].

But while the Nuremberg Code is regarded by many as the birthplace of Bioethics, its close attachment to the Nazi horrors made it seem irrelevant for the regulation of medical research outside of Germany in the post-war aftermath. As historian David Rothman observes with regard to the impact of the Nuremberg Trials in the US, "Madness, not medicine, was implicated at Nuremberg…the prevailing view was that they were Nazis first and last; by definition, nothing they did, and no code drawn up in response to them, was relevant to the United States."[69] The legacy of the Code in the evolution of Bioethics needs to be understood differently according to Rothman, in that it helped to stabilize ideals of science and research as pure, disinterested institutions that need to be safeguarded by Bioethics against ideological manipulation and misuse. Particularly in the US, lessons drawn from Nuremberg were not "that the state should regulate experimentation but quite the reverse – that the state should not interfere with medicine. [Bioethics] became a stick with which to beat the idea of 'socialized' medicine, not the occasion to oversee research...Science was pure – it was politics that was corrupting."[70] It is this framing of pure science – and of Bioethics' role in the governance of its boundaries – that set the rationale for the institutionalization of Bioethics in public policy in the following decades. For instance, the Declaration of Helsinki, issued by the World Medical Association in 1964 and remembered as a

[67] See Jonsen's detailed history of Bioethics Albert R. Jonsen, *The Birth of Bioethics*, vol. 23 (Oxford University Press, 1998), 134.
[68] 'The Nuremberg Code (1947)', *BMJ* 313, no. 7070 (1996): 1448.
[69] David Rothman, *Strangers at the Bedside: A History of How Law and Bioethics Transformed Medical Decision Making* (Routledge, 1991), 63.
[70] Rothman, 63.

founding document for principled Bioethics, delineated the doctor's mission to "safeguard the health of the people", "further scientific knowledge" and "help suffering humanity"[71]. As guidance for practitioners at the bedside and in the laboratory, the Helsinki principles resurrected ideals of science as an enterprise driven by the good and welfare of people, rather than as a potential source of human suffering and means for its exploitation and abuse.

Medical and scientific malpractice had a homecoming in the US in the 1960s and 70s, a period shaped not only by social, economic and political turmoil, but also by the revelation of several scandals with regard to clinical and research experiments that caught the public's and policymakers' attention. One of those scandals centered on Thalidomide, an experimental drug for anxiety, amnesia, and morning sickness, which had been marketed widely in Europe and, to a lesser extent, in the US, and that was linked to serious birth defects and miscarriages in 1962. Also known as the 'Contergan scandal', public scrutiny of Thalidomide experimentation and approval centered particularly around the fact that in many cases, consent to participation in research had not been acquired by physicians before the experiments, and that drugs had not been tested on pregnant women before prescriptions were issued. Yet, it took another decade, and another revelation of grave research misconduct, for American policymakers to embrace Bioethics as a desirable regime for overseeing scientific and healthcare practice and adherence to ethical norms. When the New York Times rang the bells in 1972 that "Syphilis Victims in U.S. Study Went Untreated for 40 Years", serving as "guinea pigs"[72] despite the availability of effective therapies to prevent death from syphilis, "the ethics of research, which had been under quiet scrutiny for a decade, broke into public view"[73]. Publicly condemned as the "Tuskegee Studies", the article laid bare the decades-long intentional misguidance by the United States Public Health Service of a group of black men and women suffering from syphilis, which did not know their disease was not treated but merely examined by authorities and experts. Contergan and Tuskegee, it turned out later, were not exceptional mishaps in a research culture left to its own discretion and regulatory purview – as the similarly infamous "Cincinnati Radiation Experiments" and several trials on malaria and other infectious diseases with prisoners conducted during the Cold War disclosed, "no wing of the medical profession could be trusted to keep its house in order – (and) that medicine required a new kind of collective oversight."[74] Loss of public trust in commitment of the medical research enterprise to 'do no harm', an increasing image of science as abusive of socio-economically underprivileged populations, and wider public debates about the responsibility of scientists during the 1960s and 70s provided major incentives for including Bioethics in research and governance.

Two forms of Bioethics instruments emerged in response to these events, one envisioned to regulate clinical and research practice from the inside, and another to develop and oversee adherence to

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[71] The World Medical Association, 'Declaration of Helsinki 1964', 1964.
[72] Jean Heller, 'Syphilis Victims in U.S. Study Went Untreated for 40 Years', *The New York Times*, 26 July 1972.
[73]Jonsen, *The Birth of Bioethics*, 23:148.
[74] Rothman, *Strangers at the Bedside*, 184.

ethical principles in science and medicine from above. In the US, the institutionalization of Bioethics was codified through the National Research Act signed into *hard law* by President Nixon in 1974, which created a National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research tasked with developing guidance for ethical review of studies and experiments conducted in research institutions, universities, and hospitals. On the one hand, the Act federally regulated human subjects research through a "model for making decisions – for governing with experts – that was familiar and that accommodated their existing practices."[75] Such a model standardized the designation and procedures of Institutional Review Boards (IRBs) as "the invisible handmaidens to the research enterprise"[76] for the review of research proposals and clinical trials across the country, and effectively bureaucratized the political tensions that had given rise to a greater appraisal of Bioethics principles and questions at federal level. On the other hand, it granted the National Commission, a "temporary, rather than permanent" body, with "advisory, (but) without any enforcement powers of its own"[77], which is a characteristic shared by National Commissions for Bioethics that were installed later by several US administrations (see US case study).

The advisory function of the National Commission effectively reduced its authority to proclaim the *soft law* for nation-wide medical and research ethics, including for deliberations in IRBs, a task taken up during the last years of its work through the development of the "Belmont Report" published in 1979. By approaching Bioethics as a set of principles and practices for their application, the Belmont Report was key for stabilizing the principlism that sets the tone for the field until today. The Report's three "crisp" ethical principles[78] – respect for persons, beneficence, and justice – to be applied via practices of informed consent, risk/benefit assessment, and in the selection of research subjects, reverberate, for example, in the "Universal Declaration on Bioethics and Human Rights" endorsed at international level by UNESCO in 2005. Bioethics principles, such as those suggested by the Belmont Report and the UNESCO declaration, came to be understood along similar lines as universal Human Rights, as representing *"the* (not *a*) common morality" against the cultural relativism of "social and cultural particularities and differences"[79]. Despite the involvement of theology in the early days of Bioethical institutionalization, this prevailing view of morality in Bioethics surged from and is embedded within liberal political traditions that focus on the individual and her autonomy, which are reproduced in the normative governance of the medical and scientific system and its "resolutely secular orientation"[80].

The emerging Bioethics regime not only resolved tensions in science-society relationships mounting in the 1960s and 70s, but also settled the rising conflict between mid-20th century commitments to science as an autonomous and self-regulating institution and rising demands for greater

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[75] Laura Stark, *Behind Closed Doors: IRBs and the Making of Ethical Research*, Morality and Society Series (Chicago, IL: University of Chicago Press, 2012), 76.
[76] Jasanoff, *The Ethics of Invention*, 232.
[77] Rothman, *Strangers at the Bedside*, 189.
[78] Jonsen, *The Birth of Bioethics*, 23:103.
[79] Renée Fox and Judith Swazey, *Observing Bioethics* (Oxford University Press, 2008), 8.
[80] Fox and Swazey, 226.

social control of emerging science and technology. The integration of Bioethics experts in IRBs and the newly-gained authority of public Bioethics to declare ethical principles and practices for science and medicine through high-level advisory bodies, such as the National Commission, was permissible as Bioethics "was a profession that was *not* the distrusted medical/scientific profession" and because it claimed "that it would ensure that the new values used in the medical/scientific profession were actually based upon the values of the citizens."[81] Shared governance among Bioethics and science was conceived as a strict division of labor, in which ethics experts represented society's interest and norms, and science the facts of nature: "science stands outside politics, whereas ethics deals with the political in its most fundamental sense, as collective judgments about the good"[82]. Put differently, Bioethicists were only granted soft jurisdiction over the normative dimensions of research when staying firmly within the epistemic bounds suggested by science – a settlement in need of continuous boundary-work around the authority of science and ethics[83] as the case study on Bio- and Neuro-ethics in the US will detail further below. Science, in turn, was re-stabilized as capable of self-regulation once avowing to the soft principles declared by Bioethics within the terms of condition set by researchers.

This settlement between ethics and science continued to shape the governance of medicine and the life sciences, and in particular the emerging field of molecular biology and research on recombinant DNA. When public controversies around the modification of DNA rose in the mid-1970s, for instance, scientists and policymakers initiated the Asilomar Conference to discuss a potential moratorium on further research in light of unknown risks and potential biohazards. By performing an effective, socially and ethically responsible culture of self-regulation, scientists at Asilomar could frame the issues of concern as well as desirable forms of governing them: while they assessed that "it would be wise to exercise considerable caution in performing this research", specifically through the containment of genetically modified organisms, they judged that "most of the work on construction of recombinant DNA molecules should proceed."[84] Unsurprisingly, the Asilomar meeting enjoys enduring legacy for "charting a course for molecular biology that would rely heavily on scientific self-regulation and on the notion that scientists are in the best position to make judgements about whether and when a technology is sufficiently developed to warrant public attention to its impacts and consequences."[85] Particularly in the US, solutions to current controversies around CRISPR/CAS9, Artificial Intelligence, or Neurotechnology are sought in Asilomar-type governance arrangements that emphasize the public benefit of public R&D while showing commitments to ethics integration and adherence to self-declared, common-morality principles.

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[81] John H. Evans, *The History and Future of Bioethics: A Sociological View* (New York: Oxford University Press, 2011), 107.
[82] J. Benjamin Hurlbut, *Experiments in Democracy: Human Embryo Research and the Politics of Bioethics* (Columbia University Press, 2017), 9.
[83] Susan E. Kelly, 'Public Bioethics and Publics: Consensus, Boundaries, and Participation in Biomedical Science Policy', *Science, Technology & Human Values* 28, no. 3 (2003): 339–64.
[84] Segal, 'Technology, Pessimism, and Postmodernism: Introduction', 1981.
[85] Benjamin J. Hurlbut, 'Limits of Responsibility: Genome Editing, Asilomar, and the Politics of Deliberation', *Hastings Center Report* 45, no. 5 (2015): 12.

As we witness the emergence of specialized branches of Bioethics expertise such as Nano-ethics, AI-Ethics, or Neuro-ethics, the boundary between ethics and science settled in the 1970s remains essentially unchanged. Importantly, and as I will explore further in the US case study, such agreement needs to be reached over and over again through hard-fought battles among ethicists and scientists. More often than not, scientists are reluctant to share jurisdiction with ethicists, and sometimes even publicly reject their authority and existence, as is the case with cognitive psychologist Steven Pinker from Harvard University, who recently argued in the Boston Globe that "the primary moral goal for today's bioethics can be summarized in a single sentence: Get out of the way."[86] Yet, it seems that even the most acclaimed scientists cannot do away with the Bioethics regime that has solidified in public policy as well as within research institutions over the last sixty years. The pervasive power of the arrangement in "conveying a reassuring sense of democratic supervision while giving entrepreneurial scientific and technological imaginations free rein to determine in effect what counts as the public good"[87] remains an powerful frame of public policies on science and technology, despite recurring attacks from all fronts.

Bioethics has proven to be a dynamic and creative regime with the ability to adapt to change and critique, but its core ideas and frames have remained surprisingly resilient. Not least since the Human Genome Project (HGP) set unprecedented funds aside for research on the "Ethical, Legal and Social Implications" (ELSI) of emerging genomics research in the late 1990s, a new umbrella term for the integration of ethical and social science expertise in research programs and projects emerged (see Fig. 1). Yet, a familiar rationale looms beneath the new idiom of ELSI (or ELSA in the European version of "Aspects" instead of "Implications"). As Steven Hilgartner and colleagues resume on the evolution of ELSI frameworks and instruments, they "mediate between scientific autonomy and democratic governance, providing a source of authority for defining – and, at times, dismissing – public concerns."[88] We will come back to the role-model function of ELSI governance in the HGP when analyzing the BRAIN Initiative in the US and the Human Brain Project in the EU.

But as public Bioethics in the form of high-level commissions and declarations spread beyond the US and went global (e.g., the Nuffield Council on Bioethics in the UK, the International Bioethics Committee of the UN, or the German *Ethikrat*), the order settled between ethics and science quickly became accused of instrumentalism, a lack of democratic legitimacy, and for its claims to common, universal morality. To critics at the other extreme of Steven Pinker, Bioethics had been institutionally captured[89] by science from the start in that it had little power to criticize evolving research and medicine and to effectively intervene in the development of new knowledge and technologies, let alone to "get in the way" of scientific progress when deemed undesirable by ethicists and the public. The subordination

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[86] Steven Pinker, 'The Moral Imperative for Bioethics', *The Boston Globe,* August 2015.
[87] Jasanoff, *The Ethics of Invention,* 244.
[88] Stephen Hilgartner, Barbara Prainsack, and J. Hurlbut, 'Ethics as Governance in Genomics and Beyond', in *Handbook of Science and Technology Studies,* 4th ed. (Cambridge MA: MIT Press, 2016).
[89] Albert Dzur, *Democratic Professionalism:Citizen Participation and the Reconstruction of Professional Ethics, Identity, and Practice* (Penn State University Press, 2008).

of Bioethics to the terms and orders of science implied that Bioethics in its advisory function "rarely says no"[90] to visions of the individual and public good proclaimed by the research enterprise. Favoring consensus over controversy and soft self-regulation over harder forms of public control comes at a high price for Bioethics from this perspective: as Susan Kelly summarizes in a paper that argues for an "Epistemological Luddism in Bioethics", "such an ethics runs the danger of taking the form of technique, or mere regulatory methodology."[91] More often than not does the instrument of public Bioethics focus on the impacts of products rather than the processes of biomedical research, through which more fundamental, upstream concerns on science are neglected, and by which the linear model of technoscientific progress gets re-introduced through the backdoor of ethics[92].

Conceived as a technique of expert governance rather than as a form of social deliberation on the politics of science and technology, critics argue that Bioethics assumed the role of the neutral, evidence-based, and rational mediator between science and society, losing its critical grip to influence policy and norms on science and technology. Co-founder of the Hastings Center Dan Callahan, one of the earliest and most impactful Bioethics think-tanks in the US, describes the idea of Bioethics targeted by these critiques as "fairly and carefully stating opposing positions, looking always for their best exemplifications, avoiding the kind of courtroom, daytime-TV-show polemic and bombast that have come to pass for civil discourse in our society; and (being) acutely aware of one's own ideological bias, lying like a snake in the grass below one's arguments and supposedly rational convictions"[93]. It is precisely a lack of Callahan's acknowledgment that Bioethics rests on and re-produces certain ideologies and those of technocratic elites in particular that leads commentators to ask "troubling questions about who controls technology"[94], and whose visions and values get to be represented by Bioethics in the governance of emerging technoscience.

Numerous case studies suggest that Bioethics and its descendants tend to solidify governance through expertise that leans toward positive and optimistic imaginations of technical futures, whether through reinforcing socio-technical expectations projected by revolutionary scientists and engineers[95], mobilizing speculation about technology's pathways "to invent a mandate for action"[96], or by delimiting "ethical deliberation [about technology] to uses that are already possible or are on the immediate horizon, focusing only on the next step, not on where the path ultimately leads."[97] A sociology of

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[90] Evans, *The History and Future of Bioethics: A Sociological View*, 111.
[91] Susan E. Kelly, 'Toward an Epistemological Luddism of Bioethics', *Science & Technology Studies* 19, no. 1 (1 January 2006): 69–82.
[92] See Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*.
[93] Daniel Callahan, 'Bioethics, Our Crowd, and Ideology', *Hastings Center Report* 26, no. 6 (1996): 3–4.
[94] Jasanoff, *The Ethics of Invention*, 237.
[95] Adam Hedgecoe, 'Bioethics and the Reinforcement of Socio-Technical Expectations', *Social Studies of Science* 40, no. 2 (2010): 163–86.
[96] Alfred Nordmann, 'If and Then: A Critique of Speculative NanoEthics', *NanoEthics* 1, no. 1 (1 March 2007): 33.
[97] Benjamin J. Hurlbut, 'Imperatives of Governance: Human Genome Editing and the Problem of Progress.', *Perspectives in Biology and Medicine* 63 1 (2020): 180.

professional Bioethics has emerged to either dismantle the veil of universality and neutrality surrounding the field and its practices[98], or as a way to help experts better reflect on their own normative biases, forms of organization, and governance rationales[99]. Accusations that Bioethics in its globalized form is continuing US American cultural, political and economic hegemony[100], negating "otherness"[101] and specifically non-individualist understandings of the self and its body, have furthermore prompted calls for postcolonial, feminist, and justice-based Bioethics[102] that departs from questions such as "what kind of lives and collectives are made possible [and] what rights and principles should govern them?" rather than from "narrow individual questions such as Do I consent?"[103] Bioethics, according to these voices, not only needs to become more inclusive, allowing participation of diverse perspectives and stakeholders, it needs to become attentive to the "full social life"[104] of scientific and technological inventions and interventions. If and how Bioethics in its original design can continue to enjoy authority in the governance of emerging science and technology remains an open question, particularly as frameworks and instruments with the power to convey greater democratic legitimacy and social inclusion proliferate in European policy and global governance institutions (see below). The short review of its evolution that I have just presented, however, gives us all the reason to chart a bright future for public Bioethics – true to its foundations, yet robustly imaginative when it comes to resolving the tensions inherent in the relationship between science and democracy.

Bringing reason to politics and people: The rise of Technology Assessment

If Bioethics emerged in the second half of the 20th century as a way of "bringing order and principle"[105] to public controversies around science, then its companion regime Technology Assessment (TA) can be described as governance device for bringing reason and rationality to politics and people in the appraisal of technoscientific change. While Bioethics primarily responded to a crisis of the medical and clinical research system, TA took up the task to counter problems with the legitimization of public investments in large technological projects and the prospects of an increasingly technologized economy and society looming on the horizon of the early 1970s. As Armin Grunwald, one of the pioneers of TA in the European context, describes the original motivations for the rise of this regime, it aimed at "dealing

[98] Fox and Swazey, *Observing Bioethics*.
[99] Raymond De Vries, 'How Can We Help? From "Sociology in" to "Sociology of" Bioethics', *The Journal of Law, Medicine & Ethics* 32, no. 2 (2004): 279–92.
[100] Brian Salter, Yinhua Zhou, and Saheli Datta, 'Hegemony in the Marketplace of Biomedical Innovation: Consumer Demand and Stem Cell Science', *Social Science & Medicine* 131 (2015): 156–63.
[101] Renée Fox and Judith Swazey, 'Guest Editorial: Ignoring the Social and Cultural Context of Bioethics Is Unacceptable', *Cambridge Quarterly of Healthcare Ethics* 19, no. 3 (2010): 278–81.
[102] See for example Ruha Benjamin, 'Informed Refusal: Toward a Justice-Based Bioethics', *Science, Technology, & Human Values* 41, no. 6 (2016): 967–90. Jenny Reardon, 'On the Emergence of Science and Justice', *Science, Technology, & Human Values* 38, no. 2 (2013): 176–200.
[103] Jenny Reardon, 'Why and How Bioethics Must Turn toward Justice: A Modest Proposal', *Hastings Center Report* 50, no. S1 (2020): S70–76.
[104] Alondra Nelson, *The Need For a New Bioethics*, accessed 27 May 2022.
[105] Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*, 171.

constructively with the ambivalence of technology, exploiting the innovation potentials of future technology, contributing to solving technology conflicts, and strengthening democratic reasoning and decision-making."[106] Ambivalence and controversy around the potency and power of technology to shape society to yet unknown xtents indeed penetrated the public sphere during the 1960-80s, a period marked not only by the Cold War and the race to space, but by an overall expansion of scientific and technological research sponsored by the state[107].

From the student protests of 1968 and beyond, a rising environmental and anti-nuclear arms and energy movement, to mounting energy crises and an increasing awareness of the "Limits to Growth"[108], publics demanded a greater attention to the risks of new technologies and ever louder calls for a democratization of their authoritative expert governance surfaced. Rachel Carson's "Silent Spring"[109] laid bare the detrimental consequences of US American agricultural and environmental policies planned without foresight of their long-term impacts on the eco-system. In Europe, a group of intellectuals known as the "Frankfurt School" propagated anti-technocratic ideas, such as those of Herbert Marcuse, who in his masterpiece "One-Dimensional Man" claimed that "our society distinguishes itself by conquering the centrifugal social forces with Technology rather than Terror, on the dual basis of an overwhelming efficiency and an increasing standard of living", which he believed lead to a "paralysis of criticism" and eventually to a "Society without Opposition"[110]. What was needed, according to policymakers and scholars worried about these developments, was greater capacity by democratic institutions to reason on technological choices and futures made on behalf of constituents – not to further strengthen opposition against technological solutionism, but to decide better on which technological paths ought to be taken in the name of the public. According to Harvey Brooks, a key figure in the early advocacy for TA in the US and at the OECD, "ideally the concept of TA is that it should forecast, at least on a probabilistic basis, the full spectrum of possible consequences of technological advance, leaving to the political process the actual choice among the alternative policies in the light of the best available knowledge of their likely consequences"[111]. As we will learn in the OECD case study, the subjugation of decision-making on emerging technologies to the study of choices was envisioned by Brooks and colleagues as a "perfection of conceptual instruments" for studying the relationship between technology and society, for which scientists and engineers, but also social science researchers were deemed central.

Championed in the US through the creation of the Office of Technology Assessment (OTA) in

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[106] Armin Grunwald, *Technology Assessment in Practice and Theory* (Routledge, 2019), sec. Preface.
[107] For a detailed account on how the Cold War spurred scientific and technological development beyond nuclear armament alone see Naomi Oreskes and John Krige, eds., *Science and Technology in the Global Cold War*, Transformations: Studies in the History of Science and Technology (Cambridge, MA, USA: MIT Press, 2014).
[108] Donella Meadows et al., *The Limits to Growth* (New York, NY: Universe Books, 1972).
[109] Rachel Carson, *Silent Spring* (Houghton Mifflin Company, 1962).
[110] Herbert Marcuse, 'Introduction to the First Edition The Paralysis of Criticism: Society Without Opposition', in *One-Dimensional Man* (Boston: Beacon, 1964).
[111] Harvey Brooks, 'Technology Assessment in Retrospect', *Newsletter on Science, Technology, & Human Values*, no. 17 (1976): 20.

1972 "as an aid in the identification of existing and probable impacts of technological application"[112] for Congress, TA was imagined to bring scientific and technological reason closer to the locus of democratic decision-making, and to ground such decisions in objective and rational expert assessment rather than in partisan politics and ideology. Such vision did not necessarily break with linear models of technological development but suggested a new directionality for policymakers to orient their efforts toward. As the OTA's long-time leader John Gibbons described its broader mission, TA was conceived for "helping Congress and the American people have better access to highly technical information as it relates to policy issues"[113]. The performance of neutrality in the provision of advice to Congress was a matter of survival for the OTA within the politics of Washington, where staff and consultants were advised by the OTA's first director Emilio Daddario "to scrub out biases as much as possible…not to push a position but to put data in a form where it can help people"[114].

Respectively, instruments that formed part of the TA toolkit in the US – such as technological forecasting through scenario-development and Delphi panels – were made credible through the use of scientific techniques and rational policy analysis employed by science-advisors[115]. Instead of sociologists or philosophers, TA became the exclusive domain of economists and engineers that could provide analytic models of the costs and benefits of sociotechnical change so as to improve the "intelligence of government" with regard to technological policy[116]. One of the earliest academic journals dedicated to the discussion of TA theorizing and instruments fittingly was labelled "Technological Forecasting and Social Change", which widely propagated the emerging field of 'futures research' as an avenue for examining "systematically what can be, as contrasted with what will be, or what should be"[117] (the latter being regarded as the domain of Bioethics).

As a result, advice to democratic bodies through new-found offices such as the OTA "proved less of a brake on new technology than expected, and more of a force for thinking in unexpected ways about complex problems"[118] as the New York Times assessed in 1975. The power of parliamentary TA to strengthen public control of technological development was henceforth framed as orienting regulation better towards demands by society, as an instrument for "stimulating innovation in new and socially

[112] 'Public Law 92-484-OCT. 13, 1972', accessed 27 May 2022.
[113] Gibbons quoted in Pierre Delvenne and Céline Parotte, 'Breaking the Myth of Neutrality: Technology Assessment Has Politics, Technology Assessment as Politics', *Technological Forecasting and Social Change* 139 (1 February 2019): 66..
[114] Daddario quoted in Victor McElheny, 'Technology Assessment Office Aiding U.S. on Complex Issues', *The New York Times*, 9 June 1975.
[115] Rinie van Est, 'The Rathenau Institute's approach to participatory TA', *TATuP - Zeitschrift für Technikfolgenabschätzung in Theorie und Praxis* 9, no. 3 (1 September 2000): 13–20.
[116] As Bimber observed, "proponents of technology assessment argued that some part of the solution to political problems posed by technology could be found in what was essentially more technology – analytic modelling of sociotechnical change" in Bruce Bimber, *The Politics of Expertise in Congress* (SUNY Press, 1996), 27, https://sunypress.edu/Books/T/The-Politics-of-Expertise-in-Congress.
[117] Roy C. Amara and Gerald R. Salancik, 'Forecasting: From Conjectural Art toward Science', *Technological Forecasting and Social Change* 3 (1971): 415–26.
[118] McElheny, 'Technology Assessment Office Aiding U.S. on Complex Issues'.

beneficial directions"[119]. As will become apparent in the OECD case study, such framing was key for getting society on the agenda of economists that, until then, had measured science and technology policies in their contribution to economic growth only, giving way to new forms of conceiving society as instrumental actor in the development of technology. Yet, the myth of neutrality[120] that accompanied the institutionalization of TA in the US did not stand the test of time and the OTA was dissolved in the 1980's as part of President Reagan's overall push for deregulation, which included congressional deliberations on emerging science and technology.

But while the abolishment of the OTA in the US could be read as an early setback for new assessment approaches in the governance of technoscience, the framework of TA found great uptake on the other side of the Atlantic, where several countries successfully established parliamentary and other forms of TA in the 1980-1990s (e.g., the Danish Board of Technology and the *Büro für Technikfolgenabschätzung* in Germany), some of which are still in use today. European versions of TA cautiously turned the American understanding of TA around and laid greater emphasis on the participatory dimensions needed to achieve democratically legitimate policy-decisions on science and technology. In the Netherlands, for example, the Office of Technology Assessment (now the Rathenau Institute) was an early supporter of "Constructive Technology Assessment"[121] in which stakeholders beyond experts alone got involved in the production of scenarios for the future application of technology in society. Bringing people and their views closer to science, technology, and policy was a declared goal of the Dutch nuclear energy debate kicked off by government in 1981 to respond to the deadlock among industry and social movements with regard to the further advance of atoms for peace[122]. This "soft intervention", in which "studies and reports are an input, not the main result" of the governance process[123], significantly broadened TA's set of instruments to citizen workshops, consensus conferences, and participatory scenario-development. Here, TA's function came to be re-envisioned from the downstream anticipation of technological costs and benefits to the mid[124]- and upstream integration of heterogeneous stakes in scientific and technological governance, as "a new design practice in which impacts are anticipated, users and other impacted communities are involved from the start and in an interactive way, and which contains an element of societal learning."[125]

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[119] Harvey Brooks asked in a 1976 retrospect of TA's institutionalization in the US "to what extent can it be said that TA and regulation are actually stimulating innovation in new and socially beneficial directions? For example, are not emission controls of greater social benefit than riding comfort or automatic window controls?" Brooks, 'Technology Assessment in Retrospect', 19.
[120] Delvenne and Parotte, 'Breaking the Myth of Neutrality', 66.
[121] For a history of Technology Assessment in the Netherlands, see Arie Rip and Douglas K. R. Robinson, 'Constructive Technology Assessment and the Methodology of Insertion', in *Early Engagement and New Technologies: Opening up the Laboratory* (Springer, 2013), 37–53.
[122] Rob Hagendijk and Arjan Terpstra, 'Technology, Risk and Democracy: The Dutch Nuclear Energy Debate (1981-1984)', January 2004.
[123] Rip and Robinson, 'Constructive Technology Assessment and the Methodology of Insertion', 2.
[124] See Erik Fisher, Roop L. Mahajan, and Carl Mitcham, 'Midstream Modulation of Technology: Governance From Within', *Bulletin of Science, Technology & Society* 26, no. 6 (2006): 485–96.
[125] Johan Schot and Arie Rip, 'The Past and Future of Constructive Technology Assessment', *Technological Forecasting and Social Change* 54, no. 2–3 (1997): 251.

Such turn to public engagement in TA was made credible as a way to turn public controversies around technology from a potential barrier to a strategic resource for governments in learning about public opinion, for stimulating ordered deliberation in the public sphere, and for reducing the social costs of trial-and-error policy-making. Ari Rip, a pioneer of the constructive TA approach, suggested in 1986 that "ongoing, pluralistic, and fragmented societal processes of assessment and control of science and technology should be at least as relevant as formal, commissioned TA studies"[126] to governments, which, in turn, could become guardians of desirable forms of public debate and thereby yield more robust policy-decisions. As Rip himself advocated during these days, the participation by citizens in the governance of science needed to be framed and structured in particular ways so as to avoid the polarization of controversies or the retreat of the public from interest in deliberating the desirability of technoscience: "participation is not a citizen's right *per se,* but has to be earned on the basis of specific claims about the issues in the controversy. Only in this way is it possible to avoid either a purely social dynamic or isolation from the battleground"[127]. As becomes apparent in the EU case study and in the further review below, such an approach to public engagement in science and technology governance still underwrites much of the EU's current attempts to mainstream RRI across and beyond its member-states.

Critique of TA approaches rapidly set in from two opposing directions, both of which targeted the performance of neutral and rational policy-advice by TA frameworks and practice, and hence its legitimacy as an instrument for bringing technology closer to democratic control. One camp, firmly rooted in the belief that policy advice, much like science, can indeed be carried out rationally and objectively, accused TA of being a political power game of particular actors aiming at greater influence over public science and technology agendas. Such critique was particularly voiced by conservatives during the founding days of the OTA, which some saw as strategic move by TA supporters in Congress "to arrange for permanent dominance of liberal technocrats" by carrying out "quickie studies that duplicate much other work in the field but [which are] well-timed for television news"[128]. Amongst others, it was failure on part of OTA's leaders to prove these critics wrong that the body was dissolved in the 1980s[129]. Doubts that foresight of technological development can indeed yield any valuable insight for policymakers joined this camp. Management guru Peter Drucker, for instance, found it worthwhile commenting on the OTA in 1973 with the sober judgement that "the only thing in respect to a new technology, is speculation with about one chance out of a hundred of being right", rendering TA's impact "perilous and futile"[130].

A distinctively different kind of perspective on the performance of rational and objective TA and its presumable impacts was voiced by scholars immersed in the project of advancing a new, post-

[126] Arie Rip, 'Controversies as Informal Technology Assessment', *Knowledge* 8, no. 2 (1 December 1986): 361.
[127] Rip, 364.
[128] William Safire, 'The Charles River Gang Returns', *The New York Times*, 26 May 1977, sec. Archives.
[129] A detailed account of the rise and fall of the OTA is given by Bimber, *The Politics of Expertise in Congress*.
[130] Peter F. Drucker, 'New Technology', *The New York Times*, 8 April 1973, sec. Archives.

’Frankfurt School’ philosophy of technology that was critical toward technological determinism and that we now recognize as STS. For one of its earliest scholars Brian Wynne, TA was not more than a “political rhetoric which implicitly serves to simultaneously rationalize certain structural features of corporate capitalist society, and to conceal the arbitrary and at the very least debatable nature of the basis of legitimation of some social institutions fundamental to that society.”[131] He saw the impact of TA in the adoption of a particular “crudely scientific mentality” to social controversies around technology – “if scientific consensus is so natural, then so too can be social consensus. Where it does not exist, all that is required (as in science) is more or ‘better’ knowledge.” [132] Similarly, political scientist Langdon Winner, who in 1986 advanced the thesis that technologies are not neutral artifacts but have a politics of their own, understood the TA approach as inherently limiting society’s agency in choosing desirable futures. In “The Whale and the Reactor: A Search for Limits in an Age of High Technology”, Winner criticized US American TA ideals for focusing on the downstream “consequences” of technological change only while the nature and motivation of such change was barely taken into consideration: “After the bulldozer has rolled over us, we can pick ourselves up and carefully measure the treadmarks…There is no tampering with the source of change, and only minor modifications are possible at the point of impact.”[133]

Both scholars called for a renewal of TA “beyond impacts and side effects”[134] that takes the “political, symbolic, economic and social content of technology”[135] into account. Even constructive TA’s turn to greater public engagement became accused of resting on a narrow understanding of the issues provoking public controversies in the first place: “by closing down or subtly marginalizing such issues, [participatory TA] exercises complemented neoliberal forms of representative democracy”[136], Les Levidow argued on the first wave of public engagement practice in Europe. For Levidow and colleagues, “wider, autonomous forms of participation neither sponsored nor welcomed by state bodies”[137] represented more legitimate avenues for deciding on technological futures.

As TA continues to attract interest and support of governments in various countries, debate about the merits and pitfalls of TA frameworks and instruments vis-á-vis democracy has not ceased. The community of scholars and practitioners is split over the question if TA ought to continue performing the neutrality-narrative and if such narrative still holds in increasingly pluralistic, post-truth

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[131] Brian Wynne, ‘The Rhetoric of Consensus Politics: A Critical Review of Technology Assessment’, *Research Policy* 4, no. 2 (1975): 110.
[132] Wynne, 110.
[133] Langdon Winner, *The Whale and the Reactor: A Search for Limits in an Age of High Technology, Second Edition* (Chicago, IL: University of Chicago Press, 2020), 10.
[134] Winner, 10.
[135] Wynne, ‘The Rhetoric of Consensus Politics: A Critical Review of Technology Assessment’, 154.
[136] Les Levidow, ‘European Public Participation as Risk Governance: Enhancing Democratic Accountability for Agbiotech Policy?’, *East Asian Science, Technology and Society: An International Journal* 1, no. 1 (2007): 19–51.
[137] Levidow.

societies[138]. A recent special issue of the German TA journal "TaTup" (Journal for Technology Assessment in Theory and Practice), for instance, opens with the question of how TA's commitment to the provision of rational scientific knowledge needs to be re-positioned in light of a return to populism and a crisis of democracy, posing "virulent questions about the adequate normativity of TA"[139]. The issue features a debate between TA's early pioneer Armin Grunwald and Pierre Delvenne, standing in for a new generation of approaching TA as an openly normative and political project. While Grunwald sees TA's normative dimensions merely in an obligation to democracy, its unbiased core untouched, Delvenne envisions that "TA must become a bastion of democratic politics" by becoming more self-reflexive toward particular ideas of technoscientific politics guiding TA practice and engagement.

It seems that arguments à la Delvenne are gaining increasing traction within a field struggling to find the adequate positioning of its role vis-á-vis changing political climates and demands from society. Should TA continue the project of bringing scientific reason closer to democratic procedures, or should it be more concerned with bringing democratic values to processes and practices of decision-making on technological futures? For the time being, and as long as policymakers embrace narratives of technology and its calculable impacts along the lines of Winner's bulldozer metaphor, we can rest assured that the neutrality narrative of TA will find legitimacy and demand within governments, while discussions of TA's normative dimensions are likely to stay confined within its community of thinkers and practitioners.

Enabling decision-making in light of uncertainty: The Precautionary Principle and its problems

Whereas TA approaches aimed at providing as much scientific certainty as possible on the costs and benefits of emerging technology to politics and publics, the "Precautionary Principle" (PP) acknowledges and was designed to deal with situations characterized by scientific uncertainty and public conflict about the potential risks of new knowledge and technologies on humans and the environment. Somehow ironically, while the PP aims at tackling ambiguity in science with regard to the assessment of risks, costs, and benefits of particular technologies, it has been widely noted for representing an ambiguous principle in itself. The PP has been described in various ways[140]: amongst others, as a common-sense principle to be 'better safe than sorry' in science and technology policy, a general rule to tackle the 'unknown unkowns' in the release of new technologies, or as an approach for acknowledging that 'no evidence of harm' does not imply that there is 'no harm' potentially caused by novel interventions in human bodies and their environment. In the words of 1970's vanguard for legal theorizing and activism on the environment Christopher Stone, "*the* precautionary principle's meaning

[138] Leonhard Hennen and Linda Nierling, 'The Politics of Technology Assessment: Introduction to the Special Issue of Technological Forecasting and Social Change', *Technological Forecasting and Social Change* 139 (2019): 17–22.
[139] Stephan Lingner, 'Editorial', *TATuP - Zeitschrift für Technikfolgenabschätzung in Theorie und Praxis* 29, no. 3 (15 December 2020): 3–3.
[140] See José Luis Luján and Oliver Todt, 'Precaution: A Taxonomy', *Social Studies of Science* 42, no. 1 (2012): 143–57.

– or *meanings*, for it has been put forth in so many versions, often with cognate phrasing, as to belie the pretension of the definite article – remains obscure."[141] Stone sees reasons for this "muddle"[142] in the proliferation of the PP within the context of international politics and it is indeed here that the PP has been most forcefully advanced as shared commitment to environmental protection, public health, and sustainability. As the often-cited "Rio Declaration on Environment and Development" ratified at the UN General Assembly in 1992 defined the PP, "where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation"[143].

Yet, according to Stone, the "triple negative" conjured by PP definitions such as that codified in Rio de Janeiro (not having full scientific certainty, not delaying cost-effective measures, and not allowing environmental degradation) is a "bit of a red herring", derailing attention from questions "over how much, if anything, should be done in light of what we do and do not know both about the science and the costs"[144]. It is this elusive nature of the PP – a legal principle in search of normative and practical interpretation – that allows us to locate it as much in the series of *soft law* approaches to the governance of science, technology, and innovation presented here, as it can be seen as exception within that series due to its conflation with the *hard law* repertoire of regulatory instruments of International Organizations and their member-states.

With roots in sustainability discussions unfolding in Germany around the phenomenon of *Waldsterben* (forest death), the PP made a "meteoric spread" between the 1970s to early 2000s that began as a "general aspirational policy but has steadily been transformed into an obligatory legal requirement"[145]. Several crises in the provision of scientific certainty to publics over contentious issues such as the safety of genetic engineering and food gave way to the success story of the PP in public policy. One could add that the deregulatory politics of the 1980s-90s also contributed to an overall skepticism by publics with regard to the willingness of institutions to protect citizens instead of increasingly globalized businesses and markets that rounded up a perceived crisis of trust vis-á-vis science and the state at the dawn of the millennium. For instance, the "mad cow crisis" erupting in the late 1990s in the UK was handled by policymakers with the performance of a "reassuring narrative" about the safety of beef consumption despite wide agreement in and communication by the scientific community "that it was impossible to be certain that consuming meat, milk and dairy products from

[141] Christopher D. Stone, 'Is There a Precautionary Principle', *Environmental Law Reporter News & Analysis* 31 (2001): 10790. My emphasis.
[142] Stone, 10790. My emphasis.
[143] United Nations, 'Report of the United Nations Conference on Environment and Development' (Rio de Janeiro, 12 August 1992). Principle 15
[144] Stone, 'Is There a Precautionary Principle', 10790.
[145] Gary E. Marchant, 'From General Policy to Legal Rule: Aspirations and Limitations of the Precautionary Principle', *Environmental Health Perspectives* 111, no. 14 (2003): 1799–1803.

animals with BSE posed no risk"[146] (see OECD chapter for further details on this controversy).

Yet, one of the most important catalyzers for the rise of the PP in public policy were controversies around the safety of releasing GMO's modified through new biotechnologies that began in the 1970s and that arguably continue until today. Particularly in Europe, policymakers framed public opinion as "becoming increasingly aware of the potential risks to which the population or their environment are potentially exposed."[147] Whereas in the US, risk assessment and market governance prevailed as the instrument of choice for policymakers to come to terms with new biotechnological *products,* in the EU, public resistance and dispute about the unforeseeable risks of genetic engineering legitimized the innovation of regulatory instruments and principles focused on the *processes* of genetic modification. Details of the EU's several steps and motivations to embrace the precautionary principle, including its eventual clash with US American risk assessment at the World Trade Organization (WTO) in 2003, have been widely covered and need not distract us here[148]. More relevant to our purposes is the understanding of the PP that evolved in EU law and beyond, which cemented its framing as an approach subject to scientific and normative evaluation, and applicable through *hard* and *soft law* alike.

When the EU started addressing the regulation of genetically modified foods beyond the narrowly defined PP in the Union's *acquis*[149], an (in)famous Communication by the EC specified the principle as "a decision exercised where scientific information is insufficient, inconclusive, or uncertain and where there are indications that the possible effects on the environment, or human, animal or plant health may be potentially dangerous and inconsistent with the chosen level of protection"[150]. The Communication not only detailed the conditions legitimizing the PP's use, it also elaborated how decision-makers ought to respond appropriately to situations of scientific controversy and uncertainty. Recourse to the PP was here described as "the result of an eminently political decision" whose "nature influences the type of control that can be carried out"[151]. Essentially, the Commission deemed a political

146 Patrick Zwanenberg and Erik Millstone, 'Mad Cow Disease' 1980s–2000: How Reassurances Undermined Precaution', in *Late Lessons from Early Warnings: The Precautionary Principle 1896–2000* (Copenhagen: European Environment Agency, 2021).
147 European Commission, 'Communication from the Commission on the Precautionary Principle' (2000), sec. Introduction.
148 One interpretation why the EU in particular was ready to embrace the PP as a guiding principle for its regulatory policies was that "it allowed the EU polity to move from a more bureaucratic-rationalistic mode of self-legitimation (based on risk assessment) to one that foreground the politics of uncertainty and positions the institutions of the EU – as opposed to those of the member-states – as the ones best equipped to govern those uncertainties." Jasanoff, *Reframing Rights,* 277. A detailed account of this phenomenon is provided in Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*.; and in Les Levidow, 'Precautionary Uncertainty: Regulating GM Crops in Europe', *Social Studies of Science* 31, no. 6 (2001): 842–74.
149 The Maastricht Treaty of 1992 enshrined the PP for the first time in EU law but did not really define it: "Community policy on the environment shall aim at a high level of protection taking into account the diversity of situations in the various regions of the Community. It shall be based on the precautionary principle and on the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay. Environmental protection requirements must be integrated into the definition and implementation of other Community policies." 'Treaty on European Union', 191 OJ C § (1992), http://data.europa.eu/eli/treaty/teu/sign/eng. (Article 130r).
150 European Commission, Communication from the Commission on the precautionary principle.
151 5.2.1 The Decision Whether or not to act. European Commission.

decision on the desirable level of protection vis-á-vis unknown risks the determining factor for choosing between different instruments and measures of public control over them, which significantly diluted the PP's appeal to regulate GMO's and beyond through hard legal means. The "nature of the action ultimately taken", according to the Communication, was not necessarily to "produce legal effects that are open to judicial review" but could equally imply softer forms of control such as decisions "to fund a research programme or even the decision to inform the public about the possible adverse effects of a product or procedure"[152].

Such a vision of the PP's flexible regulatory powers continued to lead arguments for its uptake and use in public policy, whether at national or international level. For instance, in emerging discussions around the release of novel nanomaterials in the early 2000s, EC's then Director General for Research René Von Schomberg widely advocated the PP approach taken in the soft "Code of Conduct for Responsible Nanosciences and Nanotechnologies Research" as a means not for "stifling research and innovation" but "for the development of risk methodologies, the execution of risk research, and the active identification knowledge gaps"[153]. A similar, albeit less reductive, account of the PP has been advanced by Andy Stirling, himself a Greenpeace activist during the 1980s-90s and now professor for Science and Technology Policy at the University of Sussex, when stating that the value of the PP does not lie in its character as "a tightly prescriptive decision rule – by definition, that is not scientifically possible under these conditions" but "rather to illustrate the rich variety of alternatives that exist if risk assessment is not properly applicable."[154] This view also gives way to arguments that see the PP as a "flexible legal principle shaped by the surrounding legal culture" rather than as a project of inter- and supranational organizations aiming at mainstreaming a "common understanding"[155] of how to govern risks and uncertainty across nation-states.

The PP's ambiguous aspiration to serve as a hard tool for the regulation of technoscience on the one hand, as well as for leaving forms of social control over technology open and flexible to softer forms of appraisal on the other, has received mixed praise that ranges from broad enthusiasm to stark rejection of its mobilization in policy-making, the latter emanating particularly from the US. The EU's step-wise, precautionary approach to the regulation of GMO's at turn-of-the-century was interpreted by GMO-producing countries (then the US, Argentina and Canada) as a de-facto moratorium that delayed approval of GMO foods with no scientific back-up, and was eventually ruled out as "illegal" and a breach of trade agreements by the WTO[156]. The view that the PP is anti-scientific, a protectionist

[152] 5.2.2. Nature of the action ultimately taken. European Commission.
[153] Rene Schomberg, 'The Precautionary Principle: Its Use Within Hard and Soft Law', *European Journal of Risk Regulation* Volume 2 (May 2012): 147–57.
[154] Andrew Stirling, 'Risk, Precaution and Science: Towards a More Constructive Policy Debate. Talking Point on the Precautionary Principle', *EMBO Reports* 8, no. 4 (April 2007): 309–15.
[155] Elizabeth Fisher, 'Precaution, Precaution Everywhere: Developing a "Common Understanding" of the Precautionary Principle in the European Community', *Maastricht Journal of European and Comparative Law* 9, no. 1 (2002): 7–28.
[156] European Commission, 'WTO Panel Rules EU "moratorium" on GMOs Was Illegal', CORDIS, February 2006.

smokescreen to ban undesired products and policies, and largely stifling scientific, technological, and human progress prevails amongst many commentators[157], and is mobilized time and again when precautionary measures are suggested toward emerging technologies, for example in current debates about the regulation of Artificial Intelligence[158]. As we will see in the EU case study, the PP today seems to be gradually replaced by commitments to an "innovation principle" endorsed by decision-makers in public and private sector governance alike, which encourages risk-taking and the creation of "best possible conditions for thinking out of the box"[159]. Some, such as relentless *provocateur* Steve Fuller, go as far as seeing "future of ideological conflict" not in battles over right or left-wing politics, but in the uptake of "proactionary" versus "precautionary" approaches in the governance of technoscientific risks[160].

Amongst others, Fuller has advocated a "proactionary" stance that "promotes" rather than "protects people[161] in a series of commentaries recently curated by the British newspaper Guardian that nicely illustrates where debate around the PP has arrived at since it first came on the agenda of policy makers and publics in the 1970s-80s. Here, we encounter again Andy Stirling promoting the PP for allowing "that time and space be found to get things right" in the governance of scientific and technological progress, as a reminder "that innovation is not a forced one-track race to the future" but "like biological evolution entails constantly branching paths"[162]. Stirling's advocacy of the PP is juxtaposed to those of Tracey Brown from "Sense about Science", a non-profit with the goal to strengthen "sound science" and ensure evidence is recognized in public life and policy-making"[163]. Brown's take that the PP is "a blunt instrument" aimed at "managing uncertainty about the future to be" while drawing "on our present fears and prejudices" leads her to judge it as "irresponsible", "short-termist", and not helping us to "face the problems" that really haunt current decision-making in areas such as pesticide regulation[164]. Somewhere between these two positions, we find STS scholar Jack Stilgoe, who believes that "principles don't prevent bad decisions (but) are merely a way of structuring decision-making, rebalancing power and redirecting attention" while he wonders "whether precaution can (indeed) become a tool for creating new, sustainable possibilities."[165] Other STS analysts have answered Stilgoe's question in rather pessimistic terms, particularly with regard to the PP's uncertain

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[157] Sven Ove Hansson, 'How Extreme Is the Precautionary Principle?', *NanoEthics* 14, no. 3 (1 December 2020): 245–57.
[158] Daniel Castro and Michael McLaughlin, 'Ten Ways the Precautionary Principle Undermines Progress in Artificial Intelligence' (Information Technology and Innovation Foundation, 4 February 2019).
[159]European Commission, 'Factsheet THE INNOVATION PRINCIPLE', 2019.
[160] Steve Fuller, 'The Future of Ideological Conflict', *Project Syndicate*, 7 May 2012, sec. Economics & Finance. Arguments by other thinkers condemning Fuller's writings as being dangerously hubristic in nature can be found in in Robert Frodeman, 'Anti-Fuller: Transhumanism and the Proactionary Imperative', *Social Epistemology Review and Reply Collective* 4, no. 4 (2015): 38–43.
[161] Steve Fuller, 'Beyond the Precautionary Principle', *The Guardian*, 10 July 2013, sec. Science Policy.
[162] Andy Stirling, 'Why the Precautionary Principle Matters', *The Guardian*, 8 July 2013, sec. Science Policy.
[163] Sense about Science, 'Who We Are', Sense about Science, 2022.
[164] Tracey Brown, 'The Precautionary Principle Is a Blunt Instrument', *The Guardian*, 9 July 2013, sec. Science.
[165] Jack Stilgoe, 'You're Sure of a Big Surprise', *The Guardian*, 10 July 2013, sec. Science Policy.

contribution to the democratization of science and technology governance. For Mariachiara Tallachini, for instance, "it is hard to see it as an innovative principle in the political decision-making process…these procedures do not unequivocally reflect a more democratic attitude towards science-based policy, but may be aimed mainly at obtaining consensus"[166].

It is in light of this ongoing battle of the PP's interpretation that we need to read Stone's critical stance towards the rise of the PP cited at the beginning of this subchapter. Notwithstanding or maybe exactly due to its production at the highest levels of policy, it remains a rather obscure principle which has so far not led to a shared understanding, let alone to shared support in policy making on science, technology and innovation. Since the roughly twenty years that have passed since Stone asked if there actually is *a* precautionary principle, we can, at least, not observe great progress but rather a slow fracture of the PP's initial promise to renew instruments and frameworks for the governance of undeterminable scientific and technological risks. Given the current state of the debate, there is little hope that the PP will evolve beyond mere "agreement on words themselves"[167]. Given, however, that words do matter in the framing of policy and world-making, we should remain attentive to the different meanings, functions, and values that likely will continue to be projected onto the idea of precaution in scientific and technological progress, as well as onto the potential of precautionary principles in governing technoscientific risks in absence of epistemic certainty, whether hard or soft.

Making innovation relevant to society: The rise and fall of Responsible Research and Innovation

Despite their many differences, the frameworks and instruments for better aligning science, technology, and democracy reviewed so far all share a broad commitment to governance through expertise – be it Bioethics professionals and their descendants, engineers and scientists in TA, or policymakers' decision to apply and interpret the PP – that has prompted recurring critique of their lacking democratic legitimacy as well as calls for a greater de-facto engagement of citizens in decision-making on and development of technoscience. By the beginning of the 2000s, such calls were not only voiced by STS scholars, who, as we have learned earlier, had been relentlessly advocating a democratization of technocratic governance cultures and structures since the late 1970s. Increasingly, public engagement was understood by policymakers themselves as the holy grail of governing innovation responsibly, which arguably represented a "participatory turn"[168] in science and technology policy.

While in the past, the authority of experts to reason on the normative dimensions of emerging science and technology was sustained by a "deficit model" of public understanding[169] that framed citizens as lacking the necessary knowledge to appraise and rationally engage with scientific and

[166] Mariachiara Tallacchini, 'Before and beyond the Precautionary Principle: Epistemology of Uncertainty in Science and Law.', *Toxicology and Applied Pharmacology* 207 2 Suppl (2005): 649.
[167] Stone, 'Is There a Precautionary Principle', 10790.
[168] Jasanoff, 'Technologies of Humility', 1 September 2003.
[169] Wynne, 'Misunderstood Misunderstanding', 92; Edward Hackett and Diana Rhoten, 'Engaged, Embedded, Enjoined: Science and Technology Studies in the National Science Foundation', *Science and Engineering Ethics* 17 (December 2011): 823–38.

technological development, the turn to participation gave way to another, one could even say opposite, model. Science, technology, and governance now was presented as lacking the language and instruments to meaningfully engage with society and its values vis-á-vis innovation, a deficit which was argued to be hampering the development of science and technology for the public benefit[170]. As one proposal put it in 2004, "scientists need to find ways of listening to and valuing more diverse forms of public knowledge and social intelligence. Only by opening up innovation processes at an early stage can we ensure that science contributes to the common good"[171]. STS thinking, deeply implied within this shift, provided a welcome resource for framing and operationalizing the new attention on part of policymakers toward a greater involvement of citizens. What came to be labelled as "Responsible Research and Innovation" (RRI) in policy-circles built upon STS language and research such as that of "systemic" implications raised by the "interplay of the technical and the social"[172] and a "collective duty of care"[173] in bringing about technoscientific futures. Yet, while "in remarkably few years, an (admittedly attenuated) form of the language of STS has been reconstructed as the language of policy"[174], attempts to mainstream RRI have not been without difficulty, and processes of attenuating public engagement and its meaning not without critique. Compared to the enduring legacy of Bioethics, TA, or the PP, RRI has had a relatively short and troubled history that has for most parts been written in the EU's headquarters and that continues to face problems of legitimacy until today.

Many see the origins of RRI in an increasing awareness by policymakers of a so-called "crisis of trust"[175] towards science and technology surfacing at the beginning of the 21st century and most vividly illustrated by public scandals in the UK around the responsible handling of the "mad cow disease". As the prominent Science and Society Report by the British House of Lords described in 2000, "Society's relationship with science is in a critical phase…many people are deeply uneasy about the huge opportunities" presented by emerging technologies "which seem to be advancing far ahead of their awareness and assent", leading to "mistrust and occasional outright hostility" and "breeding a climate of deep anxiety among scientists themselves"[176]. The report's framing of a critical moment for the governance of science, technology and society relationships was echoed in further efforts to engage the public better, and for ensuring technological progress indeed is recognized as an opportunity for the

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[170] Nina Frahm, Tess Doezema, and Sebastian Pfotenhauer, 'Fixing Technology with Society: The Coproduction of Democratic Deficits and Responsible Innovation at the OECD and the European Commission', *Science, Technology, & Human Values*, 15 March 2021, 0162243921999100.
[171] James Wilsdon and Rebecca Willis, *See-through Science: Why Public Engagement Needs to Move Upstream*, 2004.
[172] Jack Stilgoe, Richard Owen, and Phil Macnaghten, 'Developing a Framework for Responsible Innovation', *Research Policy* 42, no. 9 (2013): 1569.
[173] Richard Owen, Phil Macnaghten, and Jack Stilgoe, 'Responsible Research and Innovation: From Science in Society to Science for Society, with Society', *Science and Public Policy* 39 (5 December 2012): 758.
[174] Alan Irwin, 'The Politics of Talk: Coming to Terms with the "New" Scientific Governance', *Social Studies of Science* 36, no. 2 (1 April 2006): 300.
[175] Select Committee on Science and Technology, 'Chapter 3: Public Understanding of Science in Science and Technology Third Report' (House of Lords, 2000).
[176] Select Committee on Science and Technology.

improvement of citizens' lives, rather than a runaway process uncontrollable by humankind. Such narrative was tried and tested first in the emerging field of nanotechnology, where policymakers arguably had learned their lesson from the experience with GMO controversies which functioned as "a warning, a cautionary tale of how *not* to assess an emerging technology and allay public concern"[177].

While first notions of public engagement as instrument for "responsible development" appeared at the beginning of the 2000s in the U.S. National Nanotechnology Initiative (NNI), it was the EU which largely embraced RRI as an overarching terminology through publishing a "Code of Conduct for Responsible Nanosciences and Nanotechnologies research" which included participation of "all stakeholders" in decision-making processes on nanotechnology[178]. This shift was paralleled by national initiatives fostering responsible frameworks, such as the Dutch Responsible Innovation Program (MVI), the German *Nanokommission*, or the British Engineering and Physical Sciences Research Council's framework for Responsible Innovation. The "Rome Declaration"[179] and the designation of RRI as a cross cutting issue in the EU's seventh framework program Horizon 2020 eventually set the stage for the EU to increase budgets and actions in the field, detaching RRI from nanotechnology only and scaling it up towards emerging science and technology more generally. As the EU case study shows with greater detail, it is within the context of a failed constitutional referendum and the financial and economic crisis of the early 2000s that RRI was endorsed by policymakers in Brussels, providing new hopes for a revival of the European project now oriented toward the coming into being of an 'Innovation Union'. Here, RRI came to be envisioned as an avenue for resurrecting a European spirit of shared humanist values and collective governance of socio-technical progress, while simultaneously appealing to the EU's "political determination to return to pre-crisis levels of economic growth" reachable through "innovating innovation policy"[180].

As a result of the "all-inclusive synthesis"[181] guiding RRI efforts in policy circles, not only did the five "keys" suggested by the EC to unlock innovation's social and economic potential represent a quite eclectic vision of RRI's soft governance potential (i.e. public engagement, ethics, science education, gender equality, and open access). By subsuming a variety of approaches, goals, and instruments under the umbrella framework RRI, some of which had already been around for decades while public engagement in particular represented a novel element in the soft regulatory toolkit, it also

[177] Matthew Kearnes et al., 'From Bio to Nano: Learning Lessons from the UK Agricultural Biotechnology Controversy', *Science as Culture* 15, no. 4 (1 December 2006): 291., my emphasis
[178] European Commission, *Commission Recommendation on a Code of Conduct for Responsible Nanosciences and Nanotechnologies Research & Council Conclusions on Responsible Nanosciences and Nanotechnologies Research* (Publications Office, 2009).
[179] European Commission, 'Rome Declaration on Responsible Research and Innovation in Europe', November 2014..
[180] Stevienna de Saille, 'Innovating Innovation Policy: The Emergence of "Responsible Research and Innovation"', *Journal of Responsible Innovation* 2, no. 2 (4 May 2015): 163.
[181] Tim Flink and David Kaldewey, 'The New Production of Legitimacy: STI Policy Discourses beyond the Contract Metaphor', *Research Policy* 47, no. 1 (2018): 19.

remained a framework widely noted for its definitional ambiguity[182]. Although understandings of RRI remained in flux, prominent attempts at synthesizing instruments and concepts shared the language of collective decision-making, early integration of stakeholders, anticipation of future consequences and a more flexible system of governance. One attempt at synthesis that found wide uptake has been proposed by René Von Schomberg: "RRI is a transparent, interactive *process* by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and social desirability of the innovation process and its (marketable) outcomes and impacts"[183]. Another widely cited definition, where RRI "means taking care of the future through collective stewardship of science and innovation in the present", draws on *dimensions* such as "anticipation, reflexivity, inclusion, and responsiveness"[184].

Among these different proposals, participation of the public came to be imagined as both a potential accelerator and decelerator for innovation, as its closer integration in innovation practice and policy was envisioned to enhance public acceptance and creative knowledge and applications, at the same time as allowing time for deliberation and the creation of alternative pathways for innovation. Such framing was endorsed, for instance, by a high-level expert group concerned with providing advice to the EC on "maximizing the impact of EU Research and Innovation Programmes", which argued that "we need to get rid of the notion that research and innovation is not relevant to society. To shape our future together, we need to imagine, invent and create"[185]. This double vision of RRI as framework for making citizens more relevant to innovation governance and processes, and for making innovation more relevant to citizens, effectively propelled RRI to policymakers. Yet, and as reviewed further below, RRI's tendency to focus on the latter at the expense of a truly 'participatory turn' in policy also gave way to much critique with regard to deeper democratization efforts.

With RRI's integration in the EU's Horizon 2020 funding structures also came attempts at mainstreaming its different processes, dimensions, keys, or principles, within national governance, research institutions, and innovation-driven businesses, coupled with an urge to monitor the uptake of RRI through surveys and indicators[186]. The survey of RRI instruments in national contexts, however,

[182] Stilgoe, Owen, and Macnaghten, 'Developing a Framework for Responsible Innovation'; Mirjam Burget, Emanuele Bardone, and Margus Pedaste, 'Definitions and Conceptual Dimensions of Responsible Research and Innovation: A Literature Review', *Science and Engineering Ethics* 23 (February 2017).
[183] René von Schomberg, 'A Vision of Responsible Research and Innovation', in *Responsible Innovation*, ed. Richard Owen, John Bessant, and Maggy Heintz (Chichester, UK: John Wiley & Sons, Ltd, 2013), 51–74.
[184] Stilgoe, Owen, and Macnaghten, 'Developing a Framework for Responsible Innovation'.
[185] European Commission and Directorate-General for Research and Innovation, *LAB – FAB – APP : Investing in the European Future We Want : Report of the Independent High Level Group on Maximising the Impact of EU Research & Innovation Programmes* (Publications Office, 2017), 5.
[186] Niels Mejlgaard et al., 'Monitoring the Evolution and Benefits of Responsible Research and Innovation (MoRRI) – a Preliminary Framework for Measuring RRI Dimensions', 2016; Ellen-Marie Forsberg et al., 'Implementing Responsible Research and Innovation in Research Funding and Research Conducting Organisations—What Have We Learned so Far?', in *Governance and Sustainability of Responsible Research and Innovation Processes: Cases and Experiences* (Cham: Springer International Publishing, 2018), 3–11.

resulted in a rather patchy picture of mainstreaming RI across Europe, let alone beyond its borders[187]. Comparative studies showed how countries with a long tradition in deliberative forms of policy making such as the Netherlands and Scandinavia were and still are forerunners in public engagement practice as compared to more top-down political cultures such as those of Spain or Hungary[188]. Similarly, success at institutionalizing RRI in the private sector was rather limited, with tensions remaining between "the ideal of RI and the way in which the competitive market operates"[189], particularly with regard to innovative markets and start-up driven innovations[190].

While RRI presented a new language and aspiration that nobody could possibly be against[191], it remained inherently tied to the EC's innovation agenda rather than representing a shared European approach for and practice of innovation governance. After roughly a decade of RRI's rise in Brussels, such agenda shifted to "Open Science"[192] and "Mission oriented Innovation"[193], including new ways of framing the role of public engagement in science and technology policy in openly instrumental rather than substantive terms[194]. The notion of responsibility still appears to attract policymakers (see OECD case study), yet the long-term legacy of "the golden age of RRI"[195] seems to be weaker than that of Bioethics or TA. While some herald RRI as a "landmark" addition to these governance approaches that "will no doubt inform both formal and informal attempts to understand and improve the role of science and technology in society"[196], others remain skeptical that it "has done little to foster lasting institutional change", suggesting that RRI is still on an "unfinished journey"[197].

The rise and fall of RRI has been scrutinized from various sides, and, as could be expected, particularly by STS researchers, who were vital in putting public engagement on policy agendas in the early 2000s. On the one hand, efforts to synthesize existing governance approaches to risk assessment

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[187] Tess Doezema et al., 'Translation, Transduction, and Transformation: Expanding Practices of Responsibility across Borders', *Journal of Responsible Innovation* 6, no. 3 (2 September 2019): 323–31.
[188] Mejlgaard et al., 'Monitoring the Evolution and Benefits of Responsible Research and Innovation (MoRRI) – a Preliminary Framework for Measuring RRI Dimensions'; Forsberg et al., 'Implementing Responsible Research and Innovation in Research Funding and Research Conducting Organisations—What Have We Learned so Far?'
[189] Teunis Brand and Vincent Blok, 'Responsible Innovation in Business: A Critical Reflection on Deliberative Engagement as a Central Governance Mechanism', *Journal of Responsible Innovation* 6 (20 February 2019): 1–21.
[190] Sebastian M. Pfotenhauer et al., 'Mobilizing the Private Sector for Responsible Innovation in Neurotechnology', *Nature Biotechnology* 39, no. 6 (1 June 2021): 661–64.
[191] David H. Guston, 'Responsible Innovation: Who Could Be against That?', *Journal of Responsible Innovation* 2, no. 1 (2 January 2015): 1–4.
[192] Erik Fisher, 'Reinventing Responsible Innovation', *Journal of Responsible Innovation* 7, no. 1 (2 January 2020): 1–5.
[193] Mariana Mazzucato, *Mission-Oriented Research & Innovation in the European Union a Problem-Solving Approach to Fuel Innovation-Led Growth*, 2018.
[194] Andy Stirling, '"Opening Up" and "Closing Down": Power, Participation, and Pluralism in the Social Appraisal of Technology', in *Science and Citizens: Globalization and the Challenge of Engagement* (Bloomsbury Academic, 2005).
[195] Erik Fisher, 'RRI Futures: Ends and Beginnings', *Journal of Responsible Innovation* 8, no. 2 (4 May 2021): 135–38.
[196] Fisher, 135.
[197] Richard Owen, René von Schomberg, and Phil Macnaghten, 'An Unfinished Journey? Reflections on a Decade of Responsible Research and Innovation', *Journal of Responsible Innovation* 8, no. 2 (4 May 2021): 227.

and ethics with more deliberative instruments of public engagement were difficult to differentiate from those probed forms of scientific and technological appraisal, and the host of definitions, proposals, and arguments on and for RRI did not help in its further clarification. Already in the early days of RRI's circulation in Brussels, Ari Rip argued that "RRI may be an emperor without clothes, or that there may not even be an emperor at all, only a fashionable label", adding that "still, there are attempts to clothe the emperor…Clothing the emperor makes him more real"[198]. As the EC projected its own meanings onto what RRI could possibly mean and do for science and technology policy, others argued that it was "introduced in a top-down manner, well before the concept that was signified by it had acquired a clear and stable profile"[199]. Respectively, attempts to turn RRI into an overarching framework that compromised different communities and scholarly traditions working at the nexus of science, technology, and society were largely suspicious to those very communities. Delvenne, for example, argued that RRI represents a "travesty" of TA which needs to be observed skeptically, as TA now again "risks being reduced to a role of mere provider of ex-ante impact assessments"[200]. And Hub Zwart and colleagues asked, "what is really new" about RRI, claiming that "RRI is defined in ways that tend to resemble the ELSI stratagem quite closely" and diagnosing a struggle of RRI proponents "to articulate their own innovation in a convincing way"[201].

On the other side, articulations of RRI advanced by policymakers and scholars were examined critically with regard to the politics pursued by the RRI agenda, particularly concerning RRI's envisioned contribution to greater democratization of practices and policies in innovation. While the rise of RRI in the EU had been imagined by STS scholars as a kind of breakthrough moment for recognition in policy-making that science and technology are inherently political and, hence, should be subjected to greater participation and democratic deliberation, the EU's turn to public engagement as an instrument for enhancing public acceptance of innovation imperatives and ultimately, economic growth, was disappointing to many[202]. Van Oudheusden, for instance, asked "where are the politics in responsible innovation?" in his assessment of various RRI proposals, which seemed to be "too much about talk, argumentation, and due process" while "failing to consider how [these] processes are imbued with politics"[203]. The politics of RRI, according to Stevienna de Saille, consisted of a "lack of official acknowledgment that the ongoing, bottom-up engagement, which is RRI's ideal, may reveal that it is necessary to change or even halt a trajectory of research, or to discuss…whether they should be

[198] Arie Rip, 'The Clothes of the Emperor. An Essay on RRI in and around Brussels', *Journal of Responsible Innovation* 3, no. 3 (1 September 2016): 293.
[199] Hub Zwart, Laurens Landeweerd, and Arjan van Rooij, 'Adapt or Perish? Assessing the Recent Shift in the European Research Funding Arena from "ELSA" to "RRI"', *Life Sciences, Society and Policy* 10, no. 1 (14 May 2014): 11.
[200] Pierre Delvenne, 'Responsible Research and Innovation as a Travesty of Technology Assessment?', *Journal of Responsible Innovation* 4, no. 2 (4 May 2017): 7.
[201] Zwart, Landeweerd, and van Rooij, 'Adapt or Perish? Assessing the Recent Shift in the European Research Funding Arena from "ELSA" to "RRI"'.
[202] de Saille, 'Innovating Innovation Policy'.
[203] Michiel van Oudheusden, 'Where Are the Politics in Responsible Innovation? European Governance, Technology Assessments, and Beyond', *Journal of Responsible Innovation* 1, no. 1 (2 January 2014): 81.

developed with public funds"[204]. Equipped only with soft powers to influence policy decisions and the development of innovation, RRI not only had to "grapple with the strategic imperative of competitiveness and development"[205]. It was also accused of continuing a neoliberal agenda of governance, rather than a way to effectively turn the tide of science and technology policy through recourse to the *hard law* of Human Rights[206].

With such critique of RRI's political economy also came critique of the involvement of STS researchers in contributing and further stabilizing innovation imperatives in policy. Some saw the responsibility of STS in the RRI conundrum as serving to "close down issues, reduce innovation to techno-fixes and facilitate societal acceptability of new technologies, e.g. through public engagement activities" which also implied asking uncomfortable questions about what futures actually get envisioned in EU research agendas through the language of STS[207]. My own research suggests that instead of further solidifying technological determinism and solutionism, parts of STS advocacy for RRI helped to construct a new logic in policymaking where society was re-imagined as an effective fix for problems faced by innovation and its governance. We further argued that RRI in "its globalized, mainstreamed form helps to re-legitimize extant innovation imperatives by providing additional justificatory elements and toolkits for the mobilization of innovation in the name of society"[208].

In sum, a decade after RRI's embrace at the EU level, its various frameworks and instruments were largely regarded by STS scholars as legitimation talk and neoliberal enrolment practice against ideals of a truly empowered public with real agency to effectively subject innovation paradigms to greater democratic control. Yet, it seems that visions of greater participation by society in the (de)construction of science, technology, and innovation are not easily vanquished, and STS scholarship is surprisingly resilient when it comes to recurrent defeats in the installment of such ideals in policy discourse and practice. Contributions to a recent special issue of the "Journal of Responsible Innovation" on "RRI futures" are largely optimistic that learnings from RRI's rise and fall can help in bringing about a closer alignment between innovation and society – to "reinvent responsible innovation" - now articulated through notions such as "co-creation", "responsibility by design", "slow innovation", or "responsible stagnation"[209] (the Journal's editor Erik Fisher fittingly opens the issue with the assertation

[204] de Saille, 'Innovating Innovation Policy', 163.
[205] Andoni Eizagirre, Hannot Rodríguez, and Andoni Ibarra, 'Politicizing Responsible Innovation: Responsibility as Inclusive Governance', *International Journal of Innovation Studies* 1 (2017): 20.
[206]Simone Arnaldi and Guido Gorgoni, 'Turning the Tide or Surfing the Wave? Responsible Research and Innovation, Fundamental Rights and Neoliberal Virtues', *Life Sciences, Society and Policy* 12 (May 2016); Owen, von Schomberg, and Macnaghten, 'An Unfinished Journey? Reflections on a Decade of Responsible Research and Innovation'.; see also Charles Thorpe and Jane Gregory, 'Producing the Post-Fordist Public: The Political Economy of Public Engagement with Science', *Science as Culture* 19, no. 3 (1 September 2010): 273–301.
[207] Les Levidow and Claudia Neubauer, 'EU Research Agendas: Embedding What Future?', *Science as Culture* 23, no. 3 (3 July 2014): 397–412.
[208] Frahm, Doezema, and Pfotenhauer, 'Fixing Technology with Society'.
[209] Fisher, 'RRI Futures: Ends and Beginnings'.

that "RRI is dead, long live RRI!"[210]). Whatever label is invented next to reform technocratic expert cultures in governance, STS will surely be part of the conversation – as a provider of language, concepts, and instruments to operationalize democratic socio-technical change, or as an all-time critic to their adaptation and attenuation in policy.

In search of symmetry: The ups and downs of *soft law* in science and technology governance

Our journey into different governance approaches designed and implemented to align science, technology, and innovation with democracy largely reflects the claims advanced by the "Policymaker's Guide" that *soft law* has become an indispensable ingredient in public policy. In fact, it has accompanied the public governance of research and technology to varying degrees and in culturally divergent ways since the very uptake of science as domain of public policy after WWII. A social contract with science, most prominently summarized in 1945 by US science advisor Vannevar Bush, not only advanced science as a "proper concern for government"[211]. It also saw science, next to democracy and the economy, as "member of a team"[212] for the provision and protection of public welfare[213]. But different to a conception of democracy as ruled by the people, or the steering of markets through an 'invisible hand', scientific knowledge production was believed to work best for the common good when enjoying "complete independence and freedom for the nature, scope, and methodology of research carried on in the institutions receiving public funds"[214].

As I will elaborate in later chapters, some believed that the governance of research and technological development should be conceived in similar ways as the self-governance of markets, while others saw a need to subject it to greater scrutiny by the democratic system so as to ensure the 'team' worked best for people. The idea that control over science's pathways should be left to researchers themselves, rather than to parliaments, citizens, or businesses, however, seemed to largely reflect the postwar years' *Zeitgeist*. Marked by the recent experience of a 'misuse' of biology and genetics for Nazi ideology, and confronted with the rise of science as an indispensable ingredient of Soviet Russia's planned economy, the stabilization of a regime for the self-governance of research in the supposedly free societies of the US and Europe was hardly surprising. Yet, we have seen above how several crises of science and technology in the West provoked a number of adjustments to this regime, such as authorizing normative expertise to draw the boundaries around the ethics of research and experimentation, embedding rational knowledge in democratic appraisal of technological change, or deciding with precaution rather than with proaction on technoscientific progress.

These progressive shifts proved effective in that they re-stabilized the order between science

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210 Fisher.
211 Vannevar Bush, *Science, the Endless Frontier: A Report to the President,* 1945.
212 Bush.
213 Bush's report, often accused of laying the foundations for linear models of technoscientific progress, argued that "science, by itself, provides no panacea for individual, social, and economic ills…but without scientific progress no amount of achievement in other directions can insure our health, prosperity, and security" Bush.
214 Bush.

and society envisioned by the original contract, while they also added new ways to equip democracies with making sense and order around the advancement of science and technology for the public good. Time and again policymakers took up public debates and scandals to renew the contract, particularly by granting authority to expertise to represent the public in soft jurisdiction over the permissibility, desirability, and directionality of research and development. Governance usually rested on the vocabularies of experts themselves, who were believed to be in the best position to assess the potential risks and harms, costs and benefits, of emerging knowledge and tools. Only recently were citizens conceived as integral agent in Bush's 'team', although such a renewal of the social contract seems to be at pains with more established ways to order science, technology and society. No matter where we direct our journey, frameworks and instruments for a harmonization of science and technology's self-regulatory powers with those of democratic structures and cultures were crafted as desirable forms of soft social control and regulation by policymakers in the US, the EU, and international organizations. At the same time, they produced visions of desirable futures achievable through social regulation of technoscientific change, and, hence, also of innovation as part and parcel of the public good. We will come back to this co-productionist dynamic set free by *soft law* in science and technology governance in the chapters ahead.

Critique and controversy around the legitimacy of this settlement can be broadly categorized along two camps. On the one side, experts immersed in scholarship and policy-making on science and technology repeatedly identified flaws in the existing order, whether in the form of transgressive ethics, the danger of a politicization of democratic deliberation, or a counter-progressive agenda looming behind soft governance talk. These critics were largely convinced that to harvest the fruits of science and technology for the public benefit, it should indeed be left to its own regulatory mechanisms, with minimal regulatory interference and only when expertise provides substantive evidence that regulatory action is warranted. They suggested that democracies needed to be better equipped with recognizing and appreciating the contract, for example through education of citizens or through more robust knowledge on emerging research and innovation on part of policymakers.

On the other side, we find scholars and commentators that only gradually gained access to the power centers of science, technology, and policy, partly because they were convinced that the social contract had to be reformed and reformulated altogether. A growing intellectual community of STS researchers was set to turn the idea of politics-free science and technology upside down by arguing not only that knowledge and artifacts have politics, but also that seemingly neutral and objective policy-advice was embedded in and giving rise to particular normative commitments towards science and technology, and with them, to particular kinds of politics. Their critique, thus, cut straight to the heart of those narratives held dear and stable by social contract ideals and their supporters, which were accused of providing soft talk of democratic governance while in fact, political agendas were made through technocratic rationales and by expert elites but without people's representation and participation.

According to these scholars, a social contract in which the agency of citizens with regard to the politics of science and technology was truly recognized would have to be written in a completely different language and logic than that mobilized so far in policy[215]. After years of arguing for greater public engagement in what was regarded as inherently political decisions, parts of STS's vocabulary were found useful to tackle a perceived crisis of trust vis-á-vis science as well as toward the scientific advisory system and its complacency with social contract ideals. Yet, even when public engagement made a stellar rise into policymakers' soft regulatory toolkits, STS detected old contract ideals masked by a seemingly steep turn towards greater democratic control of science, technology, and innovation, prompting STS critique to start over again.

It is between these two camps, their deep-seated assumptions about the proper relationship between science, technology and democracy, and their various ideals of how such relationship ought be best governed, that analysis of *soft law* is primarily located. In the first strand of literatures, *soft law* is either regarded enthusiastically as an effective way to combine self-regulation with democratic systems and procedures, or perceived as a threat to the very progress of science, technology and society, and hence also to the 'teamwork' agreed upon in social contract ideals. The second approach to *soft law* in science and technology governance either sees its (illegitimate) authority in the pervasive enrolment of publics and politics into technoscientific rationales, or pits their logics against an ideal new contract with science and technology in which public deliberation effectively controls the processes and outcomes of technoscientific development, and hence also reaches more legitimate democracy. Much is gained and much is lost by following either one or the other line of reasoning and argumentation, but either way, one can end up with quite frustrated feelings: while there are more analyses, commentaries and reports on the different destinations for governance out there than can be summarized here, none of the above reviewed accounts of *soft law* in science and technology governance seems to explain how it actually works, for whom, and for what reasons; rather, they largely reproduce normative choices toward particular ideals of how to protect and provide the public good through science, technology and democracy at the expense of greater analytical understanding.

This normative bias has important consequences for accounts of frameworks and instruments mobilized in the name of a soft regulation of technoscience. By assuming that *soft law* in innovation governance is enhancing the democratic legitimacy of social contract ideals, or by critiquing such ideals with regard to their lacking democratic robustness, commentators often lose sight of explanations why soft forms of regulation have gained significant stability in policy-making over the last sixty to seventy years, how it is that they came to be regarded as legitimate tools to regulate science and technology toward the public interest, and which imaginations of democracy – in tandem with science, technology and innovation – get encoded in the construction of innovation governance through *soft law.* Moreover, we are left with open questions why it is that soft governance differs across countries and regions, and

[215] One prominent example of attempts to provide new language was Bruno Latour's *We Have Never Been Modern* (Cambridge MA: Harvard University Press, 1993).

why attempts to mainstream frameworks and instruments among different political cultures have been rather unsuccessful. Put differently, great parts of the literature on Bioethics, TA, RRI, or the PP lack a symmetrical analysis of *soft law* in science and technology policy that helps in explaining the surge and stability of theories, regimes, and styles of governing the relationship between science, technology and society, regardless of how they are evaluated[216] and notwithstanding their "current epistemic status"[217].

In this thesis, I propose that a fruitful theoretical and methodological approach to better understand the working of *soft law* in science, technology, and innovation governance can be found in co-productionist and comparative strands of STS. But first, we shall take a small detour to the history, meanings, and function attributed to *soft law* beyond the governance of science and technology: what does it mean that the frameworks and instruments of science, technology and innovation governance reviewed above 'only' have *soft* regulatory powers? Where did the idea of soft law originate, and how can we make sense of its rise in public policy concerned with orienting innovation towards the public benefit? As we will see in a moment, *soft law* has ever since been described as a mechanism for making order around changing relationships of power, and has always polarized observers and commentators along the lines we have just discussed. In this sense, the mobilization of soft regulatory frameworks and instruments for the governance of science and technology is no exception, but rather a continuation of a phenomenon and debate towards which STS research should become more attentive.

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[216] David Bloor, *Knowledge and Social Imagery,* ed. 2d edition (Chicago, IL: University of Chicago Press, 1991).
[217] Michael Lynch, 'STS, Symmetry and Post-Truth', *Social Studies of Science* 47, no. 4 (2017): 593–99.

2.2 Pluralizing the Law: The Origins of Soft Law

Literatures on *soft law* represent a universe of their own, populated by legal scholars and particularly by those concerned with studying legal reasoning and practice in international relations and stretching a variety of phenomena, intellectual schools, and political commitments. One can easily get lost in attempts to find a clear path through the many articles, books, and essays that today represent the state of the art in scholarly and public debates about *soft law*, which, over the last decades, have struggled to agree on its nature and power, its merits and pitfalls, and in particular, its legitimacy as a democratic instrument for the regulation of global affairs. The overview of *soft law's* origins and intellectual pathways that I will present in the following is but a glimpse into this universe in that it aims to synthesize its most important contours with regard to their significance for a study of *soft law* in science, technology, and innovation governance. As we will discuss in a moment, what students of frameworks and instruments for a greater alignment between innovation and society (e.g., RRI, Bioethics, or TA) have subsumed under labels such as "experimental", "tentative", or "hybrid" governance[218] bears significant overlaps with descriptions and discussions of *soft law* in international relations. Surprisingly, however, they rarely refer back to these legal debates and usually do not attribute the notion of *soft law* to their findings and proposals, which often also helps to fashion soft frameworks and instruments as radically new proposals for governance. Even when they do, as, for instance, Stefan Kuhlmann and colleagues in a recent editorial for the journal "Research Policy", they frame their ideas in a remarkably similar vocabulary as those scholars concerned with the rise of *soft law* in international politics since the 1980s. In their "conceptual introduction" to what is labelled "tentative governance", the authors claim:

> The notion of tentative governance appears particularly relevant in the case of Emerging Science and Technology (EST), given all the uncertainties and dynamics related to the scientific base, technologies, possible innovations, societal benefits and potential risks…Governance is 'tentative' when public and private interventions are designed as a dynamic process that is prudent and preliminary rather than assertive and persistent. Tentative governance typically aims at creating spaces for probing and learning instead of stipulating definitive targets…the inherent contingency of EST requires rather tentative approaches to governance, though often in combination with more definitive modes of governance, with the exact mixture involving a balancing act.[219]

Closely resembling these early 21st century diagnoses of new modes of governance for innovative science and technology, scholarship on *soft law* identified novel, experimental and dynamic

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[218] An overview of these different notions is provided in Stefan Kuhlmann, Peter Stegmaier, and Kornelia Konrad, 'The Tentative Governance of Emerging Science and Technology—A Conceptual Introduction', *Research Policy* 48, no. 5 (2019): 1091–97.
[219] Kuhlmann, Stegmaier, and Konrad.

ways of finding political agreement among countries after the end of the Cold War. The notion of *soft law* emerged in the late 1980s to early 2000s as a terminology to grasp a "new wave of experimentalism" befalling international relations, organizations, their tools, and power[220]. Under the impression of a "great power shift" towards "soft power"[221] in global orders after the end of the Cold War, and most vividly discussed for new modes of European economic and political integration[222], the notion of *soft law* "was created at a time when political scientists and international legal scholars needed new concepts in order to make sense of a changing world"[223]. New forms of rule-making among nation-states on the one hand, and a surge of quasi-legal norms on part on non-governmental actors (i.e., corporations and civil society) on the other, gave way to observations that the law was indeed changing toward the end of the 20th century. The purity of the law as an instrument that could only be proclaimed and protected by the state seemed to be gradually replaced by plural, non-hierarchical ways of norm-development – "a new polytheism" in jurisprudence and in legal practice – described by legal sociologist Gunther Teubner as "an array of various independent machineries of social norm production which produce legal norms directly from outside the law, from the various subsystems of society"[224].

Despite much controversy around their legal nature, soft social norms declared beyond the nation-state rapidly gained a reputation for their efficiency, inclusiveness, and flexibility. *Soft law* became a more general signifier for the increasing role of "commitment and compliance" to shared principles in international systems, prominently defined by legal scholar Dinah Shelton as "normative provisions contained in non-binding texts"[225]. In Shelton's view, "soft law is a type of social rather than legal norm...it usually refers to any written international instrument, other than a treaty, containing principles, norms, standards, or other statements of expected behavior."[226]

Ensuing controversies among scholars of international relations and the law have since never produced a more nuanced shared definition; the common baseline in literatures concerned with *soft law* is that "any discussions of soft law must start with an acknowledgment that there is no consensus definition of the term."[227]. The nevertheless astonishing career of the discourse and practice of *soft law* for the regulation of all kinds of human affairs, including the production of knowledge and technology, probably owes its success to this definitional hybridity itself. Let me briefly map you its most important

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[220] Robilant, 'Genealogies of Soft Law', 504.
[221] Joseph S. Nye, 'Soft Power', *Foreign Policy*, no. 80 (1990): 153–71.
[222] Such as the Open Coordination Method, see David M. Trubek, M. Patrick Cottrell, and Mark Nance, '"Soft Law," "Hard Law," and European Integration: Toward a Theory of Hybridity', SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, 1 November 2005)..
[223] Ulrika Mörth and Malena Britz, 'European Integration as Organizing: The Case of Armaments', *JCMS: Journal of Common Market Studies* 42, no. 5 (2004): 5.
[224] Gunther Teubner, 'Altera Pars Audiatur: Law in the Collision of Discourses', SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, 1997), 153.
[225] Dinah L. Shelton, 'Commitment and Compliance: The Role of Non-Binding Norms in the International Legal System (Introduction)', SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, 2000), 292.
[226] Shelton, 292.
[227] Andrew T. Guzman and Timothy Meyer, 'International Soft Law', SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, 4 August 2010), 127.

contours: what meanings, functions, and effects have been attached to the notion of *soft law* by legal scholars and those concerned with regulatory arrangements that do not rely on *hard law*? Although I cannot delve too deep into this question, the answers we are searching for necessarily need to include those debates held among defenders of diverging concepts of the law itself[228]. Our ideas of what the law (whether hard or soft) *is* as well as what it *ought* to be are informed by a long history of jurisprudence that has come to different conclusions over time and in different places, far beyond the overview I can provide here. We should note, however, that legal thought has evolved significantly since 'natural law' theories have been challenged by a variety of schools in jurisprudence, stretching legal positivism, realism, governance, and governmentality theories as well as more critical legal studies. The natural law tradition, first formulated by thinkers like Plato, Augustinus, and Aquinas, conceived the authority of the law as inherently connected to morality – as legitimate only when being morally just (i.e., advancing freedom, equality, and the common good). The simple idea that *lex iniusta non est lex* still remains a centerpiece of what we imagine the law to be and to do, yet a plurality of other perspectives on the law have entered our imagination, including the figure of *soft law.* In the following pages, we will review these different schools only briefly, and only insofar as they have given rise to divergent accounts of *soft law*.

Questioning legitimacy: Legal Positivism's hardness

At first sight, the figure of *soft law* has the allure of an oxymoron. We tend to think of the law as a body of rules not necessarily set in stone[229] but carved so deeply into our societies that it binds bodies, individuals, and collectives to quite stable and durable rules of behavior, for example through a constitution. Adding the qualification "soft" to such a connotation of law obviously raises many doubts and questions, and even hard-fought battles as legal scholarship has shown. Important for our discussion of *soft law* is the common assumption inherited from legal positivism that the law is a particular kind of social regulation, one that is – contra natural law theories – different from 'morality' or 'opinion'. What the prominent legal philosopher John Austin considered to be law in the 19th century, at least, is still very much rooted in our imaginations of the specific nature of law: "laws proper, or properly so called, are commands; laws which are not commands, are laws improper or improperly so called"[230]. The law was understood by Austin along two criteria, the first of which implied that only a sovereign (e.g., a monarch, a parliament, or other type of government) could make commands, whereas the second criterion established that commands are "enforcements of obedience"[231], which implied that disobedience of the law can be sanctioned by the sovereign. As the founding father of legal positivism,

[228] Matthias Goldmann, 'We Need to Cut Off the Head of the King: Past, Present, and Future Approaches to International Soft Law', *Leiden Journal of International Law* 25, no. 2 (2012): 339.
[229] Some of the first codes of law have actually been carved in stone, such as the Mesopotamian Code of Ur-Nammu dating back to 2100 BC.
[230] John Austin, *Austin: The Province of Jurisprudence Determined*, ed. Wilfrid E. Rumble, Cambridge Texts in the History of Political Thought (Cambridge: Cambridge University Press, 1995), 10.
[231] Austin, 10.

Austin was crucial not only for our reasoning on what the law *is* but decisive for our ideas for what it is *not*. For instance, he believed that "opinions or sentiments held or felt by an indeterminate body of men in regard to human conduct", "much of which is usually termed International Law",[232] are improperly called 'law'.

It is here that we can trace the roots of debates around the permissibility of *soft law* terminology in international relations, where one of the hardest conflict lines always centered around where to locate the use of non-binding norms among countries within "International Law in Her Infinite Variety"[233]: Should these seemingly loose commitments – not commanded by any sovereign constituted by people and not enforceable through sanctions – be considered as 'legal' instruments? For positivist defendants of the law, the question alone would already be "redundant"[234], as they simply object the use of the term "law" for something that, with no binding and coercive power, "simply is no law at all"[235]. At best, legal positivism has considered the concept of *soft law* as a "threat to the autonomy of the law and an undesirable danger to domestic democracy"[236], as it does not have its source in a sovereign consented to by people, and hence no legitimacy in regulating them. Why have others insisted that *soft law* has any power anyway[237]?

Studying practice and effects: Legal realism's managerialism

Approaches that have not relied on a binary distinction between law proper (i.e., *hard* coercive commands) and improper law (i.e., *soft* non-binding rules) do not understand the law in relationship to its ideal-type legitimacy but in terms of its real-world practice and effects. Against legal positivism, the school of legal realism is against definitions of what the law is according to scholars like Austin and instead is broadly interested in what judges as well as laypeople understand and practice as law: "in one aspect law is as broad as life", Karl Llewellyn, one of the modern founders of legal realism asserted, which implies that "one will have to follow life pretty far to get the bearings of the legal matters one is examining"[238]. Legal realism has been crucial for the development of sociological studies of the law, whose most important project was to study the law as objectively as possible, as an empirical object rather than with a pre-determined idea of what the law is or what it ideally ought to be. Making the case for such a project, Llewellyn wrote in 1962:

232 Austin, 10.
233 R. R. Baxter, 'International Law in "Her Infinite Variety"', *The International and Comparative Law Quarterly* 29, no. 4 (1980): 549–66.
234 Jan Klabbers, *The Concept of Treaty in International Law*, 1998.
235 Prosper Weil, 'Towards Relative Normativity in International Law?', *The American Journal of International Law* 77, no. 3 (1983): 413–42.
236 Goldmann, 'We Need to Cut Off the Head of the King: Past, Present, and Future Approaches to International Soft Law', 342.
237 Bryan H. Druzin, 'Why Does Soft Law Have Any Power Anyway?', *Asian Journal of International Law* 7, no. 02 (2016): 1–18.
238 Karl N. Llewellyn, *Jurisprudence: Realism in Theory and Practice* (Transaction Publishers, 2011), 44. His emphasis.

> What interests me is that when a judge is working in a 'well-settled field' he is likely to pay no attention to what such gentleman say, and to call it irrelevant speculation; whereas when he is working in an 'unsettled field', he seems to pay a lot of attention to their ideas…this I take to mean that *for some purposes* they are talking something very close to 'law', under any definition; and for *other purposes,* they are talking something whose connection with 'law' is fairly remote. And this problem of the world calling up wide-scattered and disparate references, *according to the circumstance,* seems to me vital.[239]

Respectively, realist thinkers have stressed the contingency and context in which people reason on and practice law, the reasons provided for as well as the interests guiding the framings of law.

In international relations literatures, realism has given rise to functional and institutional analyses of the ways and grounds states choose to enter international agreements and settle *soft law* among them, shifting inquiries to "managerial" questions such as "why do states and other international actors conclude soft or hard agreements?" or "when or why do states comply with binding or non-binding international norms?"[240] While the original realist approach to international law was pointing to the underlying interests for states to settle collaboration through *soft law* (i.e., primarily to exploit their power), institutional scholars of international relations have been more interested in showing what the usefulness of *soft law* for states and other actors might represent. According to these studies, the use of soft agreements takes place within a continuum of the law and is but one of many shades of the creation of international legality. Due to its many benefits, however, "international actors often deliberately choose softer forms of legalization as superior institutional arrangements"[241].

Here, *soft law* is the reflection of a particular problem actors in the international arena are trying to solve, such as overcoming state sovereignty over norms or dealing with uncertainty among countries on a particular matter. The rationalist observer then is interested in finding out the cost/benefit ratio for states to choose these arrangements in the first place, an observation some authors have used to actively advocate soft rules versus hard treaties in international governance. Among other benefits, these experts argue, *soft law* bypasses the hard sanctions exerted by *hard law*, allows greater flexibility in rule-making, and makes room for agreement where hard law does not; "soft law, in short, is easier and cheaper to negotiate than hard law"[242]. Others have emphasized that issues "not ripe for treaty action because of scientific uncertainty or lack of political consensus may help mask disagreements over substance, overcome competing visions of organization's purposes and resolve institutional crisis"[243].

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239 Llewellyn, 44.
240 Goldmann, 'We Need to Cut Off the Head of the King: Past, Present, and Future Approaches to International Soft Law', 352.
241 Kenneth W. Abbott and Duncan Snidal, 'Hard and Soft Law in International Governance', *International Organization* 54, no. 3 (2000): 423.
242 Guzman and Meyer, 'International Soft Law', 126.
243 Shelton, 'Commitment and Compliance', 15.

Soft law can also create the expectation that non-binding obligations at some point translate into binding national domestic law or 'hard' international treaties and, hence, produces innovation in law through mutual learning. From this perspective, such quasi-legality "distinguishes soft law from purely political agreements"[244].

Governing without government: Global Governance's progressivism

Whereas realist and institutional jurisprudence ordered *soft law* in a continuum with *hard law*, studies and theories targeting new and flexible forms of decision-making as forms of 'governance' left much of traditional legal reasoning behind. In these literatures, "international governance is understood as the formal and informal bundles of rules, roles, and relationships that define and regulate the social practices of state and non-state actors in international affairs."[245] Norm-production beyond traditional state boundaries, arguably a result of increasing international harmonization and economic globalization at the end of the 20th century, came to be framed by governance scholars as a form of "post-political regulation" expressed through "voluntary regulatory arrangements" that rest on "consensual relationships"[246]. *Soft law*, once juxtaposed to the bureaucratically burdensome, slow, and seemingly ineffective post-WWII international legal order, was envisioned as a pragmatic governance instrument for the coming into being of a truly global world after the end of the Cold War. As one commentator summarized, "the international legal order is an evolving one that requires a wide range of modalities for change and development, especially into new subject areas"[247].

The non-coercive effectiveness attributed to *soft law* made it a suitable modality for governing what Francis Fukuyama coined the "End of History" in 1989. In a world free of political battles, hard conflicts between states were imagined to decrease in favor of "Common Marketization" and to be replaced by "economic calculation, the endless solving of technical problems, and the satisfaction of sophisticated consumer demands"[248]. Beyond global markets, such seemingly neutral and technocratic forms of governance were also advocated by scholars and non-governmental organizations through a "new turn to law as a mode of producing a just society"[249] e.g., for the advancement of human rights. War and the threat of violence among states were imagined to be substituted by a global avowal to market-liberalism and civic pluralism for which *soft law* was deemed a useful vehicle as it granted input

244 Timothy Meyer, 'Soft Law As Delegation', *Fordham International Law Journal* 32, no. 3 (1 January 2008): 890.
245 Anne-Marie Slaughter, Andrew S. Tulumello, and Stepan Wood, 'International Law and International Relations Theory: A New Generation of Interdisciplinary Scholarship', *The American Journal of International Law* 92, no. 3 (1998): 371.
246 Christina Garsten and Kerstin Jacobsson, 'Post-Political Regulation: Soft Power and Post-Political Visions in Global Governance', *Critical Sociology* 39, no. 3 (1 May 2013): 421–37.
247 C. M. Chinkin, 'The Challenge of Soft Law: Development and Change in International Law', *International and Comparative Law Quarterly* 38, no. 4 (1989): 866.
248 Francis Fukuyama, 'The End of History?', *The National Interest*, no. 16 (1989): 16–17.
249 Mark Goodale and Sally Engle Merry, 'Foreword', in *Anthropology and Law*, A Critical Introduction (NYU Press, 2017), ix–xii.

as well as output legitimacy to international agreements[250]. Instead of being perceived as a weakness, in this view, the softness of international legal practice lent the new global world its stability[251].

Following these accounts, the self-regulation of actors and sectors through "hybrid" and "networked"[252] forms of collaborative steering represents a new form of "governing without government" in which "the boundaries between public, private and voluntary sectors became opaque"[253]. With governance taking place outside of the traditional legislative arena, the role of the state shifted from one of providing to one of enabling and regulating public goods produced by private actors[254]. *Soft law* can gain considerable power in this context because it operates in the "shadow of hierarchy"[255], which means that the threat of legislative and executive action by the state puts pressure on actors to adhere to their self-established rules[256]. As a method of governance, these scholars suggest, "Soft Law May be Harder Thank You Think" because it induces change in behavior through "shaming, diffusion through mimesis or discourse, deliberation, learning, and networks"[257].

Rather than legal authority resting firmly with the sovereign or in the every-day enactment of the law, "new modes of governance"[258] are broadly described by governance theorists as shared authority over policy areas produced by state actors, corporations and civil society in international fora[259]. In her splendid genealogy of *soft law*, Anne di Robilant shows how the discursive construction of *soft law* within European integration always followed two enthusiastic political visions of this phenomenon: one being social, "invoking notions of living law, social law and pluralism, (which) serves an agenda pursuing both social protection and efficient flexibility"; the other being market-liberal, "evoking ideas of organic efficiency and autonomy well-suited to fit an agenda pursuing market integration and deregulation"[260]. *Soft law* might still grant the state an implicit *primus inter pares* role in providing and protecting the public interest – state power still looms in the shadows –, but the increasing involvement of civil society as well as business is advocated by both social and market-liberal

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250 Kristin Bergtora Sandvik, 'Soft Law', in *The International Encyclopedia of Anthropology* (John Wiley & Sons, Ltd, 2018), 1–2; Anne Peters and Isabella Pagotto, 'Soft Law as a New Mode of Governance: A Legal Perspective', SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, 28 February 2006).
251 Teubner, 'Altera Pars Audiatur', 16.
252 Trubek, Cottrell, and Nance, '"Soft Law," "Hard Law," and European Integration'.
253 Rhodes, 'The New Governance: Governing without Government', 660.
254 Adrienne Héritier and Dirk Lehmkuhl, 'Governing in the Shadow of Hierarchy New Modes of Governance in Regulation', in *New Modes of Governance in Europe: Governing in the Shadow of Hierarchy*, ed. Adrienne Héritier and Martin Rhodes (London: Palgrave Macmillan UK, 2011), 13.
255 Fritz W. Scharpf, 'Legitimationsprobleme Der Globalisierung Regieren in Verhandlungssystemen', in *Regieren Im 21. Jahrhundert — Zwischen Globalisierung Und Regionalisierung: Festgabe Für Hans-Hermann Hartwich Zum 65. Geburtstag*, ed. Carl Böhret and Göttrik Wewer (Wiesbaden: VS Verlag für Sozialwissenschaften, 1993), 165–85.
256 Bob Jessop, *The State: Past, Present, Future* (2015: Wiley), 176.
257 David M. Trubek and Louise G. Trubek, 'Hard and Soft Law in the Construction of Social Europe: The Role of the Open Method of Co-Ordination', *European Law Journal* 11, no. 3 (2005): 356.
258 Adrienne Héritier, 'New Modes of Governance in Europe: Policy-Making without Legislating?', *Common Goods: Reinventing European and International Governance, 185-206 (2002)*, January 2002.
259 Rodney Hall and Thomas Biersteker, *The Emergence of Private Authority in Global Governance*, 2002.
260 Robilant, 'Genealogies of Soft Law', 506.

enthusiasts, as a welcome re-ordering of authority in decision-making across public and private, global and local domains. Whereas the social imagery champions “direct civil society participation in global governance”[261], market-liberal views herald *soft law* as a tool for the international community to better respond to and incorporate global business needs. “soft law”, in short, “adds a social flavor to the market agenda and an efficiency twist to the social agenda.”[262] To strengthen their arguments, these agendas present *hard law* executed by the state as unable to allocate the dynamic and flexible character of global business or of the rising “networking civil society”[263]; hard law simply lags behind these “broader global transformations” which demand “effective and experimental solutions” and a “radically different normativity”[264]. As critical legal scholar David Kennedy has so pointedly summarized, such is the vision of a “kind of ersatz global sovereign or reassuring father, at once problem solver and ethical lodestar”[265].

Attesting asymmetries: Critical Legal Studies’ critique

While realist jurisprudence and scholarship on governance has widely celebrated *soft law* as a progressive and rational instrument for more efficient decision-making, “critical legal studies” (CLS) – the “enfant terrible”[266] of the field – has taken up the project to dismantle new governance approaches as inherently political and normative ways of producing, distributing and maintaining power. On the one hand, CSL opposed the realists’ claims that the law can be studied objectively, and instead proposed that jurisprudence is always normative and political – including CSL, which identified itself from the onset as a left-leaning, anti-establishment, and (neo)Marxist “movement”[267]. On the other hand, and as a result, CSL insisted that “law is politics”[268], socially constructed within the elites of legal scholarship and practice, and hence informed by “attitudes, beliefs and values of legal actors”[269] of ideological nature. By studying legal epistemology and practice through postmodern, poststructuralist, constructivist, or feminist approaches, CSL has turned its critique towards the hierarchy and hegemony of ruling elites stabilized by the law, to “law’s role in political and economic struggle rather than its promise of order, its distributional impact rather than its peace-building potential”[270].

According to these perspectives, discourses, and practices of *soft law* work as contingent, socio-historically situated “political technology which creates, enhances, maintains, perverts, and modifies the

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261 John J. Kirton and Michael J. Trebilcock, *Hard Choices, Soft Law: Voluntary Standards in Global Trade, Environment and Social Governance* (London: Routledge, 2016), 5.
262 Robilant, ‘Genealogies of Soft Law’, 554.(di Robilant, 2006, p. 554)
263 John Keane, *Civil Society: Old Images, New Visions* (Polity Press, 1998), 18.
264 Robilant, ‘Genealogies of Soft Law’, 506.
265 David Kennedy, ‘Law, Expertise and Global Political Economy’, *Tilburg Law Review* 23, no. 1–2 (21 December 2018): 109–20.
266 Mörth, ‘Soft Law and New Modes of EU Governance – A Democratic Problem?’, 5.
267 Roberto Mangabeira Unger, ‘The Critical Legal Studies Movement’, *Harvard Law Review* 96, no. 3 (1983): 561–675.
268 Teubner, ‘Altera Pars Audiatur’, 152.
269 Alan Hunt, ‘The Critique of Law: What Is “Critical” about Critical Legal Theory?’, *Journal of Law and Society* 14, no. 1 (1987): 12.
270 David Kennedy, ‘Law in Global Political Economy: Now You See It, Now You Don’t’, n.d., 127–51.

exercise of power within a given social body"[271]. Here, the production of *soft law* figures as a means for ordering social relationships and creating meaning through recourse to the legal: it is "a mechanism for exercising individual and collective agency" at the same time as it "regulates and often constrains social, political, and economic action."[272] Critical voices observing the emergence of *soft law* from the 1980s onwards attest to asymmetries in who gets to encode such ordering power in the "global", "plural" sphere – "soft law is actually limited to powerful actors"[273] – legitimized under the veil of shared authority and inclusive governance. According to some of the radicals of the CLS movement, seemingly collective processes of norm-making are in fact only providing legitimacy to de-facto top-down hegemonic practices and discourses reproduced within neoliberal globalization[274]. A turn to objective expertise and rationality, coupled with declarations of universal norms and ethics, is argued to mask this asymmetry:

> As if norms and facts – rather than real people – were responsible for the result. And as if what is going on is indeed 'governance'. Not rent-seeking or nest feathering; not reinforcing some private interests against others; not reinforcing inequality or consolidating social power while managing dissent; not managing an entertainment spectacle. Governance, in short, is not struggle.[275]

Critical approaches have been particularly fruitful for advancing our understanding of the making of *soft law* in international organizations and through the norms of (neo)liberalism. In their reading, the progressive liberal agenda of global governance, manifest in concepts like "development" or "human rights", is but a codification of authority on part of democratically illegitimate rulers such as international bureaucracies. Barnett and Finnemore, for example, have argued that the soft power of international organizations is derived from epistemic classifications of the world, the fixing of meanings, and the diffusion of norms within processes that emphasize objectivity and technocratic forms of reasoning rather than particular political agendas[276]. Harsher accounts have warned us of the "ethical hubris"[277] of progressive *soft law* framings, asking us not to "be fooled by the appealing and delicate nature of soft arguments: respectful of differences, aware of cultural specificities, concerned with gaining efficiency from flexibility, and refusing the arrogance of decision making in the name of cultural relativism"[278].

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[271] Filippo M. Zerilli, 'The Rule of Soft Law: An Introduction', *Focaal* 2010, no. 56 (2010): 11.
[272] Mark Goodale, *Anthropology and Law* (NYU Press, 2017), 22, https://nyupress.org/9781479895519/anthropology-and-law.
[273] Sandvik, 'Soft Law'.
[274] Boaventura de Sousa Santos and César A. Rodríguez-Garavito, *Law and Globalization from Below: Towards a Cosmopolitan Legality* (Cambridge University Press, 2005), 9.
[275] Kennedy, 'Law, Expertise and Global Political Economy', 115.
[276] Michael Barnett and Martha Finnemore, *Rules for the World* (Cornell University Press, 2004), 31–32.
[277] Goodale, *Anthropology and Law*, 220.
[278] Ugo Mattei, 'Hard Code Now!', *Global Jurist Frontiers* 2, no. 1 (11 February 2002).

If "law is politics is the war cry of CLS"[279], there are two different views on where such politics are located in the realm of *soft law.* On the one hand, the *processes* that underwrite the production of *soft law* are inherently political in that they "are important for determining what is noticed as a global problem as well as which solution is chosen to address it"[280]. On the other hand, *soft law* "promotes the *goals* of the social project in a climate of democratic deficit and ideological stalemate"[281] and particularly those of actors interested in keeping and expanding authority over the distribution and dominion of power.[282] Whereas the first stresses asymmetries in power concerning who enjoys authority to frame the problems that *soft law* is supposed to solve (e.g. experts), the latter targets unequal power relationships (e.g. between center/periphery, North/South, or social classes) encoded in soft social norms that play the language game of heterarchical and inclusive decision-making. Respectively, critical analyses have prompted calls "towards an integrated Marxist approach to international law"[283] and for the development of a "subaltern cosmopolitan legal theory" that counters further hierarchization and stratification of societies through *soft law*[284].

[279] Teubner, 'Altera Pars Audiatur', 152.
[280] Deborah D. Avant, Martha Finnemore, and Susan K. Sell, eds., *Who Governs the Globe?,* Cambridge Studies in International Relations (Cambridge: Cambridge University Press, 2010), 7.
[281] David M. Trubek et al., eds., *Critical Legal Perspectives on Global Governance: Liber Amicorum David M. Trubek* (Oxford, United Kingdom ; Portland, Oregon: Hart Publishing, 2014), 13. My emphasis.
[282] Kennedy, 'Law, Expertise and Global Political Economy'.
[283] B. S. Chimni, *International Law and World Order: A Critique of Contemporary Approaches*, 2nd ed. (Cambridge: Cambridge University Press, 2017); Kennedy, 'Law, Expertise and Global Political Economy'.
[284] Boaventura de Sousa Santos, 'The Counter-Hegemonic Use of Law in the Struggle for a Globalization from Below', 2005, 441.

Conclusion

The demarcation of boundaries between attributes apparently so natural as 'soft' and 'hard' occurs most vigorously when there are great stakes in settling their meaning, and our short review of different approaches to *hard* and *soft law* shows no exception to this rule. During the emergence of a new global order in aftermath of the Cold War, the concept of law entered into a "collision of discourses"[285] with far-reaching effects on understanding, theorizing, and practicing the law. The pluralization of social norm production beyond the law of nation-states and in the global sphere arguably had as a consequence that legal thought also became more plural in terms of concepts and approaches to what international law is as well as to what it ideally ought to be – as one prominent critical scholar put it, "by the century's end, we dreamed of law in many ways, a grab bag of diverse and inconsistent ideas about what the law is and how it functions, any of which could be drawn on strategically"[286]. S*oft law,* as we have seen, became a useful figure to reimagine the rather orthodox field of jurisprudence, both for overcoming legal positivism's hardness, as well as for including new perspectives such as that of Global Governance or CLS.

As a result, a diversity of meanings got projected into the notion of *soft law:* from the observation of the beneficial functions of non-binding agreements in international politics, the celebration of governance as an efficient mode of regulation beyond governments, to harsh critique of (neo)liberal ideology expanding through soft governance talk, *soft law* emerges as a deeply polarized concept. For *soft law* proponents, it presents a welcome re-distribution of power from hierarchical government to more heterarchical forms of governance, including the benefits of flexible and fast decision-making over the slow and contentious settlement of hard law commands via the judiciary. For the 'crits', in turn, *soft law* further deepens long-held asymmetries in the distribution of power, including the strategic exclusion of peripheral actors for the expansion of hegemonic, liberal ideology. At the core of these debates rests the question of *soft law's* democratic legitimacy: should norms, principles, and rules that are produced outside of traditional legal settings, governmental institutions, and democratic procedures be considered democratically legitimate? Does the absence of democratic processes in the formulation of *soft law*, such as parliamentary input, juridical review, or direct citizen participation, imply a lack of democratic legitimacy and thus also of political authority? In short, what are soft law's "legitimacy credentials" given that "the adoption of soft law lacks institutional, procedural, and democratic guarantees"[287]? Despite the vast array of literatures on *soft law* at hand, significant differences persist in how legal scholars assess these questions, and yet again, we are facing a dearth of analyses that approach different commitments and critique towards *soft law* from a symmetrical perspective.

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[285] Teubner, 'Altera Pars Audiatur'.
[286] Kennedy, 'Law, Expertise and Global Political Economy', 112.
[287] Danai Petropoulou Ionescu and Mariolina Eliantonio, 'Democratic Legitimacy and Soft Law in the EU Legal Order: A Theoretical Perspective', *Journal of Contemporary European Research* 17, no. 1 (10 February 2021): 49.

Debates concerning the legitimacy of *soft law* in world politics, as might become clearer at this point, mirror closely those discussions concerned with the legitimacy of *soft law* in the politics of science, technology and innovation. In international relations, the increasing uptake of *soft law* in the late 20th century provided both a promissory imaginary of a progressive shift toward governance beyond governments, as well as rather pessimistic visions of "powerful players" taking advantage of "a world with no center"[288]. In science and technology policy, the embrace of *soft law* in the latter half of the 20th century was projected to progressively endow the autonomy of science with greater democratic legitimacy beyond its hard regulation, at the same time as it was accused of "all too often fall(ing) together with dominant ideologies"[289], with "anti-democratic consequences in both procedural and substantive terms – procedurally by delegating deliberative responsibility to relatively non-transparent expert bodies; and substantively by privileging individual rights over collective and communal values"[290].

Both debates were struggling with how to conceive of new phenomena perceived as largely self-regulating, autonomous, and powerful entities making worlds and making order, as well as of new instruments imagined to align such entities with democratic cultures and procedures. And in both strands of literature, commentators could find great deficits with regard to *soft law's* democratic legitimacy, as well as great benefits with regard to *soft law's* efficiency in overcoming the hurdles of reaching such legitimacy via traditional, or hard, democratic procedures. Eventually, both battles over the appropriate interpretation of *soft law* were fought by actors committed to widely diverging political agendas, all with their own ideals of the law, democracy, and the ways they should best be founded on and protect the interest of the people. These ideals significantly pluralized as next to the usual suspects, new actors emerged with their own visions of what the appropriate relationship between hard and soft law, governance and government, center and periphery, and so on ought to be so as to become democratically legitimate.

What is at stake in these seemingly disparate debates is, in fact, the very ideal of a democratically constituted sovereign that has guided legal and political imagination since the Enlightenment, in which legitimate rule rests solely within self-government by the people and their common will, and which is codified through the highest of all laws of liberal democracies – the Constitution. Don K. Price has summarized the logic of this ideal in the following way:

> A free citizenry can hold government responsible only if it can choose from time to time which elected officers should hold power and what the limits of that power should be. It can do so only if the contending political leaders, while disagreeing on policies, agree in large measure to maintain government as a going concern and to respect the legal

[288] Kennedy, 'Law, Expertise and Global Political Economy', 113.
[289] Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*, 237.
[290] Sheila Jasanoff, 'Governing Innovation' (Seminar, Seminar-597, Harvard, May 2009).

processes by which they hold or give up their power.[291]

In the latter half of the 20th century, the constitutive function of these democratic ideals for political practice and social order was confronted with the surge of new ideals of self-regulation in both domains, global and technoscientific politics, that largely escaped not only the vocabulary of theory, but also of the political cultures that were founded on liberal democratic credentials of people's self-government and its constitutional guarantees.

If "the force of law cannot even begin to pose as democratic if it does not appear to represent the people rather than its own agents"[292], then *soft law* is a radical provocation of long-held, primarily positivist beliefs about the legitimacy of the law: it represents but the will of its own agents, whether international organizations and their technocrats, or scientific and other experts judging on the ethical and social implications of science and technology. How these competing ideals could be harmonized, or whether one should win over the other, became critical questions towards the turn of the century, in which both imperatives of globalization as well as technoscientific innovation, were arguably expanding at ever greater speed and scale. At the same time, the concept of democracy and political government came to be re-configured toward "post-political" and more efficient forms of regulating the public good of societies, which arguably also produced wide-ranging tensions, or crises, for liberal democracy ideals.

Albeit our journey into the universe of *soft law* necessarily had to make a short stop-over at the planet of international relations literatures in which *soft law was* first articulated, the rest of this thesis will be concerned with how conflicts of democratic legitimacy vis-à-vis the imperative of *soft law* are resolved in policy-making on science, technology, and innovation. To understand this planet, we need to take different tools on board than those mobilized by the many students, advocates, activists, and critics of *soft law* reviewed so far; these tools were primarily used as weapons taken up to fight for and against particular ideals of democracy, the law, and their righteous relationship to science and technology or to the global sphere. Our tools, in turn, should be able to restore symmetry in the analysis of *soft law's* nature, function and effects, and to help us better explain the roots and causes of *soft law's* expansion in the regulation of technoscientific development without *a priori* judgement on its ontological standing and normative or political permissibility. They will have to be targeted not at the fact *that* soft law is "eating the world", as the Policymaker's guide at the beginning of this chapter so confidently claimed, or at the appraisal if it *ought* to do so, but at gaining deeper insights into *how* soft law has gained significant power to re-imagine the proper relationship between science, technology, and democracy, and *why* it is these forms of imagination today are widely institutionalized in the political cultures of liberal democracies and acknowledged as legitimate expressions and guarantees of the public's self-government – despite, or maybe because of, their rather weak democratic credentials.

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[291] Don Price, *America's Unwritten Constitution* (Cambridge, MA: Harvard University Press), 2–3.
[292] Yaron Ezrahi, *Imagined Democracies: Necessary Political Fictions* (Cambridge: Cambridge University Press, 2012), 156.

3. A Co-productionist Approach to the Study of Soft Law in Innovation Governance

As we have learned in the preceding chapter, the rise of *soft law* in science and technology policy is scrutinized from various perspectives, and in particular by scholars invested in either promoting soft norms and rules as more effective forms of governance, or in criticizing their mobilization as democratically legitimate instruments of socio-technical regulation. To follow these approaches in the analysis of governance regimes in emerging neuroscience- and technology across the three case studies of this thesis would sooner or later lead us to two diverging lines of interpreting soft governance. One is of the optimistic kind, suggesting that *soft law*'s legitimacy derives from its ability to flexibly incorporate social and economic interests and demands into dynamic innovation pathways. From this perspective, soft steering efforts are a stepping stone for a well-governed future of innovation in society, offering but advantages as compared to legal regulation through hard means. The other reading would get us down to seeing soft principles and rules as a rhetoric masquerade of old social contract ideals with science, which allows to further legitimize the ongoing self-regulation of scientific knowledge production and technological development in the absence of a greater de-facto involvement of society. In this rather pessimistic view, *soft law* is a technocratic instrument that largely preempts democratic deliberation of the politics of science and technology in society, whether through inhibiting novel forms of direct public participation or through bypassing more traditional processes of parliamentary and legal review. Both approaches are somehow asymmetrical in that they hold one variable stable – that of democracy or innovation – while the other is held flexible – that of the legitimate place and processes of subjecting, or reducing, one to the other.

To approach the study of *soft law* from a symmetrical perspective – i.e., without an *a priori* understanding and stance on its nature, function, and effects – requires different methodological inroads that help us in the interpretation of diverging claims and meanings put forward by actors involved in the production of soft norms for the governance of technoscience. Symmetry in the analysis of processes that settle soft principles and guidelines vis-à-vis science and technology demands their explanation to be impartial[293] toward what democracy, science, innovation or the law come to signify for particular actors in particular contexts; from an analytical perspective, there is no right or wrong, true or false, morally and politically legitimate or illegitimate nature to these notions and concepts. Rather, different meanings attached to them can be assessed as claims to (scientific, technological, or normative) knowledge about reality which arise from culturally entrenched visions of the legitimacy of science, technology, and democracy in regulating individuals and societies. Such a methodological relativism does not discourage our research from taking normative conclusions with regard to the mobilization of *soft law*, but binds us to be analytically open toward the varied interpretations and imaginations of *soft*

[293] Bloor, *Knowledge and Social Imagery*, 13.

law advanced by actors in contemporary science and technology policy[294]. As STS scholar John Law has put it,

> To be a relativist – to recognize multivocality – implies no commitment to immorality or opportunism…Rather it may lead us to an important form of intellectual caution: the sense that all knowledges are shaped, contingent, and in some other world could be otherwise.[295]

This chapter proposes an approach to *soft law* as an epistemic and normative instrument of governance: it produces authoritative knowledge on emerging science and technology, and through such knowledge, social order around new knowledge and artifacts. Vice-versa, social and political orders shape how such knowledge is produced, who is granted authority to produce it, and which means are employed to make it credible to politics and publics. Comparison is key to carve out the epistemic-normative nature of *soft law,* as different claims advanced in the production and settlement of soft rules for technoscientific development are inextricably tied to contingent, socially and culturally embedded forms of conceiving the legitimate order between democracy, science, and technology. To inquire these claims symmetrically implies reading them in relationship to and in conjunction with each other: how are understandings of *soft law* connected to different conceptions of legitimate democracy and is its relationship innovation? And vice-versa, how do different cultures of scientific and technological governance shape ideals and practices of *soft law* as legitimate form of democratic regulation? A fruitful "idiom" and methodology for addressing these questions can be found in co-productionist strands of STS and its "interactional" variant[296] in particular. Advanced by eminent STS thinker Sheila Jasanoff, this approach draws attention to the "epistemic, material and social formations that constitute science and technology"[297], at the same time as it underscores the centrality of science and technology in the shaping of reason, practices, and institutions that constitute modern societies and their sense of democratic order. Maintaining symmetry in a co-productionist analysis requires us "to use the same resources in explicating closure, stability and change in people's *knowledge of the world* and their organization of *life in the world,* for each is constitutive of the other"[298].

In the following pages, I will review the distinctive approach of co-production vis-á-vis other traditions in STS that have emphasized symmetry as a methodological principle, and then delve into some of the key concepts pertaining to the interactional co-productionist toolkit, such as "civic

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[294] Wiebe E. Bijker, 'The Need for Public Intellectuals: A Space for STS: Pre-Presidential Address, Annual Meeting 2001, Cambridge, MA', *Science, Technology, & Human Values* 28, no. 4 (2003): 443–50.
[295] John Law, 'Introduction: Monsters, Machines and Sociotechnical Relations1', *The Sociological Review* 38, no. S1 (1990): 6.
[296] Jasanoff, *States of Knowledge*.
[297] Jasanoff, 4.
[298] Sheila Jasanoff, 'Beyond Epistemology: Relativism and Engagement in the Politics of Science', *Social Studies of Science* 26, no. 2 (1996): 397. Her emphasis.

epistemologies", "bioconstitutionalism" and "socio-technical imaginaries". Whereas research interested in the dynamics, or "patterns"[299], of co-production has generated a wealth of insights into the mutual shaping of scientific and political order, scholars have only recently begun to observe a "turn of the tide"[300] from 20th century social contract ideals envisioned to regulate the relationship between democracies and science to early 21st century imperatives of innovation that increasingly dominate the public imagination of desirable social progress. Such a shift, as I will elaborate throughout this thesis, has significant implications for the (re)ordering of science, technology, and society relationships through *soft law*: as public reasoning on the proper place and role of science in democracy increasingly turns to settling questions related to the legitimate position of technoscientific innovation in democratic systems, questions of the appropriate place of democracy in innovation processes and governance are opened up, giving way to new forms of reasoning and imagining the legitimate interplay between science, technology, and society.

Maintaining symmetry in STS analysis: From SSK and SCOT to Co-Production

From its beginnings, the field of STS has emphasized the need for symmetry in the study and interpretation of scientific, technological, and social stability and change. Such emphasis derived from the observation that the philosophy and sociology of knowledge, up until broadly the 1970s, explained the success or failure of scientific theories and concepts "by appeal to the procedures, results, methods and maxims of the activity itself"; science, in other words, had become "its own explanation"[301]. Whether a novel scientific claim was perceived as adequately representing or failing to give a coherent account of reality had been largely subjected to answering seemingly rational and logical questions: scientific theories that were rationally and causally explicable would be conceived as 'true', while those that were not could be discarded as erroneous, false, or, at best, limited. While the former departed from a stable idea(l) of the scientific method as supreme way of reaching and judging the truth, the latter derived failures in the stabilization of scientific theories from causes to be found in the psyche of the scientist or his external, social environment. As a result, scientific knowledge and its application through technologies became portrayed as a key driver of social progress, yet one which stands, and must remain, outside and independent of society.

Nowhere did such asymmetry in analysis become more apparent than in assessments of controversies around the permissibility and credibility of novel scientific paradigms[302]. Whereas the standard view saw the resolution of such controversies in the establishment of "uncontested facts", a new generation of scholarship observed "that the stakes involved in settling disputes go far beyond

[299] Jasanoff, *States of Knowledge,* 36.
[300] Pfotenhauer and Juhl, 'Innovation and the Political State: Beyond the Facilitation of Technologies and Markets'.
[301] Bloor, *Knowledge and Social Imagery,* 9.
[302] Thomas S. Kuhn, *The Structure of Scientific Revolutions: 50th Anniversary Edition* (University of Chicago Press, 2012).

testing the truth or falsity of scientific propositions against nature's reality"[303]. By taking a relativist perspective on science, the "Strong Program of the Sociology of Scientific Knowledge" (SSK) proposed that what seemed to be purely 'scientific' controversies in fact was shaped, and reflective of, the social, historical, and cultural context in which such controversies took place. As theorizing on the "Social Construction of Technology" (SCOT) claimed, the same could be observed even more forcefully when studying the development and design of technological artifacts.

Yet, the maintenance of symmetry in the analysis of knowledge disputes implied refusing linear, deterministic claims that either saw science, or society, as primary shapers of each other; what was needed was an approach able to explain the mutual shaping – or *co*-production – of knowledge and society. Two lines of coproductionist inquiry emanated from these insights: 'Constitutional Co-production', widely known as 'Actor-Network-Theory' (ANT), and 'Interactional Co-production'[304]. While departing from different theoretical angles, empirical subjects, and methodological inroads, they equipped social studies of science and technology with a methodologically impartial set of tools similar to those claimed by natural science itself. But different to asserting objectivity in research, STS scholarship embraced epistemic relativism as a way to "soften realities" not as given, but as a web of "different normativities and realities being woven together"[305]. Importantly, and as we have discussed earlier, this has also prompted STS scholarship to "imagine better alternative realities"[306], particularly when it comes to the relationship between technoscience and democracy, with far-reaching effects for the study of *soft law* in science and technology governance. Here, STS has somehow circled back to make asymmetrical claims about the need to democratize science, technology, and their governance, i.e., to subject research, development, and decision-making to a seemingly stable, taken-for granted notion of democratic politics. In light of this development, this thesis observes "a kind of primacy upon the 'social' that careful work in STS, broadly conceived, has consistently denied"[307]. This is a mode of asymmetrical research and engagement that early STS scholarship originally aimed to leave behind altogether when insisting on the *co*-construction of scientific, technological and social orders.

The social shaping of science and technology: SSK and SCOT

Among the first efforts to fledge the turn to symmetry in the sociology and philosophy of knowledge is David Bloor's "Knowledge and Social Imagery", which proposed that the study of scientific truths should not be concerned with their correspondence in nature or reality, or with the definition of the concept of truth itself. According to Bloor, sociologists should rather be asking "to what use the concept

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[303] Sheila Jasanoff, 'Controversy Studies', in *The Blackwell Encyclopedia of Sociology* (John Wiley & Sons, Ltd, 2019), 1.
[304] Jasanoff, *States of Knowledge*.
[305] John Law, 'STS as Method', in *The Handbook of Science and Technology Studies* (Cambridge, MA: MIT Press, 2016), 44.
[306] Law, 44.
[307] Sheila Jasanoff, 'A New Climate for Society', *Theory, Culture & Society* 27, no. 2–3 (1 March 2010): 19.

of truth is put and how the notion of correspondence functions in practice"[308] in a symmetrical fashion: "all *beliefs* are to be explained in the same general way, regardless of how they are evaluated."[309] By approaching scientific knowledge as a form of "social convention"[310] which, similar to that of religion, assumes the role of making authoritative meaning of the world - of ordering our experiences in it as Durkheim would have it – SSK elegantly dissolved the boundary between scientific knowledge and social beliefs. Yet, the project did not end here, for such a dissolution of boundaries between science and society did not account for the reasons why some collectively held beliefs gain greater or lesser authority or enjoy longer or shorter longevity in society:

> Conventions are not arbitrary. Not anything can be made a convention. The constraints on what may become a convention, or a norm, or an institution, are social credibility and practical utility. Theories must work to the degree of accuracy and within the scope conventionally expected of them. These conventions are neither self-evident, universal or static. Further, scientific theories and procedures must be consonant with other conventions and purposes prevalent in a social group. They face a 'political' problem of acceptance like any other policy recommendation. [311]

SSK was key for the general observation in STS that knowledge claims regarded as 'scientific' enjoyed greater authority in societies than other types of knowledge claims, and that processes establishing such hierarchy were in fact marked by socio-political negotiation rather than self-evident ways of reaching objective 'truth'. Following up on SSK, the "Empirical Program of Relativism" (EPOR) split research on such processes into three stages of analysis: first, showing how knowledge claims are subject to "interpretive flexibility" during moments of controversy; second, inquiring how such flexibility is then limited, how "closure" is achieved; and third, linking particular controversies and their resolution to the "wider social and political structure"[312]. Early empirical work in SSK tended to focus on the first two stages of the EPOR, producing a wealth of micro studies on the social construction of scientific controversies and their socio-political closure; reaching the third stage of connecting micro- with macro-analysis, as we will discuss in a moment, would become the main achievement of co-productionist STS.

Symmetry in SSK analysis was quickly broadened in scope through the "turn to technology" in STS[313], and in particular by advancements made in theorizing SCOT. As much as SSK aimed to dissolve

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[308] Bloor, *Knowledge and Social Imagery*, 37.
[309] Bloor, 158. My emphasis.
[310] Bloor, 43. My emphasis
[311] Bloor, 43.
[312] Harry M. Collins, 'Stages in the Empirical Programme of Relativism', *Social Studies of Science* 11 (1981): 10–13.
[313] Steve Woolgar, 'The Turn to Technology in Social Studies of Science', *Science, Technology & Human Values* 16 (1991): 20–50.

analytical boundaries between science and society, it rested on a "separation of science from technology"[314] which needed to be resolved both with regard to disciplinary as well as empirical boundaries: how could the sociology, philosophy and history of science and that of technology be brought into conversation? And what did actors participating in controversies around new technologies think and mean themselves when labelling a problem 'technological' or 'scientific'? In a seminal article that aimed at opening the "black box" of technology in sociology and history, Trevor Pinch and Wiebe Bijker suggested that SSK's methodology could be equally applied to the "social construction of facts" as to that of "artifacts"[315]. They observed that social science had not only conceptualized science-technology but also society-technology relationships in linear, unidirectional, and deterministic ways: "science discovers, technology applies"[316], and successful technologies are those taken up and used by society. In contrast to such monolithic views, SCOT argued that "the success of an artifact is precisely what needs to be explained. For a sociological theory of technology it should be the *explanandum*, not the *explanans*."[317] The relationships characterizing science, technology, and society could be better understood as a "seamless web"[318], as "the boundary between them is a matter for social negotiation and represents no underlying distinction"[319].

SCOT's empirical research on technological controversies added significant meat to the three-stage process suggested by the EPOR. The analysis of interpretive flexibility around novel artifacts, as Bijker demonstrated for the development of the bicycle, showed that controversy not only takes place with regard to "how people think of or interpret artifacts but also that there is flexibility in how artifacts are *designed.*"[320] Involved in these negotiations were not only scientists or engineers, but also different "relevant social groups" with "radically different interpretations of one technological artifact"[321]; accommodation of these differences in the design process, in turn, was driving technological development. Moreover, what was considered as the problem a technology was argued or showed to fix, such as safety or gender issues in the design of the bicycle, was key in the process of settling meaning among social groups according to SCOT. Methodologically, these observations pointed to claims around particular problems and solutions in controversies, suggesting that differences in problem/solution construction could also be supportive for identifying which social groups were involved in the construction of new technologies. Two forms of closure were observed by SCOT in technological

[314] Trevor J. Pinch and Wiebe E. Bijker, 'The Social Construction of Facts and Artefacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other', in *The Social Construction of Technological Systems*, 4th ed., 1993, 399–441.
[315] Pinch and Bijker.
[316] Pinch and Bijker, 25.
[317] Pinch and Bijker, 24. Their emphasis.
[318] Wiebe E. Bijker, Thomas Parke Hughes, and Trevor Pinch, eds., *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*, 4th ed. (Cambridge, Mass: MIT Press, 1993), 10.
[319] Bijker, Hughes, and Pinch, 11.
[320] Pinch and Bijker, 'The Social Construction of Facts and Artefacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other', 40. Their emphasis.
[321] Pinch and Bijker, 41. Their emphasis.

evolution and stabilization – "rhetorical closure" and "closure by redefinition of the problem" – both of which provided decisive moments for the analyst to understand the power relationships between social groups and to direct attention to more dominant actors in the settling of meaning as well as in the very construction of an artifact:

> This is also where aspects such as power or economic strength enter the description, when relevant. Although the only defining property is some homogeneous meaning given to a certain artifact, the intention is not just to retreat to worn-out, general statements about 'consumers' and 'producers'. We need to have a detailed description of the relevant social groups in order to define better the function of the artifact with respect to each group. Without this, one could not hope to be able to give any explanation of the developmental process.[322]

SSK and SCOT presented important methodological pointers for a new approach in the sociology of knowledge and technology – now broadly labelled STS – that was particularly useful for countering received views on science, technology, and their relationship to society. By insisting on symmetry in the analysis of the making of facts and artifacts, they were a key, if only first, step for dismantling grand narratives of social progress driven by scientific knowledge and technological development. Instead of naturalizing science and technology as realms outside, or above, social structures and activity, they relativized them to social conventions, groups, and forms of negotiation among these. Importantly, such relativism did not essentialize science and technology as equal to any other form of knowledge or manipulation of nature but served to explain why they enjoyed greater authority in settling meaning for society than other forms of meaning-making in society. Symmetrical analysis of the stabilization of scientific 'truths' and new technological designs during moments of controversy not only revealed different stages actors went through when negotiating closure, but also the power-relationships between actors in the shaping of new knowledge and artifacts. As such, SSK and SCOT were highly relevant approaches to the 'inner' social workings and dynamics of technoscientific change, particularly because their use of symmetry made us see how concrete actors and groups were involved in the construction of meaning around scientific claims and technological design. Rather than transcendental truths or black-boxed technologies, 'successful' scientific knowledge and technological artifacts could now be studied as the outcome of social struggles over meaning, authority, and power.

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[322] Pinch and Bijker, 35.

3.1 The Mutual shaping of Science, Technology, and Society: Turning to Co-production

Critique of early attempts at methodological symmetry in STS research emanated from a second strand of scholars whose project was to deconstruct not only positivist, deterministic and linear ideals of science and technology, but also taken-for-granted views on society and politics. Whereas SSK's and SCOT's project had illuminated the black box of scientific knowledge and technological artifacts with regard to their social construction, they eventually engaged in a "tug-of war between two extreme positions"[323], that of natural realism, in which the social was reduced to its objective 'nature', and that of social realism, in which the natural was explained in purely 'social' terms. By (implicitly or explicitly) favoring analysis concerned with the social shaping of knowledge and technology, SSK and SCOT in fact had held the black box of society stable vis-á-vis contingent science and technology, forwarding social realist claims at the expense of thorough symmetrical analysis. Such critique emanated in particular from sociologists who rejected ideas of a "background, determinant, social structure"[324] along the lines of Michel Foucault's poststructural method: society or the 'social' should neither be regarded as given, nor as an object of inquiry whose ontological nature can (and should) be defined by the sociologist. Rather,

> What may be observed are sets of different people trying to define the nature of social structure, and then trying to persuade others to subscribe to that definition. This claim has a methodological corollary: social scientists should stop trying to determine the *nature* of the social structure that they believe generates these conflicts, and instead treat the latter as data. In other words, society should not be seen as the referent of an ostensive definition, but rather be seen as being *performed* through the various efforts to define it.[325]

In this view, analysis should equally deconstruct notions of the social as of the scientific and technical, in particular where actors engage in the drawing of sharp boundaries when designating a subject or object as one or the other[326]. Maintaining symmetry in analysis, then, required inquiry into the "co-production of society and nature"[327] instead of following either the natural or the social realist (determinist) fallacy. Respectively, co-productionist methodology needed a different vocabulary for describing how scientific, technological, and social power were related to each other – in the words of Foucault, such vocabulary needed to acknowledge "that power and knowledge directly imply one

[323] Michel Callon and Bruno Latour, 'Don't Throw the Baby out with the Bath School! A Reply to Collins and Yearley', in *Science as Practice and Culture,* ed. Andrew Pickering (University of Chicago Press, 1992), 345.
[324] John Law, 'Editor's Introduction: Power/Knowledge and the Dissolution of the Sociology of Knowledge', *The Sociological Review* 32, no. 1_suppl (1 May 1984): 17.
[325] Law, 17–18. His emphasis.
[326] Thomas F. Gieryn, 'Boundary-Work and the Demarcation of Science from Non-Science: Strains and Interests in Professional Ideologies of Scientists', *American Sociological Review* 48, no. 6 (1983): 781–95.
[327] Callon and Latour, 'Don't Throw the Baby out with the Bath School! A Reply to Collins and Yearley', 349.

another"[328]. This relational concept of power directed analysis to the very practices, techniques, and discourses that mark power-relationships during the (de)stabilization of scientific theories and technological artifacts, helping the analyst to "clarify how power originates, where it gets lodged, who wields it, by what means, and with what effect within the complex networks of contemporary society"[329].

The two lines of inquiry that followed these ideas – 'interactional' and 'constitutive' co-production – today provide a comprehensive set of tools for studying the mutual shaping of science, technology and society. While the constitutive strand of co-productionist analysis forms a relevant entry point for scholarship concerned with the stabilization and maintenance of new forms of scientific, technological and social order, the interactional perspective provides a fruitful inroad into the "accommodations between scientific and other forms of social life at moments of manifest conflict and change"[330]. In the following pages, I argue that the study of *soft law* in science and technology governance can best be approached from the interactional perspective of co-production, as it represents a powerful mechanism for accommodating highly controversial imperatives of technoscientific innovation into political cultures that describe and imagine themselves as modern democracies. At the same time, the resolution of controversies around innovation imperatives also implies accommodating ideals and imaginations of legitimate democratic order in the governance of technoscientific change. But before delving into the distinct methodological approach of interactional co-production that allows us to carve out these dynamics, we will briefly review why the constitutive perspective is less suited to studying them.

Following actors and their networks: ANT or 'constitutional' co-production

A pioneer in applying the principle of symmetry in STS methodology to elucidate how the social, technical and scientific are co-produced, ANT proposed to study "science in action"[331] through the rejection of any pre-set boundaries between the social and the natural, the human and the non-human, or those entities exerting agency in the settlement of techno-scientific disputes and allocation of power therein. As Michel Callon famously detailed in his study of the domestication of scallops in France, ANT methodology would have to rest on three principles of analysis: first, the analyst needed to be fully agnostic about who represents an actor involved in a controversy; second, symmetry implied maintaining the same "registers when mov(ing) from the technical to the social aspects of the problem studied"[332]; and third, agnosticism and symmetry in analysis required "abandonment of all a priori

328 Michel Foucault, *Discipline and Punish: The Birth of the Prison* (New York: Vintage Books, n.d.).
329 Jasanoff, 'The Idiom of Co-Production', 5.
330 Jasanoff, *States of Knowledge*, 28.
331 Bruno Latour, *Science in Action: How to Follow Scientists and Engineers Through Society* (Harvard University Press, 1987).
332 Michel Callon, 'Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St Brieuc Bay', *The Sociological Review* 32, no. S1 (1984): 200.

distinctions between the natural and the social"[333]. Simply put, ANT suggested that the demarcation of boundaries between different entities – whether between science and society, human or nonhuman agency, or the material and epistemic – was first and foremost a strategic move of actors themselves rather than a move to be made by the sociologist before and during entering a field of study. Moreover, what constituted an 'actor' in the first place was not to be defined by the analyst but by the case itself: "anything that does modify a state of affairs by making a difference is an actor", and hence also "a hammer, a basket, a door closer, a cat, a rug, a mug, a list or a tag [can] act"[334]. To maintain such a symmetrical perspective, sociologists would have to turn into anthropologists studying scientific and technological controversies like outsiders entering a foreign culture, "bracketing our familiarity with the object of our study"[335]. All that was required from the analyst is to follow the actors throughout their journey to enroll other actors in favor of their knowledge claims:

> The observer must consider that the repertoire of categories which he uses, the entities which are mobilized, and the relationships between these are all topics for actors' discussions. Instead of imposing a pre-established grid of analysis upon these, the observer follows the actors in order to identify the manner in which these define and associate the different elements by which they build and explain their world, whether it be social or natural.[336]

Accordingly, analysis in ANT opened up a new vocabulary for describing and analyzing science in the making, one that could capture the hybrid elements that actors mobilized when opening up and closing down controversy around scientific facts and technological artifacts, such as replacing "actor" with "actant", "social relations" with "actor network", or "discovery" with "negotiation"[337]. Such a shift in terminology was meant to provide social science with a new concept of power that emphasized its relational and collective character rather than locating power either in the social, the epistemological, or the material. As the founding father of ANT Bruno Latour put it, it allowed "social scientists to understand power as a consequence and not as a cause of action"[338], and to acknowledge that "society is not what holds us together, it is what is held together"[339] by networks constituted of people, objects, discourses, representations, etc. In this view, the power to establish widely shared meaning of the world – to make knowledge claims authoritative – never rests solely in one actor category or interest group.

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[333] Callon, 196.
[334] Bruno Latour, *Reassembling the Social: An Introduction to Actor-Network-Theory*, Clarendon Lectures in Management Studies (Oxford ; New York: Oxford University Press, 2005), 71.
[335] Bruno Latour and Steve Woolgar, *Laboratory Life: The Construction of Scientific Facts* (Princeton University Press, 2013), 29.
[336]Callon, 'Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St Brieuc Bay', 201.
[337] Callon, 347.
[338] Bruno Latour, 'The Powers of Association', *The Sociological Review* 32, no. 1_suppl (1984): 269.
[339] Latour, 276.

Rather, and "metaphorically speaking, statements…are much like genes that cannot survive if they do not manage to pass themselves on to later bodies"[340] through several acts of translation. For the purpose of this chapter, we do not need to get into more depth with ANT theory and methods, but discuss with greater detail why it represents a relevant, yet unsuitable way to approach the making of *soft law* in the governance of innovation in this thesis.

One way to discard ANT from the methodological inroads of this thesis is by asking if "scientists themselves" in fact represent "the best of all guides"[341] for understanding how *soft law* operates in science and technology governance. If we would follow only the neuroscientists in the case studies presented later on, we would surely gain deep insights into how novel claims around the brain and its functioning are constructed and related to scientist's imagination of human nature and maybe even to their ideas of society, how these claims are made, for example, by drawing on the support of new imaging techniques for visualizing brain activity, and how large, or strong, the network for forming associations with other 'actants' must be to sustain such claims as collectively held interpretation of the human brain. If we were lucky, we could also encounter those scientists sharing their expertise "outside" of their labs and on the ethics committees, working parties, or advisory councils called into being in order to settle soft norms for policy-making on neurotechnology. And indeed, my case studies are telling of the mutual shaping of scientific, technological, and normative claims that are woven into the making of *soft law* for neuroscience and -technology. Yet, their source, or origin, does not lie in a "science that does not know yet"[342] that forms the starting point for ANT analysis, quite the opposite. What I observe by following the making of *soft law* in the US, EU and OECD is, in fact, a controversy about the means and ends of neurotechnological innovation in society that is held among actors representing authoritative expertise on ethical, legal, or social norms.

Central to the study of what we might call 'norms in action' are controversies around the desirability and legitimacy of democratically regulating the self-governance science and technology that extend far beyond specific scientific or technological debates. In this context, scientists perform the role of the knowledgeable agent able to deliver the "hard facts" upon which "soft" normative deliberation ought to rest[343]. Rather than departing from the scientists' laboratory or the engineers' bench to study

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[340] Latour, *Science in Action*, 38.

[341] "Instead of black boxing the technical aspects of science and then looking for social influences and biases, we realized how much simpler it was to be there before the box closes and becomes black. With the simple method we merely have to follow the best of all guides, scientists themselves, in their efforts to close one black box and to open another. This relativist and critical stand is not imposed by us on the scientists we study; it is what the scientists themselves do, at least for the tiny part of technoscience they are working on." Latour, 21.

[342] Latour, 7.

[343] Latour himself distinguishes between the 'hard' facts produced inside of science and the 'soft' facts that are produced outside of science: "it is crucial to understand that these are two opposite solutions to the same paradox; 'harder' facts are not naturally better than 'softer' ones; they are the only solution if one wants to make others believe something uncommon….the same paradox may be solved in two different ways, one that extends long networks, the other that does not" Latour, 209. I share his perspective that one is not necessarily better than the other, but my analysis suggests that 'soft' facts about society are equally powerful in enrolling people into new 'hard' claims about the nature and functioning of the human brain. Such a perspective does not privilege

how neuroscientific claims are enmeshed with claims about the social, we are hence confronted with the "laboratories of society"[344] in which normative visions of desirable technoscientific innovation are in the making *vis-à-vis* novel scientific claims about the 'true' or 'real' nature of humans and societies. This has important consequences for the choice of methods throughout research. As Sheila Jasanoff has argued, "it matters hugely…whether we see the laboratory as the site par excellence for studying scientific controversies or social controversies as laboratories for studying how science and technology work in society"[345].

This does not mean that the methodological version of symmetry advanced by ANT scholarship should be abandoned altogether, as it serves as an important reminder that what is designated as 'society', 'science' or 'innovation' in these settings should be approached from an anthropological perspective and left to the descriptions (and inscriptions) of actors in the field themselves. However, where such boundary work takes place makes all the difference in the course of analysis: society, or the social, is not only held together by scientists and their hybrid 'actant' networks; it is equally held together by policymakers and bureaucrats, ethicists, traditions of political philosophy, STS scholars, actors identifying themselves as 'citizens', rules and procedures for 'democratic' deliberation, guideline documents etc. To be sure, ANT encourages us to think about these entities along the same lines as we would approach scientists and engineers, to be "as agnostic about society as about nature"[346]. But it is of little help when explaining how the making of 'society' (or, for the purpose of this thesis, 'democracy') and the making of 'science' (or 'innovation') are interlinked in contingent ways. Nor does it provide us with the methodological tools to understand how the 'inside' of science is coupled with 'outside' forms of establishing meaning and power in the world that trespass epistemology. Put differently, while we may learn a lot through following ANT's quest to better understand how scientists, businesses, sociologists, or politicians establish weaker or stronger networks in their attempt to spread factual knowledge of what society, science, democracy or innovation *is,* we remain blind toward seeing how they also co-produce what society, science, democracy, or innovation *ought* to be in the same, parallel move. As we will discuss in a moment, it is precisely in this interaction of epistemic and normative world-making that a symmetrical analysis of *soft law* is best located.

Another way to think about ANT's usefulness for this project is to ask about the merits of ANT analysis for comparative analysis. ANT, in a way, is blind towards the situatedness of novel networks in highly stabilized networks that inform the thinking, practice, and agency of actors under study. For example, as much as Latour mobilizes several historical "scenes" of the making of DNA science that help to "carry us back through space and time"[347], it matters relatively little that the first scene is located

one form of fact-finding or one 'inside' or 'outside' domain over the other; it is truly symmetrical if we are to take Latour and his colleagues seriously.

344 Sheila Jasanoff, 'Genealogies of STS', *Social Studies of Science* 42, no. 3 (2012): 439.

345 Jasanoff, 439.

346 Latour, *Science in Action*, 256.

347 Latour, 2.

in Paris, the second in Cambridge, England, the third in Weborough, Massachussetts, etc. Following ANT, the different 'outside' actors and actants available to genetic scientists in these places are highly relevant to the strength of networks; yet, what gets lost in the analysis is a greater understanding of the relationship between new networks and those pre-existing or surrounding them: "to be there *before* the box closes and becomes black" also means ignoring all those black-boxes established before. In ANT vocabulary, the powerful new "inscriptions" by scientists and their "cascades" of translation that Latour hails as the central devices for turning "an incredible statement into a credible one"[348] seemingly absorb all preceding inscriptions; they only have their own space and time[349].

Interestingly, despite all the radical rejection of socio-political language for analysis, Latour does seem interested in changes in "how a culture *sees the world"*[350]. But his understanding of culture is reduced to visual and semiotic techniques of representing things, to the ways they are made visible through new technical instruments that become mobile in time and space. That scientists, engineers, policymakers, and citizens are disciplined in situated[351] visions of science, innovation, or democracy – visions which rely on long genealogies of philosophy, religion, and politics in the same way as networks rely on the passing of genes onto later bodies – is out of sight for ANT. These cultures rely on texts and practices, and carry with them a whole range of technologies and techniques for sustaining their disciplinary power[352] yet their change is not necessarily caused by revolutions in inscription instruments. Following other thinkers that will be presented below as well as my own fieldwork, shifts in seeing the world may also be induced by shifts in reasoning, imagining, and ordering it without the help of 'rational' textual, numerical, or visual devices. The opposite is the case: the new networks of 'Neuroethics' or 'RRI' I observe in my three cases struggle to reproduce the epistemic culture of science (e.g., in the OECD case, where a culture of indicators meets soft, "responsible" innovation policy), or depart quite intentionally from civic epistemologies and imaginaries of the future that are specific to the times and places in which these networks unfold, involving affective elements beyond the cognitive and visual[353].

In summary, while ANT sheds important light on the relational and, in fact, *co*-produced nature of scientific power to counter social determinism in analysis, it somehow attributes all causes of socio-technical change to the material representation, organization, and ordering of knowledge: "the social is nothing other than patterned networks of heterogeneous materials"[354]. If a "shift in thinking has nothing

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[348] Bruno Latour, 'Drawing Things Together', in *Representation in Scientific Practice*, ed. Michael E. Lynch and Steve Woolgar (Cambridge, Mass: The MIT Press, 1990), 43.
[349] Latour, *Science in Action*.
[350] Latour, 'Drawing Things Together', 30. His emphasis.
[351] Donna Haraway, *Primate Visions: Gender, Race, and Nature in the World of Modern Science*, Reprint edition (New York: Routledge, 1990).
[352] Foucault, *Discipline and Punish: The Birth of the Prison*.
[353]McNeil Maureen et al., 'Conceptualizing Imaginaries of Science, Technology and Society', ed. Ulrike Felt et al. (Cambridge, MA: MIT Press, 2017), 435–64.
[354] John Law, 'Traduction/Trahison: Notes on ANT', n.d., 15. describes the "actor-network diagnosis of science" as "a process of 'heterogeneous engineering' in which bits and pieces from the social, the technical, and the

to do with the mind" but takes place only by "manipulation of the laboratory setting"[355], and it is only through material-semiotic allies that some actors gain more power than others[356], then we wonder about those settings and processes of knowledge-making in which instruments for inscription are widely absent – what about settings where instruments such as "new reactive paper, a new indexing system for librarians, a new notation for algebraic function"[357] are not mobilized to make a claim more convincing? Do they necessarily have less power, smaller networks, or fewer allies? Are they to be discarded from history, as "the history of science is the history of these innovations"[358]? Are epistemic and material means really the only resources available to actors when pursuing domination over meaning-making[359]? And what is eventually co-produced by them, what is their effect?

In the methods section, I argue that a reading of *soft law* as text along the lines of ANT thinking on power helps us to see 'soft' reports, guidelines, or recommendations as powerful ordering instruments; it is only through their codification in text that they gain constitutional force. However, the power to codify, represent, and inscribe in policymaking what responsible or ethical innovation *is* and what it ideally *ought* to be lies in mobilizing culturally embedded ways of ordering the relationship between society, science and technology that go unnoticed by centering analysis only on the stabilization of material-semiotic networks. ANT gives us all the reasons to follow the actors in their constitution of hybrid networks, but it does not allow us to go a step further and see how power is equally located in the socio-technical constitutions established through the network. For such a move in analysis of soft power, we need to direct analysis from science in action, to society, science, and technology in interaction[360].

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conceptual and the textual are fitted together, and so converted (or "translated") into a set of equally heterogenous scientific products" (np).

[355] Latour, 'Drawing Things Together', 51.

[356] Latour, 56.

[357] Latour, 47.

[358] Latour, 47.

[359] In his chapter "Drawing things together", Latour claims that "a man is never much more powerful than any other – even from a throne; but a man whose eye dominates records through which some sort of connections are established with millions of others may be said to dominate. This domination, however, is not a given but a slow construction and it can be corroded, interrupted, or destroyed if the records, files and figures are immobilized, made more mutable, less readable, less combinable, or unclear when displayed. In other words, the scale of an actor is not an absolute term but a relative one that varies with the ability to produce, capture, sum up, and interpret information about other places and times." Latour, 56.

[360] Jasanoff, *States of Knowledge*.

3.1.2 Dismantling Boundaries between Politics and Science: The Interaction of Scientific, Technological, and Political Order

The interactional variant of co-production emerged as a methodological inroad into analyses that juxtaposed scientific and political forms of ordering the world in a symmetrical fashion. While ANT emphasized the non-human elements involved in the production of science, studies in the co-production of scientific and political forms of reasoning brought the human back into STS research, emphasizing that "it is still humans and their collectives who can imagine a world that is governable by science and technology"[361]. One of the earliest detailed accounts of interactional co-production was presented by historians and philosophers of science Steven Shapin and Simon Schaffer in their study of "Leviathan and the Airpump: Hobbes, Boyle and the Experimental Life". By inquiring the controversy on experimentalism versus deductivism (or natural vs. civic philosophy) unfolding during the 17th century Restoration era, the authors observed that "the disputes between Boyle and Hobbes became an issue of the security of certain social boundaries and the interests they expressed"[362]. For Hobbes, the air-pump experiments conducted by Boyle were threatening his political philosophy on the 'undivided state', while for Boyle, Hobbe's arguments for the formation of a Leviathan presented a sure path toward an unfree society. Whereas the dispute centered around Boyle's air-pump, Shapin and Schaffer showed that both actors were, in fact, discussing the ideal way to produce knowledge at the same time as they were discussing what "the ideal community"[363] of their polity ought to look like; in other words, they both claimed solutions to the "problem of knowledge" and to "to the problem of social order"[364]. Shapin and Schaffer's account of the controversy hence opened-up quite a different set of questions to the relationship between science and society than those of SSK, SCOT or ANT. These questions were geared toward the "conditional relationship between the nature of the polity occupied by scientific intellectuals and the nature of the wider polity[365]":

> What did people actually do when they were making what they considered to be knowledge? How did they warrant what they produced, and how did they secure credibility and authority for it?[366] [and] How is social order possible? How does it happen that groups of people act as if they more or less agree about the quotidian forms of collective life; to sustain institutions in which forms of collective life may be carried out; to coordinate their activities – not just to achieve collective ends but to frame the

[361] Sheila Jasanoff and Sang-Hyun Kim, *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power* (University of Chicago Press, 2015), 17.
[362]Steven Shapin and Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (Princeton, N.J: Princeton University Press, 1985), 283.
[363] Shapin and Schaffer, 320.
[364] Shapin and Schaffer, 332.
[365] Shapin and Schaffer, 332.
[366] Shapin and Schaffer, xlviii.

grounds of their internal conflicts?[367]

"Leviathan and the Airpump" became a classic in co-productionist strands of STS because it allowed for symmetrically deconstructing claims advanced by actors about the appropriate order within and among science and politics. The boundary between science and politics that had been constructed since the Enlightenment, and particularly by the experimental scientists led by Boyle, was not given, but the result of scientists' struggle to claim a free polity of their own within processes of state-making; at the same time, "the intellectual product made within that polity ha(d) become an element in political activity in the state"[368]. Liberal politics in particular "tended to draw legitimacy by claiming a relationship between its political ideals and an idealized polity of science"[369]. Such order had proven so stable that it went unquestioned not only by historians of science and those of politics, but also by the wider modern scientific and political imagination. Rather than focusing analysis on the explanation of successful or unsuccessful scientific theories, technologies, or actor-networks, Schapin and Schaffer suggested that "the language that transports politics outside of science is precisely what we need to understand and explain"[370]. This methodological move prompted analysts to go beyond "inside" and "outside" questions on science and toward following three interrelated lines of inquiry during research: "(1) the polity of the intellectual community; (2) the solution to the practical problem of making and justifying knowledge; and (3) the polity of the wider society"[371]. Through connecting these themes in the interpretation of controversies, STS research could eventually study debates about the credibility of scientific knowledge and about the legitimacy of political norms symmetrically:

> Wherever and whenever groups of people come to agree about what knowledge is, they have practically and provisionally solved the problem of how to array and order themselves. To have knowledge is to belong to some sort of ordered life; to have some sort of ordered life is to have shared knowledge.[372]

Shapin and Schaffer's insights proved particularly productive for research on the distribution of power between science and politics in liberal democracies, as it was here that an ideal of neutral and objective scientific knowledge had turned into an "invaluable resource for the construction of the democratic political order"[373]. As the political philosopher Yaron Ezrahi observed, reliance on scientific and technological expertise allowed to present democratic politics as grounded in public facts rather

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[367] Shapin and Schaffer, xlix.
[368] Shapin and Schaffer, 332.
[369] Charles Thorpe, 'Political Theory in Science and Technology Studies', 2008, 64.
[370]Shapin and Schaffer, *Leviathan and the Air-Pump*, 342.
[371] Shapin and Schaffer, 342.
[372] Shapin and Schaffer, xlix.
[373] Yaron Ezrahi, 'Science and the Political Imagination in Contemporary Democracies: Yaron Ezrahi', in *States of Knowledge* (Routledge, 2004), 256.

than personal interest or ideology, as a heterarchical enterprise rather than a system of "hierarchical or self-referential accountabilities"[374]. Such "latent political function of science and technology" largely externalized the grounds of political action to the sphere of seemingly rational, objective, and instrumental "scientific-technical standards of action"[375]. The historian of science Theodore Porter, for instance, showed that quantitative methods and representations are mobilized as "technologies of trust" in democratic politics, transforming relationships of personal trust into a "cult of impersonality" sustained by "mechanical objectivity"[376]. And in a critical interpretation of this development, James Scott described the liberal settlement between science and politics as a "high modernist ideology" displaying a "deeply authoritarian"[377] character, as "only those who have the scientific knowledge to discern and create this superior social order are fit to rule in the new age"[378]. Through this ideology, politics became increasingly framed as an obstacle to social progress and replaced by the authority of scientists and engineers "to speak about the improvement of the human condition [and to] disallow other competing sources of judgement"[379]. According to the Indian anthropologist Shiv Visvanathan, such authority became particularly visible in places where high modernism was still competing with other epistemic cultures in a repressive and often violent way[380]. But while these observations were valuable contributions to STS scholarship that demonstrated how scientific knowledge was put to work in liberal democratic politics, they were less informative for understanding how in parallel, liberal democratic ideals, values and institutions shaped scientific knowledge and technological progress. The interaction of these two processes became the subject of research for Sheila Jasanoff and her work on civic epistemologies, bioconstitutionalism, and socio-technical imaginaries.

Civic epistemologies, bio-constitutionalism, and socio-technical imaginaries

As a further development of the various strands of STS theory discussed above, Jasanoff's approach to co-production today presents a comprehensive set of concepts and methods for studying the interplay of science and politics in and among modern democracies. With a background in law, her vast empirical and conceptual work on the governance of science and technology – whether through regulatory science, courts, bioethics committees or global governance institutions (to name but a few) – departs from the observation that "STS research has been more effective in showing how people build scientific instruments, medical standards, or large technological systems than legal rules, ethical principles or

[374]Ezrahi, 'Science and the Making of Representative Actions and Accountable Actors', 66.
[375] Ezrahi, 66.
[376] Theodore Porter, *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life* (Princeton University Press, 2020), 90.
[377] James C. Scott, *Seeing like a State: How Certain Schemes to Improve the Human Condition Have Failed*, Yale Agrarian Studies (New Haven: Yale University Press, 1998), 94–95.
[378] Scott, 94.
[379] Scott, 94.
[380] Shiv Visvanathan, *A Carnival for Science: Essays on Science, Technology, and Development* (Oxford University Press, 1997). Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*.

regimes of administrative rationality"[381]. Central to Jasanoff's research are controversies around public decision-making on new scientific and technological entities that provoke a re-ordering, or "surgery"[382], of public reasoning, i.e., of the "institutional practices, discourses, techniques and instruments through which modern governments claim legitimacy in an era of limitless risk – physical, political, and moral"[383]. Such an approach suggests a different perspective to symmetrical analysis in STS concerned with the drawing of boundaries between science and society: while science appears as a purely epistemological process, it is central for shaping "social practices, identities, norms, conventions, instruments and institutions"[384]; vice-versa, while politics is usually attributed a purely normative function, it is inherently underwritten by and giving way to epistemological and ontological commitments. In short, "scientific cultures are at one and the same time political cultures"[385] that can be studied by significantly expanding the range of places, settings, and actors beyond science alone. The law, international organizations, or advisory councils here appear as central "instruments" for the co-production of public reasoning on science and technology[386] as they not only shape how scientific knowledge is produced, but also re-shape how new ways of seeing the world are accommodated alongside long-held cultural commitments to socio-political order. In Jasanoff's words,

> In this view of co-production, human beings seek to ascertain facts about the natural world are confronted, necessarily and perpetually, by problems of social authority and credibility…At times of significant change, such as those we tend to call 'scientific revolution', it may not be possible to address questions of the facticity and credibility of knowledge claims without, in effect, redrafting the rules of social order pertaining to the trustworthiness and authority of individuals and institutions. Only by solving social problems in this way can satisfactory warrants be produced for radically new orderings of nature. Doing science merges, in other words, into doing politics.[387]

Symmetrical analysis along these lines is particularly useful for recognizing the situatedness and contingency of forms and instruments of co-production in political culture, which is expressed in diverging forms of public reasoning, ordering, and imagining new knowledge and technologies and their relationship to society. Whereas ANT prompted the study of the laboratory as a site for anthropological observation and interpretation of 'science in action', this reading provokes us to turn into anthropologists of commonplace views on political culture and its relationship to knowledge, to "become better

[381] Sheila Jasanoff, *Science and Public Reason* (Routledge, 2012), 7.
[382] Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*.
[383] Jasanoff, *Science and Public Reason*, 5.
[384] Jasanoff, *States of Knowledge*, 2.
[385] Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*, 290.
[386] Jasanoff, *States of Knowledge*, 39.
[387] Jasanoff, 29.

observers of naturalizing moves in our own politics"[388]. Key to these observations are questions directed at the interaction of democratic and scientific reasoning and the forms of epistemic, ontological and normative order arising from their co-production: "how [is] knowledge-making incorporated into practices of state-making, or of governance more broadly, and in reverse, how [do] practices of governance influence the making and use of knowledge"?[389] By following research on these questions in a diversity of settings, countries, and regions, Jasanoff shows that the co-production of science and politics is far from uniform across communities that identify themselves as democratic and committed to scientific and technological progress:

> Context matters. How, in particular, does culture shape the ways in which people see and evaluate their worlds? How does the pairing of knowledge and power look to citizens conditioned by different relations to ruling institutions and by different experiences of governance? How can history be accounted for in explaining the diversity of public engagements with science and technology? And, above all, how can we accommodate a proactive, dynamic, epistemically active conception of the 'public': a collective that neither passively takes up nor fearfully rejects all scientific advances, but instead (as real publics are doing all over the world) shapes, crafts, reflects on, writes about, experiments and plays with, tests, and resists science and technology – so as to produce multiple forms of life around the same techno-scientific developments?[390]

In "Designs on Nature: Science and Democracy in Europe and the United States", for example, comparison of biotechnology policies in Britain, Germany and the US elucidates the starkly different modes through which each community has come to terms with new forms of defining and manipulating life. Here, Jasanoff shows that

> To make sense of the resulting national settlements, one must look not only at the discoveries and commodities that materialize out of research laboratories and industrial facilities; one must equally take into account the scripts for human development and collective choice that emanate from a nation's political and social institutions, and from its citizens.[391]

Moments of controversy figure as entry point into comparative analysis as it is here that the "problems of disorder"[392] caused by technoscientific innovation unveil the "systematic means by which a political

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[388] Jasanoff, *Science and Public Reason*, 7.
[389] Jasanoff, *States of Knowledge*, 3.
[390] Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*, 254–55.
[391] Jasanoff, 290.
[392] Jasanoff, *States of Knowledge*, 6.

community makes binding collective choices"[393]. Yet, Jasanoff does not repeat SSK's or SCOT's fallacy of seeing these long-held social conventions as the primary drivers of scientific and technological change. Rather, her symmetrical approach to socio-technical transformation takes into consideration both the stability *and* instability of political *and* epistemic culture, which "must be seen not only as resilient and resistant to change, but also constructed, flexible, and subject to renewal"[394].

As a contribution to political theorizing on modern democracies[395], Jasanoff's account adds a new methodological and conceptual vocabulary to STS research on how power is produced, distributed, maintained, and reconfigured through the intimate relationship between science and politics. Power does not solely rest in the successful enrolment strategies of scientists or engineers, but in the configuration of public agency in technoscientific governance, i.e., the "legal and institutional arrangements that presuppose certain ideals of human agency and autonomy"[396]. Rather than locating power in the politics of scientific practice and reason alone, Jasanoff directs analysis to the culturally grounded forms of framing, disciplining, and including citizens and their reasonability in public deliberation and decision-making on science and technology. Whether or not publics are granted representation, participation, and voice in public debates about innovation governance plays a crucial role for understanding "the construction of the political subject as a reasoning agent"[397] vis-á-vis scientific and technological expertise across countries and institutional settings. From the standpoint of political theory, this conception of power draws attention to the crafting of authority, legitimacy, and accountability of public knowledge and action on science and technology:

> Citizens after all are the primary audience for whom the state enacts its scientific and technological demonstrations. As a play could not exist without spectators, so the grand narrative of progress through science and technology demands assenting publics to maintain its hold on the collective imagination, not to mention the collective purse-strings. Not only the credibility of science but the utility of the state's knowledge-producing endeavors must repeatedly be brought home to citizens.[398]

These power dynamics, as Jasanoff and others have extensively shown, constitute a particular feature of the theatres of liberal democracies. Efforts to legitimize public investments in and policies on science and technology rest as much on scientific ideals, such as universality, objectivity, and instrumentalism, as they mobilize liberal imaginations of the public good, the good society, and good government: "especially at the edges of sociotechnical change, one cannot determine what the facts are

[393] Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*, 21.
[394] Jasanoff, 22.
[395]Jasanoff, *Science and Public Reason*, 5.
[396]Jasanoff, 5.
[397] Jasanoff, 5.
[398] Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*, 247.

without making value-laden decisions"[399] in each of these realms. To carve out how these two domains of knowledge and norm-making are jolted together in modern politics, "we must employ analytic categories different from those of decision makers operating within the policy process"[400]. The way actors and institutions frame, draw boundaries, reason and deliberate on, as well as construct the identities of new knowledge claims and respective avenues for epistemic and normative settlement present some of the lenses for disentangling the constitution of power between science and society (see methods chapter). Three concepts in particular have emerged from empirical research that follows these analytical pathways: civic epistemologies, or the modes through which publics "assess claims by, on behalf of, or grounded in science"[401]; socio-technical imaginaries, or "collectively enacted hopes and expectations"[402] toward the future, specifically to the role of science and technology therein; and bioconstitutionalism, or the "constitutive interplay of biological and legal conceptions of life"[403]. In the following pages, I discuss these concepts with regard to their potential for the analysis of *soft law* in contemporary science and technology policy, and particularly for cross-cultural comparison of recent shifts from science to innovation that are accompanied by reconfigurations in the authority of *soft law* to regulate science and technology for the public benefit.

Civic epistemologies: Making public knowledge on science, technology, and innovation

Just as science follows particular methods, rules and procedures to assess new knowledge claims and technological innovation, so do political collectives enact culturally specific ways of demonstrating, assessing and judging the credibility of policy claims. The interaction of both of these forms of generating authoritative knowledge is captured through the concept of "civic epistemologies", which Jasanoff defines as "the institutionalized practices by which members of a given society test and deploy knowledge claims used as a basis for making collective choices"[404]. Civic epistemologies arise from "culturally specific, historically and politically grounded"[405] practices rather than formal rules or procedures, yet they also take an institutionalized and systematic form that allows to follow their evolution and change over the course of time. For instance, in her transatlantic comparison of biotechnology policy, Jasanoff shows how scientific claims enjoy greater authority in US politics than in Britain, where experts form the locus of deliberation on science and technology, or in Germany, which displays specific ways of "institutional rationality"[406] through the inclusion of a variety of stakeholders

[399] Stephen Hilgartner, Clark Miller, and Rob Hagendijk, eds., *Science and Democracy: Making Knowledge and Making Power in the Biosciences and Beyond* (London: Routledge, 2015), 3.
[400] Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*, 23.
[401] Jasanoff, 249.
[402] Sheila Jasanoff, 'Future Imperfect: Science, Technology, and the Imaginations of Modernity', in *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power*, ed. Sheila Jasanoff and Sang-Hyun Kim (Chicago; London: The University of Chicago Press, 2015), 23.
[403] Jasanoff, *Reframing Rights*, 3.
[404] Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*, 255.
[405] Jasanoff, 249.
[406] Jasanoff, 288.

from across society. Each style for the production of public knowledge on emerging biotechnology "carved out deliberative spaces that were not subject to ordinary rules of political accountability"[407] such as parliamentary review. These "hidden reserves of power"[408] are nevertheless key for the perceived legitimacy of public policies on emerging science and technology as they serve as powerful means to settle the credibility, rationality and moral robustness of claims advanced therein[409].

Civic epistemologies are, hence, central for how the legitimacy of public reasoning and decision-making on science and technology, whether by states and their governments, supranational institutions, or international organizations, is achieved[410]. Such achievement is not to be taken for granted, but depends on particular practices, performances, and forms of discourse mobilized in governance. How an expert committee, evidence in regulatory science, or public deliberation is assembled, structured, and presented to wider publics is decisive for settling the credibility of knowledge-claims at the interface of science and politics, and with it, the legitimacy of public institutions and their power to govern citizen's lives:

> Culturally distinctive styles of reasoning are reinforced in the micro-practices of powerful institutions, as when an advisory committee defines who is a peer for purposes of peer review, a judge decides where to draw the line between common sense and expert witnessing, or citizens ask for demonstrations of competence from government officials in order to restore public confidence. At such moments the legitimacy of the greatest institutional actors, including nation states and supranational agencies, is temporarily called into question. Challenges to reason serve, in effect, as moments in which the ideal of rational choice for the good of society must be asserted and performed yet again. Through repeated episodes of public reasoning, policy institutions affirm their right to exist, to be taken seriously, and to govern for the people.[411]

As Jasanoff elaborates in "Designs on Nature", such performances are widely different across contexts, yet evolve around similar dimensions that are constitutive for creating publicly credible knowledge through which policy-action is made legitimate. They involve institutionalized routines with regard to (1) which actors participate in deliberations around emerging science and technology, and how such participation is structured; (2) how accountability in governance is performed, i.e., what kind of assumed "basis of trust"[412] guides policy deliberations (e.g., trust in institutions, personal expertise, or the legal system); (3) which practices of demonstration are employed that render knowledge visible to

[407] Jasanoff, 288.
[408] Jasanoff, 288.
[409] Jasanoff, 255.
[410] As Jasanoff points out with respect to public reasoning and its relationship to civic epistemologies, "reason is achieved, not attained" Jasanoff, *Science and Public Reason*, 18.
[411] Jasanoff, 20.
[412] Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*, 259.

publics, such as technology's potential, empirical evidence, or strong expert consensus; (4) how knowledge production is rendered objective, that is, how actors claim disinterestedness and the capacity to speak for all; (5) which credentials are attached to expertise, particularly when deliberations are confronted with great uncertainty, such as an "expert's formal qualifications and personal or institutional experience"[413]; and lastly, (6) how transparent these processes are to the wider citizenry, particularly with regard to disagreement among participants during deliberations. Taken together, comparative analysis of these dimensions of public knowledge-making helps to answer why it is that "the same scientific facts and technological artifacts so often elicit such different political responses"[414] across settings, and how we can account for significant "varieties of democratic experience"[415] when it comes to technoscientific governance. As such, and from the standpoint of political theory, they serve as a heuristic for understanding how the crafting of public knowledge underwrites democratic culture, and vice-versa, how democracies rule through the production of public knowledge.

For multiple reasons, the concept of civic epistemologies is, thus, key to the analysis of *soft law* in contemporary innovation governance. On the one hand, it encourages us to think of soft governance bodies, practices, and instruments as powerful devices enacted by public institutions in their quest to generate and maintain legitimacy of investments in and support of science and technology. To claim such investments as beneficial to society, policymakers, scientists, engineers, ethicists, etc. engage in significant epistemological work, forms of structuring, demonstrating, and representing knowledge, and ways to include or exclude those sets of actors and expertise deemed (in)credible to wider publics. Further, the composition of governance arrangements is not only generative of power in terms of who gains authority to define what publicly reliable knowledge *is*, but also with regard to how such knowledge *ought* to be achieved in democratic societies. As STS scholar Ben Hurlbut has argued for the case of public Bioethics committees in the US, "these bodies are a productive site for uncovering the subtle ingredients that inform ideas of public reason" since "underpinning [their] work [are] background notions of how the state and its citizens should relate to knowledge: to what is known and how it should be known, including the language in which knowledge should be described and deliberated"[416]. In this sense, deliberations for the production of *soft law* have an epistemic and normative character, both of which informs the credibility, legitimacy, and authority of governance exerted by them. As we will discuss in a moment, it is through the co-production of norms and knowledge in these fora of public reasoning that *soft law* gains quasi-constitutional force in ordering the relationship between citizens, technoscience, and democratic institutions.

On the other hand, reading *soft law* in science and technology governance with the different dimensions characterizing civic epistemologies allows for cross-cultural comparison of the contingent ways political communities put knowledge and norms to work in the production of public reason around

[413] Jasanoff, 267.
[414] Jasanoff, 270.
[415] Jasanoff, 287.
[416] Hurlbut, *Experiments in Democracy*, 15.

emerging science and technology. Such comparison, as Jasanoff has extensively shown, yields important insights into the culturally specific ways of embedding knowledge and artifacts into democratic cultures, as well as into the processes that render science and technology a legitimate domain of public action in democratic societies. When followed over a longer period of time, as I attempt to do across the case studies of this thesis, it results that *soft law* is grounded in practices for the production of credible public knowledge that are closely related to understandings of legitimate democracy, both of which have been mobilized not least since Hobbes' and Boyle's dispute over the boundaries of science and politics in the early days of Enlightenment (see above). Particularly since science policy became institutionalized as a domain of public action during the second half of the 20th century, the 'social contract' with science has served as a *leitfmotif* in science and technology policies of modern democracies. Contrasting how it has been put to work in different contexts, however, is key for carving out "different national understandings of the place of science in society, different experiences of success and failure in technological innovation, and different institutional traditions of enrolling science to serve to social ends"[417]. In other words, through comparison of the ways and means through which science is mobilized as a public knowledge resource, we can account for divergences of the "constitutional position of science"[418] in the US, EU's, and OECD's reasoning on 'ethical' or 'responsible' innovation in neurotechnology.

At the same time, the production of *soft law* in science and technology governance represents what Hurlbut has called "experiments in democracy" as it is here that authoritative views on "what forms of democratic representation (that is, of 'standing in') are appropriate to governing scientific and technological societies – what views must be considered, what voices heard, and what kinds of judgements rendered"[419]. In the case studies presented and discussed later on, I show how despite its experimental elements, the making of *soft law* in the US, EU, and OECD relies on democratic ideals that can be traced back to different Enlightenment visions of legitimate government, such as Lockean liberalism or Rousseau's pledge for republicanism. Similar to the trajectory of science governance, ideas about democracy have been developed further during the 20th century, including a renewed focus on questions of justice and participation in the production of public knowledge. Which imagination of legitimate democracy is put to work in each of my case studies is closely related to the political projects that institutions in each case pursue and reaffirm through investments in 'ethical' or 'responsible' innovation. In the EU, for instance, *soft law* for the development of responsible neuroscience and -technology serves as a powerful device to conjure a united European republic beyond the single European market, and at the OECD, we can witness the coming into being of new ideals of democratic harmonization as a prerequisite for economic globalization. These ideals, in turn, affect how knowledge is produced, by whom, based on what sorts of expertise, etc. The conceptual lens of civic epistemologies

[417] Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*, 245.
[418] Jasanoff, 245.
[419] Hurlbut, *Experiments in Democracy*, 15.

thus not only helps us to recognize their differences, but also to see the contingent interaction of political and epistemic commitments that remain largely obscure in interpretations of *soft law* by other kinds of scholarship. Closest to this sort of analysis are critical legal studies in jurisprudence and STS research that seeks to reveal the unequal distribution of power in science and technology. Yet, and as I argued earlier, their largely asymmetrical styles of interpretation – and critique – derail attention from the subtle, yet powerful, forms of co-production enabled by *soft law*.

Bioconstitutionalism: Reframing life, re-ordering governance

While the concept of civic epistemologies contributes to greater understanding of how governance arrangements and procedures for deliberation shape the production of public reason, the notion of 'bioconstitutionalism' points to the co-production of authoritative meaning over the nature of human beings at the interface of science and the law. Derived primarily from research concerned with innovation in genetics, it aims at explaining how the "constant, mutually constitutive interplay of biological and legal conceptions of life, the former focusing on life's definition and the latter on its entitlements, is a fundamental feature of scientific and technological societies"[420]. Revolutions in genetics and biotechnology provide a particularly illustrative case of the co-production of bioconstitutional order in modern societies as it is here that the "politics of life itself"[421] are radically re-negotiated, both in terms of biology's control over definitions of human nature, as well as with regard to the control of individuals over their bodies, rights, and freedoms vis-à-vis the state and market[422]. By calling into question the "central dogma for the constitutionally regulated state" of protecting the life of its citizens via the law, reconfigurations in biological knowledge about human bodies "segue into redefining the obligations of the state in relation to live in its care"[423]. New entities produced by scientific knowledge on and enabled by technological manipulation of human bodies, such as IVF embryos[424] or human-animal chimeras[425], re-draw seemingly fixed ideas of what human beings are, how they should be protected, and through which institutions and procedures such protection can best be guaranteed. When confronted with these questions, policy institutions grapple with multiple layers of uncertainty – "ontological, moral, and administrative"[426] – which are settled in culturally distinct ways, revealing "often inarticulate moral concerns"[427] as well as broader forms of metaphysical

[420] Jasanoff, *Reframing Rights*, 3.
[421] Nikolas Rose, *The Politics of Life Itself: Biomedicine, Power, and Subjectivity in the Twenty-First Century* (Princeton University Press, 2006).
[422] Kaushik Sunder Rajan, *Biocapital: The Constitution of Postgenomic Life* (Duke University Press, 2006).
[423] Jasanoff, *Reframing Rights*, 3.
[424] Sheila Jasanoff and Ingrid Metzler, 'Borderlands of Life: IVF Embryos and the Law in the United States, United Kingdom, and Germany', *Science, Technology, & Human Values* 45, no. 6 (1 November 2020): 1001–37.
[425] Amy Hinterberger, 'Regulating Estrangement: Human–Animal Chimeras in Postgenomic Biology', *Science, Technology, & Human Values* 45, no. 6 (2020): 1065–86.
[426] Jasanoff and Metzler, 'Borderlands of Life: IVF Embryos and the Law in the United States, United Kingdom, and Germany'.
[427] Jasanoff, *Reframing Rights*, 291.

boundary-work between "living and nonliving, human and nonhuman, natural and artifactual"[428].

Against widely held ideas of the law 'lagging behind' technoscientific development or as strictly detached from the production of scientific knowledge, bioconstitutionalism provides a different view on the law as an active player in these processes of normative, ontological, and metaphysical re-ordering of life. Research led by Jasanoff and others has shown instead

> A more complex, interactive dynamic in which biology and law continually borrow from one another, and thereby affirm one another's authority, in generating accounts of what is natural and reasonable. In moments of ontological politics – where the nature of a biological entity or phenomenon is contested, but agreement is needed to resolve corollary matters of normative concern – biological accounts draw on the law's conceptual repertoire, with the result that what an entity *is* often comes to be shaped by legal norms of how those entities *ought* to be understood and governed.[429]

Although central to the reframing of individual and collective rights, the dynamics set free by the interaction of science and the law are seldomly appreciated as constitutional in character, particularly with regard to which knowledge claims gain authority in settling meaning over human nature and respective legal entitlements. The contingent meaning of things and beings gets naturalized within the co-production of norms and knowledge, reflecting "deeper underlying commitments to a constitutional order"[430] that include the constitutional position of science in political systems. As Jasanoff claims, "the dual work of biological classification and moral clarification proceeds in conformity with deeper scripts of acceptable deliberation in modern political cultures"[431]. Formal democratic avenues for deliberation are but one site where new forms of ontological and normative ordering take place. They may be settled in courts, as when the US Supreme Court decided in *Diamond v. Chakrabarty* that life forms engineered by science are patentable, a ruling that significantly shaped American reasoning around human embryonic stem cells (hESC) and the bioconstitutional order enacted through their patentability[432]. Parliaments too represent a key site for working out bioconstitutional politics. Illustrated by research on Italian hESC legislation, parliaments can further be accompanied by drawing on the authority of the church in defining the rights of embryos vis-á-vis their manipulation by scientists[433].

Beyond these more obvious settings, however, constitutional questions with regard to emerging

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[428]Hurlbut, Jasanoff, and Saha, 'Constitutionalism at the Nexus of Life and Law', 3.
[429] Hurlbut, Jasanoff, and Saha, 7.
[430] Hurlbut, Jasanoff, and Saha, 19.
[431] Jasanoff, *Reframing Rights*, 61.
[432] Shobita Parthasarathy, 'Co-Producing Knowledge and Political Legitimacy: Comparing Life Form Patent Controversies in Europe and the United States: Comparing Life Form Patent Controversies in Europe and the United States Shobita Parthasarathy', in *Science and Democracy* (Routledge, 2015).
[433] Ingrid Metzler, 'Between Church and State: Stem Cells, Embryos, and Citizens in Italian Politics', in *Reframing Rights* (The MIT Press, 2011).

science and technology are also resolved through public bodies that usually escape legal and political analysis and theorizing. Scientific and normative classification, for example, forms the bedrock of international politics. By influencing how 'global' knowledge orders are produced, including on matters such as genetic diversity across populations[434], environmental protection[435], or pandemic preparedness[436], global governance institutions take authority in defining "what in the contemporary world needs governing, who has the competency to govern, and what reconstructions of subjectivity and (imagined) community – for instance of polity, state and sovereignty – these projects of governance entail"[437].

Through claiming authority on these questions, processes of global classification are extended to the harmonization and standardization of reasoning and governance on new knowledge and technologies among countries by attending as much to the ideals of 'universal' science as to 'universal' human rights. Transnational knowledge production not only brings about new "global kinds"[438] and in particular new forms of "political subjectivity in the globalized world"[439], but also different models of "epistemic subsidiarity"[440] that allocate authority over public reasoning at different levels of governance. While the authority over new classifications of life through parliaments and courts is, in theory, subject to people's consent, these forms of bioconstitutional ordering lack the credentials of democratic legitimacy, wherefore the performance of objective reasoning through expertise does "much of the heavy lifting of legitimation"[441]. Equipped only with the powers to rule through *soft law* (see chapter 2), the codification of bioconstitutional order through indicators, statistics, or modelling forms a central device for international institutions in re-locating notions of human nature, its moral dimensions, and appropriate forms of governance to the global sphere[442].

Another important site where the powerful dynamics of bioconstitutionalism can be observed are Bioethics committees, which share challenges of democratic legitimation and soft rule with international governance bodies. The institutionalization of Bioethics as a "democratic imperative to come to terms with the 'impacts' and 'consequences' of emerging biotechnologies"[443] during the 20th

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434 Jenny Reardon, 'Human Population Genomics and the Dilemma of Difference', in *Reframing Rights* (The MIT Press, 2011).
435 Brian Wynne and Claire Waterton, 'Knowledge and Political Order in the European Environment Agency', in *States of Knowledge* (Routledge, 2004).
436 Benjamin J. Hurlbut, 'A Science That Knows No Country: Pandemic Preparedness, Global Risk, Sovereign Science', *Big Data & Society* 4, no. 2 (2017): 2053951717742417.
437 Hurlbut, 2.
438 Clark Miller, 'Democratization, International Knowledge Institutions, and Global Governance', *Governance* 20, no. 2 (2007): 325–57.
439 Sheila Jasanoff, 'Subjects of Reason: Goods, Markets and Competing Imaginaries of Global Governance', *London Review of International Law* 4 (November 2016): 369.
440 Sheila Jasanoff, 'Epistemic Subsidiarity – Coexistence, Cosmopolitanism, Constitutionalism', *European Journal of Risk Regulation* 4, no. 2 (2013): 133–41.
441 Jasanoff, 'Subjects of Reason: Goods, Markets and Competing Imaginaries of Global Governance', 368.
442 Sheila Jasanoff and Marybeth Martello, eds., *Earthly Politics: Local and Global in Environmental Governance*, Politics, Science, and the Environment (Cambridge, MA, USA: MIT Press, 2004).
443 Hurlbut, *Experiments in Democracy*, 11.

century raised novel forms of bioconstitutionalism to "align constructions of the natural, the right, and the reasonable"[444] via *soft law*[445]. As discussed in the previous chapter, the "Asilomar moratorium" on experimentation with recombinant DNA set the precedent for public reasoning that would inform the governance of life in modern democracies for decades[446]: science has authority over questions of knowledge, whereas Bioethics is granted jurisdiction "over the value-laden dimensions of research and over the evaluation of the normative significance of technologies' social effects"[447]. In fact, Bioethics committees are deeply embroiled in the joint constitution of epistemic, normative, and ontological order. In her analysis of bioethical deliberation across Germany, Britain and the US, Jasanoff reveals how these bodies "serve as a site of ontological surgery – that is, for deciding how to describe and characterize the problematic entities whose natures must be fixed as a prelude to ethical analysis"[448], and how such acts of classification diverge under co-productionist comparison. As such,

> [Bioethics] bodies are places where, under the rubric of making ethical judgements, political theories are tacitly argued, culturally dominant views about representation and public reason shape debates, and ethical principles follow from basic choices about which positions will be represented by whom. Those deliberations in turn shape our conceptions of entities at the frontiers of life: what a thing is and how we should treat it are repeatedly, if diversely, resolved together.[449]

From this perspective, the power of Bioethics is everything but 'soft'. Rather, the several dimensions sorted out by Bioethics committees – whether in the form of IRBs, presidential advisory councils, or global deliberative fora – can indeed be interpreted as constitutional in nature, affecting both re-definitions of understanding life as well as of responsibility for its governance vis-á-vis new scientific knowledge and technological development. Whereas such ordering work is usually not subject to parliamentary ratification, legal review, or procedural codification, it is through the performance of the reasonable normative arbitrator over new forms of life that Bioethics gains and exerts bioconstitutional power. For these reasons, Jasanoff argues that Bioethics committees represent "a particularly interesting site for observing the influence of bioconstitutionalism: it is a private sphere, in that it is not governed by the state, and yet it is concerned with the legitimacy and enforceability of its decisions"[450]. Not indicators and statistics but the construction of "accounts of the forms of reasoning

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[444] Hurlbut, Jasanoff, and Saha, 'Constitutionalism at the Nexus of Life and Law', 7.
[445] Jasanoff, *Reframing Rights*.
[446] Hurlbut, 'Limits of Responsibility: Genome Editing, Asilomar, and the Politics of Deliberation'.
[447] Hurlbut, *Experiments in Democracy*, 9.
[448] Jasanoff, *Reframing Rights*, 61.
[449]Jasanoff, 78.
[450] Sheila Jasanoff, 'Introduction: Rewriting Life, Reframing Rights', in *Reframing Rights* (The MIT Press, 2011), 73.

appropriate to collective moral sense-making"[451] allows such performance to gain credibility. As Hurlbut has observed with regard to the making of Bioethics in US politics since the 1970s,

> The mandate of public bioethics bodies is to reason on behalf of the wider public. Bioethics walks a fine line between representing plural, publicly held views ('all sides of the issue') and constructing accounts of 'reasonable' views— in effect, those views that would be publicly held were the public competent in moral reasoning…In effect, they construct an account of an ideally reasonable public, and position themselves as reasoning as such a public would reason.[452]

Bioconstiutional order is marked by a particular imagination of the public's (in)capacity to reason on emerging technoscience. Different to scientists or Bioethics experts, publics are framed as "only capable of taking sentimental, emotional and intellectually vacuous positions"[453] and as widely deficient of understanding, interpreting, and assessing scientific and technological knowledge[454]. Governance through Bioethics not only reflects a particular view on the public understanding of science, but also of the laypeople's role and responsibility in technoscientific governance. While Bioethics is largely devoid of de-facto mechanisms for public participation or legitimation, it reiterates ideals of representative democracy in which decision-making is delegated to representatives, whose power, in turn, is controlled by the checks and balances between different branches of government codified by a constitution. Following STS scholar Steven Hilgartner, the governance regime of Bioethics should hence be treated "as analogous to constitutional systems that construct subjects, objects and relationships among them"[455]. With these observations in mind, let me now briefly summarize why the lens of bioconstitutionalism forms an indispensable ingredient for symmetrical analysis of *soft law* in this thesis.

On the one hand, the concept of bioconstitutionalism allows us to understand the constitutional nature and effects of the interaction between science and the law, whether taking place in traditional legal settings such as parliaments and courts, or through bodies endowed only with soft rule-making power. To approach the case studies of this thesis from the perspective of bioconstitutionalism means reading neuroscientific claims over the nature of human life and commitments toward its 'ethical or 'responsible' governance in conjunction: how does new neuroscientific knowledge advance particular ideals of governance, and vice-versa, how do *soft law* bodies contribute to the production of desirable ontological order? A symmetrical analysis of these questions complicates the widespread assertion that science is a purely knowledge-driven enterprise with the 'right to name' new facts, and

[451]Hurlbut, *Experiments in Democracy*, 14.
[452] Hurlbut, 14.
[453] Brian Wynne, 'Creating Public Alienation: Expert Cultures of Risk and Ethics on GMOs', *Science as Culture* 10, no. 4 (2001): 445.
[454] Wynne, 'Misunderstood Misunderstanding'.
[455] Stephen Hilgartner, 'Constituting Large-Scale Biology: Building a Regime of Governance in the Early Years of the Human Genome Project', *BioSocieties* 8 (October 2013): 398.

the law only a reactive body for the protection of norms and rights vis-á-vis new entities produced by science. Rather, *soft law* is as much "a space of active experimentation" with ontological categories as science is deeply involved in settling rights and responsibilities of human bodies vis-á-vis public institutions[456].

Such a turn in perspective on the constitutive nature of *soft law* also implies reading its effects as extending well beyond the mere settling of normative principles and rules with regard to innovation in neurotechnology. The work conducted by *soft law* bodies examined throughout this thesis instead has a stabilizing effect on new scientific ideas of the human brain and its relationship to human identity. These ontological commitments, in turn, inform governance orders deemed legitimate for innovation in neuroscience and -technology: "proactive epigenesis" of human minds and social norms suggested by philosophers and scientists in the HBP, for example, reflects the EU's wider aspiration to innovate collectively, presenting emerging knowledge on the brain as well as neurotechnologies as inherently embedded in and the result of social processes. In the US, in turn, Neuroethicists' adherence to neuroscience's *dictum* of individual identity and agency sitting in the rational brain also allows the projection of a Rawlsian well-ordered American society governed by neurotechnologies' potential to enhance individual justice, freedom, and opportunity. Both cases illustrate that shifts toward public imperatives of innovation do not mark an "epochal break" with the Age of Science or of Enlightenment[457]; rather, long-held cultures and imaginations of conceiving the public good through science provide the backbone on which imperatives for the production of (individually, collectively, or globally) desirable innovation rest. In this sense, *soft law* in contemporary innovation governance forms the joint that connects heterogeneous regimes of what 'good' science and 'good' innovation is and how it should be pursued, protected, and provided, adding to bioconstitutionalism the 'technoscientific constitutionalism' that marks the public imagination of our time'.

On the other hand, the concept of bioconstitutionalism enables us to analyze what is held stable, and what is changing, in the transition from knowledge to innovation imperatives in contemporary science and technology governance. While the evolution of bioconstitutional arrangements was closely tied to changes induced by modern biology's understanding of human life and bodies, their extension to technoscientific constitutional orders reflects a sort of "second-order rationalization"[458] of socio-technical progress beyond the biological alone. In addition to bodies and their re-positioning with regard to political and moral entitlements[459], the implications and effects of technoscience on the whole of society form the target of these novel constitutional regimes. They include the production of epistemic

[456] Hurlbut, Jasanoff, and Saha, 'Constitutionalism at the Nexus of Life and Law', 6–7.
[457] For a compelling critique of such arguments on the shift to "techno-science", see Alfred Nordmann, *Science in the Context of Technology* (Universitäts- und Landesbibliothek Darmstadt, 2010).
[458] Ulrich Beck, Wolfgang Bonss, and Christoph Lau, 'The Theory of Reflexive Modernization: Problematic, Hypotheses and Research Programme', *Theory, Culture & Society* 20, no. 2 (2003): 16.
[459] As Jasanoff has claimed in re-framing rights, "radical shifts in the biological representation of life thus necessarily entail far-reaching functions – in effect, a re-positioning of human bodies and selves in relation to the state's legal, political, and moral apparatus." (p. 4)

and normative order in individual and collective sovereignty vis-à-vis the publicly proclaimed imperatives of innovation and the settlement of questions relating to the political economy of technoscience: what can societies and their citizens demand from innovation and vice-versa, how far can public institutions go in requesting from citizens their consent to and participation in the reformulation of the common good?

Different to a framing of publics as largely devoid of knowledge and agency in the governance of science, my case studies provide a rich pool of examples on how *soft law* bodies engage in considerable work to produce innovation reflexively, in anticipation of its effects on, and in partnership with society. In the US, a turn from Bioethics to Neuroethics expertise allows the extension of the desirability of innovation in neuroscience beyond the lab and the patient, through which the constitutional position of science in American political culture is cautiously re-configured to not only provide neutral and disinterested knowledge to be translated by markets, but also technoscientific innovation for the making of a 'well-ordered society'. The US case is particularly intriguing, as it is here that we can observe greatest adherence to the ideal of separating science and ethics (i.e., to bioconstitutional order), at the same time as we can witness a cautious (if only rhetorical) opening of such a regime towards the inclusion of publics upstream in the governance and processes of innovation. In the EU, by contrast, reflexivity is performed from the onset through the direct consultation of citizen perspectives in the governance of neuro-innovation and through the wider appropriation of democratic norms and models[460] into science and innovation policy, as well as by crafting understandings of the human brain as inherently embedded in its social environment. And in the OECD, changes in utilitarian and econo-centric approaches to science and technology give way to convergence with new forms of conceptualizing society as a relevant actor within innovation systems, which evidences nothing less than an innovation in the organization's gospel of an 'Innovation Imperative'. The next section argues that a key element for achieving legitimacy of investments in innovation on part of public policy is the construction of desirable futures achievable through 'ethical' or 'responsible' innovation: how do *soft law* bodies contribute to the co-production of such imaginaries, and what is their role in justifying a reordering of science, technology, and society relationships in the present?

[460] Jason Chilvers and Matthew Kearnes, 'Remaking Participation in Science and Democracy', *Science, Technology, & Human Values* 45, no. 3 (2020): 347–80.

Socio-technical imaginaries: Constructing socio-technical futures and presents

The concept of socio-technical imaginaries serves to understand how civic epistemologies and bioconstitutional commitments are not only constitutive for particular epistemic and normative orders in modern societies, but also with regard to the framing of futures enabled by science and technology for society. Next to questions that concern the settlement of what a thing *is* and how it *ought* to be governed, science and politics draw on "collectively held, institutionally stabilized, and publicly performed visions of desirable futures" which are "animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology"[461]. The lens of socio-technical imaginaries elucidates how visions of the future that societies embrace in technoscientific governance interact with past and present orders of social regulation and reasoning: what ideals of social order bind societies to particular forms of governing and regulating emerging technoscience? And how, in turn, do expectations toward scientific and technological futures shape practices of governance in the present? From this perspective, narratives constructed around the benefits – and the risks – that science and technology will unfold for society appear as deeply linked to situated visions of legitimate governance. As Jasanoff argues, "an imaginary is neither cause nor effect in a conventional sense but rather a continually rearticulated awareness of order in social life and a resulting commitment to that order's coherence and continuity"[462]. To distill such commitments during analysis, moments of disorder caused by the introduction of new knowledge and artifacts are particularly important, as it is here that public reasoning on social progress and its achievement through science, technology, and governance is (re)articulated. Controversies around technological innovation in particular provide a crucial arena for the reconfiguration of socio-technical imaginaries, since

> The products and processes that nation states choose to promote through (science and technology) relate back in complex ways to the social goods their public feel they need and want, and can accept without intolerable cost. Technology, in this sense, operates as the material manifestation of collective preferences, shaped and governed by what we may term national sociotechnical imaginaries.[463]

Reiterating the interactional character of Jasanoff's take on co-production, inquiry into socio-technical imaginaries encourages us to read the production of scientific claims and technological objects in conjunction with the making of political collectives, whether at national, regional, or global scale. Benedict Anderson's work on the "origins of national consciousness" in the construction of "imagined communities"[464] and Arjun Appadurai's research on the "the transformation of everyday

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[461] Jasanoff, 'Future Imperfect: Science, Technology, and the Imaginations of Modernity', 4.
[462] Jasanoff, 26.
[463] Jasanoff, 'Epistemic Subsidiarity – Coexistence, Cosmopolitanism, Constitutionalism', 135.
[464] Benedict Anderson, *Imagined Communities: Reflections on the Origin and Spread of Nationalism* (Verso, 2006).

subjectivities"[465] through imaginaries of globalization are important precursors for understanding the power of socio-technical imaginaries in the practices and narratives of modern politics[466]. Political philosopher Charles Taylor in particular dissected the "modern social imaginary" that evolved between the 16th and 19th century and that still guides political practice and reasoning today: rather than a hierarchical order between God and its subjects, Enlightenment ideals of a natural moral order such as those of John Locke suggested a heterarchical organization of society in which individuals secure their mutual benefit, rights, and freedom. Through analysis of these shifts, Taylor defines a social imaginary as "the ways people imagine their social existence, how they fit together with others, how things go on between them and their fellows, the expectations that are normally met, and the deeper normative notions and images that underlie these expectations"; when these "images, stories, and legends" are shared "by large groups of people, if not the whole society", adherence to "common practices and a widely shared sense of legitimacy" is established[467]. Research on socio-technical imaginaries expands and adds to such theorizing the key role played by science and technology in the imaginative constitution of political communities:

> To understand order and, its obverse, disorder in contemporary societies, we need an encompassing theoretical framework that draws together our scientifically and culturally conditioned perceptions of reality, our capacity to create new collectives through technological as well as social means, and the changes in expectation that arise when science and technology interact with individual self-awareness and the sense of being well ruled.[468]

While imaginaries are operating in the prescriptive domain of the fictitious, they also entail "ontic components"[469] that shape how people relate to each other, how they organize their activities, and to which forms of regulation they subject themselves. As Yaron Ezrahi pointedly observed, social imaginaries share with the working of science a "self-concealing imagination, which attempts to ontologize and present its products as incontestable facts", to which he adds that "what warrants the tangibility of the nation or the state in any particular society depends on the effectiveness with which the rich cultural resources that produce reality effects inn any given society are engaged."[470] These resources are epistemic, material, and normative forms of generating legitimacy for specific policy goals and agendas, particularly when it comes to investments in innovative technology. Functioning as instruments that construct shared visions of desirable futures and as powerful visions in themselves for

[465] Arjun Appadurai, *Modernity at Large* (University of Minnesota Press, 1996), 8.
[466] Jasanoff, 'Future Imperfect: Science, Technology, and the Imaginations of Modernity'.
[467] Charles Taylor, *Modern Social Imaginaries* (Duke University Press, 2004), 23.
[468] Jasanoff, 'Future Imperfect: Science, Technology, and the Imaginations of Modernity', 14.
[469] Taylor, *Modern Social Imaginaries*, 10.
[470] Ezrahi, *Imagined Democracies: Necessary Political Fictions*, 13.

how societies ought to be governed, socio-technical imaginaries "operate as both glue and solvent, able – when widely disseminated and effectively performed – to preserve continuity across the sharpest ruptures of innovation or, in reverse, to upend firm worlds and make them anew"[471].

Like situated forms of public reasoning and bioconstitutional ordering, socio-technical imaginaries are characterized by historically grown ideals of social, scientific, and material progress, at the same time as they are subject to being tested, and maybe even transformed, in the course of socio-technical change – "unlike mere ideas and fashions, sociotechnical imaginaries are collective, durable, capable of being performed; yet they are also temporally situated and culturally particular"[472]. Studying their dynamics, hence, includes comparative *longue durée* research that traces the genealogy of communities' "sense of self and their passions for how things ought to be" such as "constitutional principles, juridical practices, and public reason"[473], as well as potential shifts in such trajectories vis-á-vis "events that might disrupt order"[474], such as the introduction of new scientific and technological entities into societies. Policy-institutions and the law form a key site where the (re)articulation of socio-technical imaginaries in societies can be observed, including "discourses and processes of issue framing and agenda setting"[475]. Yet they may also be formulated by other "actors with the authority to shape the public imagination"[476], such as corporations and their humanitarian efforts[477] or international organizations' aspirations toward securitization[478]. Across different settings, four interrelated stages characterize processes through which socio-technical imaginaries take shape, spread, and stabilize throughout communities:

> First, work in the imaginaries framework necessarily invites us to examine the origin of new scientific ideas and technologies and the social arrangements or rearrangements they help sustain…Second, by inquiring into imagination as a social practice, we follow the embedding of ideas into cultures, institutions, and materialities, whereby the merely imagined is converted into the solidity of identities and the durability of routines and things. Third, [we] illustrate moments of resistance, when new conceptions of how to change the world bump up against the old, or when powerful competing imaginations struggle to establish themselves on the same social terrain. Last, in tracing socio-technical projects from conception to realization, we explore the phenomenon of extensions, the complex processes by which unconventional ideas gain traction, acquire

[471] Jasanoff, 'Future Imperfect: Science, Technology, and the Imaginations of Modernity', 29.
[472] Jasanoff, 19.
[473] Jasanoff, 22.
[474] Jasanoff, 26.
[475] Jasanoff, 25.
[476] Jasanoff, 25–26.
[477] Elta Smith, 'Corporate Imaginaries of Biotechnology and Global Governance: Syngenta, Golden Rice, and Corporate Social Responsibility', in *Dreamscapes of Modernity* (University of Chicago Press, 2015).
[478] Clark A. Miller, 'Globalizing Security: Science and the Transformation of Contemporary Political Imagination', in *Dreamscapes of Modernity* (University of Chicago Press, 2015), 279.

strength, and cross scales, for example, by persisting through time or by overcoming geopolitical boundaries.[479]

Research on socio-technical imaginaries conducted along these lines is telling of the relational dynamics of power on which new scientific and technological ideas depend, be it between individual actors and wider publics, traditional and new ideals of social order, or fictitious and 'factual' descriptions of reality. In their landmark article on socio-technical imaginaries, Jasanoff and Kim, for instance, show how diverging forms of public reasoning in the US and South Korea with regard to nuclear power rely on imaginaries of 'containment' (US) and socio-economic 'development' (Korea) that can be traced to "divergent imaginations of state responsibility toward citizens"[480], as well as to widely different conceptions of lay publics and their agency in political decision-making. Delving into a specific national setting can also elucidate the relational nature of socio-technical imaginaries. Ulrike Felt's analysis of controversies around nanotechnologies in Austria illustrates how trajectories of a collective sense of social order interact with visions of (un)desirable scientific and technological change: Austria's choice to "keep technologies out" here reflects wider "public choices not for or against technology but for or against particularly imagined forms of life"[481]. And even a close reading of how judges imagine technology in relationship to constitutional principles is revealing of the close "interaction between the technological and legal imagination"[482]; as David Winickoff argues, "these imaginaries entail not only visions, theories, and a priori characterizations of technological objects, but also models of how those objects interact with the social technology known as law"[483]. Expansion of analysis from these situated cases to the circulation of models for technoscientific development has been equally productive in showing how 'global' imaginaries of innovation interact with local forms of socio-technical governance. For example, in Sebastian Pfotenhauer's and Jasanoff's research on "travelling imaginaries of imagination", the internationally sought-after "MIT Model" is re-articulated "by local understandings of the kinds of futures that seem worth aspiring to, the legitimate mechanisms for attaining them, and the argument in favor of innovation that seem plausible"[484].

All of these cases open up a new perspective on how technoscientific visions of the future are never about science or technology alone, but always shaped by, as well as reconfiguring the governance

[479] Sheila Jasanoff, 'Imagined and Invented Worlds', in *Dreamscapes of Modernity* (University of Chicago Press, 2015), 323.
[480] Sheila Jasanoff and Sang-Hyun Kim, 'Containing the Atom: Sociotechnical Imaginaries and Nuclear Power in the United States and South Korea', *Minerva* 47, no. 2 (26 June 2009): 140.
[481] Ulrike Felt, 'Keeping Technologies out: Sociotechnical Imaginaries and the Formation of Austria's Technopolitical Identity', *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power*, 2015, 121.
[482] David Winickoff, 'Judicial Imaginaries of Technology: Constitutional Law and the Forensic DNA Databases', July 2011, 158.
[483] Winickoff, 165.
[484] Sebastian Pfotenhauer and Sheila Jasanoff, 'Traveling Imaginaries: The "Practice Turn" in Innovation Policy and the Global Circulation of Innovation Models', in *The Routledge Handbook of the Political Economy of Science*, ed. David Tyfield et al. (Routledge, 2017), 426.

arrangements that political communities experience as reasonable, justified, and legitimate. The contingent ways through which societies make technological choices, in turn, also helps to explain why certain innovations are accepted or rejected in specific contexts. Analysis of socio-technical imaginaries serves to de-construct popular narratives of the individual innovator as sole driver of technoscientific progress: as "imaginaries by definition are group achievements"[485], it is only when multiple actors share ideals of socio-technical progress with individual actors that certain technoscientific projects gain credibility and legitimacy in policy. The collective nature of socio-technical imaginaries necessarily entails processes of inclusion and exclusion of particular ideas and visions on how science and technology might benefit societies in the future. An important task for the analyst, hence, consists in showing how "legislatures, courts, the media, or other institutions of power elevate some futures above others, according them a dominant position for policy purposes"[486].

Stephen Hilgartner's work on "socio-technical vanguards" details the processes through which individual visions gain traction in shared imaginations of desirable futures. In his study of propositions for a revolution in synthetic biology, he identifies small groups and their leaders who "assume a visionary role, performing the identity of one who possesses superior knowledge of emerging technologies and aspires to realize their desirable potential"[487]. These avant-garde groups suggest a revolution in envisioning synthetic biology as driver of desirable futures by drawing on existing socio-technical imaginaries such as "America the innovator", and through the formation of "discourse coalitions" with the familiar vocabulary and narratives of such collectively shared imaginaries. The discursive alliances formed among innovators and wider forms of public reasoning on national identity then serve to explain how "socio-technical vanguards seek to make futures, but they cannot make them simply as they please; they do not make them under self-selected circumstances, but do so using vocabularies and practices already given and transmitted from the past"[488]. From this perspective, seemingly radical innovations such as those in synthetic biology are, in fact, embedded in long-held institutional narratives of science, technology, and society relationships; in Hilgartner's words, "the struggle to make new futures entails recapitulating the past"[489].

What does the concept of socio-technical imaginaries add to the analysis of *soft law* in contemporary innovation governance, and how does it contribute to a greater understanding of the socio-technical orders that are co-produced through *soft law* across the case studies of this thesis? By pointing to the powerful role of public institution's framing of the impacts of innovation on society in conjunction with their reasoning on legitimate governance arrangements for achieving socially desirable innovation, the framework of socio-technical imaginaries extends well beyond studying the role and politics of

[485] Jasanoff, 'Future Imperfect: Science, Technology, and the Imaginations of Modernity', 25.
[486] Jasanoff, 4.
[487] Hilgartner, 'Capturing the Imaginary: Vanguards, Visions and the Synthetic Biology Revolution', 34.
[488] Hilgartner, 34.
[489] Hilgartner, 50. 0

expectations, visions[490], and techno-scientific promises[491] in the governance of innovation. While sociologists of science and technology have extensively studied the role of future-making through technoscience, giving way to the insight that "by definition, innovation in contemporary science and technology is an intensely future-oriented business with an emphasis on the creation of new opportunities and capabilities"[492], its interaction with existing social imaginaries of legitimate order and governance usually gets lost during analysis. Differently put, if we would only turn to the promissory politics of innovation mobilized in my case studies to enroll publics, such as the resolution of 'grand challenges' (e.g., the rise of an 'Alzheimer crisis' or an ever-more competitive 'brain economy') through neurotechnologies, the turn to *soft law* in innovation policy would hardly be explicable.

With the lens of socio-technical imaginaries we gain a more symmetrical account of the mutual constitution of social and technoscientific order in public acts of future-making, particularly with regard to the different discourses and practices that allow certain innovations – as well as certain governance regimes – to thrive in public policy. Where these visions originate, how they are embedded in political culture, which forms of resistance accompany their stabilization, and whether or not they extend through space and time are important indicators for explaining why certain neurotechnological innovations are mobilized in different settings, and what role *soft law* plays in situating them in wider imaginaries of public order specific to the contexts under study. As I discuss later on, the socio-technical futures that the US, EU, or OECD prescribe through *soft law* are reflective of each "political community's shared imaginary of what constitutes lawful governance, and more particularly [of] what modes of reasoning, judgement, and rule are proper and legitimate" in each case[493]. In the US, such imaginary rests on liberal principles of minimal government and maximum individual freedom; in the EU, it is grounded in visions for a united European public and a respective order for a European republic; and at the OECD, liberal-republican commitments among member-states aspire to bring about globally inclusive technologies and markets.

These imaginaries, in turn, help to explain why the US invests in the BRAIN initiative's revolutionary visions of technologies derived from *in vitro* neuroscience, the EU in the HBP's promises of a full-scale simulation of the brain via *in silico* science, and the OECD in the elevation of neurotechnological innovation more generally as a shared opportunity and concern for global governance. In each of the cases, the production of *soft law* for the regulation of neurotechnological innovation toward the public benefit links to long-held ideals of legitimate governance, at the same time as it opened up new forms of imagining the place of neuroscientific innovation in the future of political collectives. To paraphrase from Hilgartner, soft principles and rules are, hence, telling of the contingent ways through which each case struggled to make new futures through recapitulating governance ideals

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[490] Hilgartner, 201.

[491] Pierre-Benoit Joly and Claire Le Renard, 'The Past Futures of Techno-Scientific Promises', *Science and Public Policy* 48, no. 6 (August 2021): 900–910.

[492] Mads Borup et al., 'The Sociology of Expectations in Science and Technology', *Technology Analysis & Strategic Management* 18, no. 3–4 (2006): 286.

[493] Hurlbut, Jasanoff, and Saha, 'Constitutionalism at the Nexus of Life and Law', 4.

from the past.

Analysis of the production of soft guidance for the governance of neuro-innovation through the concept of socio-technical imaginaries is also key for carving out shifts in frames about the public good mobilized by science and technology policy over time. While 20th century ideals of a social contract among science and society framed innovation as an all-embracing panacea to future social or economic problems, 21st century imperatives of 'ethical' or 'responsible' innovation reflect a new narrative in which social norms, values and needs are envisioned as a powerful fix for the potential problems and risks caused by innovation in the future. As my case studies testify, contemporary imperatives of innovation today cannot rest on framing the future as determined by technoscientific progress any more, but need to bring attention to the sovereignty of political collectives in deciding which technologies are (un)desirable in the protection and provision of the common good. In other words, to gain legitimacy in science and technology policy for investments in particular innovations today, it is not sufficient to frame technological progress as a driver of the future public good – rather, publics and their preferences are increasingly framed as primary enablers of good technological futures. In the discussion of the different cases analyzed in this thesis, I claim that this change in imagination has hard effects, as it not only re-configures commitments to the social contract among science and politics, but also the political economy through which technoscience comes to be envisioned as a value for political collectives. Innovation imperatives such as those for neurotechnology, in this sense, are stabilized by what might be considered the 'constitutional imagination' that each of my case studies produces through *soft law*, in that they revolve around the specific forms of social regulation deemed legitimate and desirable in the governance of technoscientific change.

Conclusion

Several methodological inroads have evolved in STS scholarship to study the relationship between science, technology, and society from a symmetrical perspective. These different traditions are grounded in diverging intellectual and political projects advanced by STS scholars: while SSK and SCOT were engaged in countering technological and scientific determinism, ANT's agenda opposed socially deterministic ideas of the making of science and technology. Jasanoff's approach to co-production takes both of these projects as a starting point for inquiry into how science, technology, and society interact. Neither science and technology, nor societies and their political institutions, are primary shapers of one another – rather, there is a mutual relationship between the epistemic and normative working of power in contemporary societies. Three concepts in particular help in disentangling the contingent interaction between science and politics in modern societies. The concept of "civic epistemologies" points us to culturally specific ways of generating public reason, and more specifically the governance arrangements and forms of knowledge put in put in place to deliberate on emerging science and technology. "Bioconstitutionalism" furthers our understanding of how processes of public knowledge production establish normative and ontological order with regard to novel forms of life produced by technoscience. The lens of "sociotechnical imaginaries" adds to these the key role played by frames mobilized in public reasoning about the futures brought about by scientific and technological progress. Each of these analytical frameworks, in turn, serves to explain why certain scientific claims become authoritative or are discarded in societies and how different technologies gain public support or rejection by publics. Together, and when compared across contexts, they shed light on the culturally distinct and historically situated ways of co-producing democracy and technoscience in the public arenas of modern societies.

In this chapter, I have proposed that the interactional variant of co-production represents the most fruitful inroad into symmetrical analysis of *soft law* in contemporary innovation governance. By drawing our attention to public policy, the law, and those bodies set up to accommodate science and technology in public reasoning, we can better understand the powerful role of *soft law* in the generation of democratic legitimacy around innovation imperatives. It is by going beyond "totalizing stories – whether positive or negative – concerning science and technology"[494] as well as unidirectional views on the law as leading – or lagging behind – technoscientific development, that we can get a grip on the power of *soft law* in the governance of neuro-innovation. While these narratives are deeply engrained in the politics of science and technology, the comparative perspective mobilized by interactional co-production allows a more nuanced interpretation of how *soft law* is put to work in different contexts, and with it, of the diverging ways that neuro-innovation is embraced by political collectives as a good worthy of public support. As instruments of co-production, soft governance bodies are key for authorizing particular views, forms of expertise, and processes for deliberation, and, hence, for prescribing particular forms of reasoning on science and technology to democratic societies. Despite their ostensibly non-binding and merely moral power, they perform ontological and normative surgery

[494] Jasanoff, 'The Idiom of Co-Production', 37.

on which notions of human life are permissible, and how responsibilities for protecting it are distributed among actors and institutions. Last but not least, *soft law* elevates and discards particular imaginaries of innovation's impact on society, and with them, distinctive ideals of governance to achieve neuro-innovation that is desirable for society.

The emphasis of interactional co-production on *long-durée* historical research furthermore helps us in explaining the recent shifts from science to innovation in public reasoning and imagination across contexts. Whereas science and the law formed the nexus of constructing publicly credible and politically authoritative policies, the turn to imperatives of innovation opens up new forms of generating legitimate governance through *soft law.* These include a novel role for public representation and participation in deliberations and decision-making on innovation (e.g., "Neuroethics" or "RRI"), as well as discursive frames that picture societies as the central drivers of, rather than obstacles to, technocientific progress. As I have argued above, instead of settling concerns of bioconstitutional order via hard law or Bioethics, public institutions today are immersed in codifying normative and ontological order through plural forms of *soft law* for what we might call an emerging regime of 'technoscientific constitutionalism'. Here, bioconstitutional principles are extended to classifications of technoscientific order, giving way to a new role for *soft law* bodies in reasoning and imagining desirable innovation beyond the biological alone. In this thesis, I propose that such a shift is sustained by a 'constitutional imaginary' that centers not so much on how collectively desirable futures can be achieved through science and technology, but how innovation can be achieved through the agency of societies in steering technoscientific development toward beneficial ends. A key insight derived from interactional co-productionist research is that transformations like these are enabled not only by new, revolutionary claims and objects, but likewise through recourse to historically grown institutions, imaginations, and styles of public reasoning. Bioconstitutional principles are not discarded in novel governance regimes, but necessarily form part and parcel of emerging imperatives to innovate on part of public institutions. And related constitutional imaginaries still entail causal and linear visions of the relationship between society, science, and technology, even when turning their logic upside down. In the case studies and comparative discussion that follows, I will illustrate how interactional approaches to co-production can give us more detailed insights into the mutual constitution of neurotechnological innovation and democracy through of *soft law* across the US, EU, and OECD, its changes over time, and reasons for its stability as well as perceived legitimacy.

4. The Multi-Sitedness of Soft Law in Innovation Governance

To read *soft law* in innovation governance from the methodological perspective of interactional co-production entails the selection of specific research methods and empirical materials. As discussed earlier, carving out the dynamics through which *soft law* bodies and texts co-produce order and imaginaries of socially desirable innovation requires cross-cultural comparison, *long durée* historical research, and the ethnographic sensibilities of STS research. In particular, the de-construction of boundaries set forth by actors in the production of *soft law*, their framing of the appropriate relationship between innovation and society, and the performances conducted to produce credible normative reason on emerging science and technology are important entry-points for analysis. Which materials are chosen during research, and how they are put in relationship to each other, moreover, matters greatly to a co-productionist reading of *soft law*: they should be limited to particular case studies, contexts, and controversies, but also allow us to carve out commonalities across settings, potential broader shifts in governance practices and discourses, and joints between micro-cases and wider aspects of political culture. In this chapter, I discuss the different methods and materials that I have engaged during research for this thesis, which I propose as a broad guideline for a co-productionist reading of *soft law* in the governance of neuro-innovation and beyond. While they reflect my particular case studies and empirical observations concerned with soft governance of innovation in neurotechnology, I attempt to sketch how they could also serve the study of power exerted by *soft law* in contemporary science and technology governance more generally. I conclude by offering some thoughts on the relevance of reflexivity throughout research, as well as on the challenges and opportunities that arise from being engaged in the fields that we study.

Following soft law in science and technology policy: A mobile, multiply situated object of research

When beginning research for this thesis, its case studies, empirical materials and methodological perspectives were far off on the horizon, and I did not expect my research journey would take me to inquire the making of something as elusive as 'soft law' in 'innovation governance'. What started as a research project on the OECD and its engagement with 'responsible innovation' evolved over the years into a much more complex set of questions, settings, and insights than I had imagined. While the bounded research design foreseen for this project would have involved its own complexities, including getting to grips with the multi-layered and multi-national politics of the OECD, it turned out that the object I was following and, indeed, constructing over the course of research was located in dispersed communities of practice, forms of discourse, and materials. In other words, to understand what characterized the particular ways of producing 'responsible innovation' in a transnational policy organization such as the OECD, I needed to follow threads of discourse, people and histories that extended my research from a situated, local phenomenon to its embeddedness in an emerging global landscape of what I present here as the shift to *soft law* in innovation governance.

Research in the social sciences is messy, as are the worlds studied by social science. One way to deal with this dilemma is by acknowledging that "we cannot expect single answers", that we "have to give up on simplicities"[495], both with regard to the questions we ask to our research subject(s) as well as concerning the worlds we construct through the answers we derive from them. The idea of "multi-sited ethnography" is intended to capture the openness of research toward the objects and subjects that emerge when we take the complexity of phenomena seriously yet still try to carve out the joints that hold them together. While ethnography has been at the heart of STS methods, not least since Latour and Woolgar proposed to study the construction of scientific facts in "Laboratory Life"[496], it is particularly when STS research is moving out of the laboratory and between the different worlds where science, technology, and society is in the making that the merits of multi-sited ethnography become evident. Next to following only actors or things, techniques of multi-sited ethnography also involve following metaphors, plots, stories, and allegories, as well as conflicts or lives and their biographies[497]. It is the relationship between these sites that this ethnographic method aims to elucidate, while stressing that the connections of disparate stories, events and actors are made through the imaginative researcher rather than representing a 'real' or 'factual' correlation. As such, "the notion of multi-sited ethnography centers attention on the construction of the ethnographic object…[it] suggests that we deliberately pursue alternative ways of formulating the objects of study"[498]. In the words of founding father of multi-sited ethnography George Marcus,

> This mode defines for itself an object of study that cannot be accounted for ethnographically by remaining focused on as single site of intensive investigation…This mobile ethnography takes unexpected trajectories in tracing a cultural formation across and within multiple sites of activity that destabilize the distinction, for example, between lifeworld and system, by which much ethnography has been conceived. Just as this mode investigates and ethnographically constructs the lifeworlds of variously situated subjects, it also ethnographically constructs aspects of the system itself through the associations and connections it suggests among sites.[499]

Through the mobility of research across sites and cases, Marcus aims to equip anthropology with the capacity to account for the micro-cases that usually form the centerpiece of its ethnographies and to connect these to the "macrotheoretical concepts and narratives"[500], such as the "capitalist world

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[495] John Law, 'After Method: Mess in Social Science Research', January 2004, 2.
[496] Latour and Woolgar, *Laboratory Life*.
[497] George E. Marcus, 'Ethnography in/of the World System: The Emergence of Multi-Sited Ethnography', *Annual Review of Anthropology* 24 (1995): 95–117.
[498] Christine Hine, 'Multi-Sited Ethnography as a Middle Range Methodology for Contemporary STS', *Science, Technology, & Human Values* 32, no. 6 (2007): 656.
[499] Marcus, 'Ethnography in/of the World System: The Emergence of Multi-Sited Ethnography', 96.
[500] Marcus, 96.

system"[501], without taking these as pre-set frames in research. As Christine Hine observes, multi-sited ethnography, hence, represents a sort of middle range methodology for STS that straddles divides between efforts to generate "unified theories", which often seem removed from "observable social experience", and merely descriptive observations that do not provide "enough conceptualization to guide future study or generalize to other situations"[502]. It is through accounts of the researcher of how the micro and the macro hang together that both sensitivity to the situatedness of a phenomenon as well as relationships to its broader, systematic context are maintained. Comparison of different objects and subjects emerging during ethnography is key for the researcher to generate these linkages. According to Marcus,

> In multi-sited ethnography, comparison emerges from putting questions to an emergent object of study whose contours, sites, and relationships are not known beforehand, but are themselves a contribution of making an account that has different, complexly connected real-world sites of investigation. The object of study is ultimately mobile and multiply situated, so any ethnography of such an object will have a comparative dimension that is integral to it, in the form of juxtapositions of phenomena that conventionally have appeared to be (or conceptually have been kept) 'worlds apart'.[503]

Multi-sited ethnography proved to be a useful method to reckon with the multiple, unexpected, and seemingly disparate phenomena that appeared during the research that led to this thesis. It turned out, for example, that the OECD's engagement with 'responsible innovation' eventually crystallized in a project by the BNCT working party on the social and ethical dimensions of innovation in neurotechnology; that a key reason for such focus were member-states' diverse investments in big neuroscience projects; that all of these projects had begun to establish different ways of including instruments for ethical and social deliberation in their quest to develop technological instruments for better understanding and intervening in the human brain; that while the landscape of brain research and development was highly competitive, particularly with regard to emerging neurotechnology markets and vis-à-vis China, member states were still keen on developing global guidelines for 'responsible innovation' in the field, including, but not limited to, the OECD's fora; and that what appeared as an emerging global consensus on the appropriate governance frameworks and instruments for neuro-innovation were in fact multiple, situated forms of reasoning and imagining the relationship between innovation and society. Moreover, these phenomena somehow seemed to hang together beyond the confined boundaries of the OECD or the specific field of neuroscience and -technology: for example, actors repeatedly referenced other areas of technoscientific innovation that either had provoked the turn

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501 Marcus, 99.
502 Hine, 'Multi-Sited Ethnography as a Middle Range Methodology for Contemporary STS', 654.
503 Marcus, 'Ethnography in/of the World System: The Emergence of Multi-Sited Ethnography', 102.

to 'ethical' or 'responsible' discourse in innovation governance, such as Nanotechnology or GMO's, or that were expected to soon provoke a number of ethical, legal and social issues for policymakers, such as Artificial Intelligence. And while some of the relevant actors in the field were repeatedly involved in OECD deliberations, other important figures seemed to be key either only to national contexts, institutions, and governance settings, or to organizations and projects that were competing with the OECD's aspiration to produce the first international set of recommendations for 'Responsible Innovation in Neurotechnology', including within the OECD itself.

To account for these emerging insights, I could not stay within the confined boundaries of the OECD but quite literally had to move with them: from workshops, conferences, and meetings among policymakers, scientists, and academics in illustrious settings such as the National Academy of Sciences in the US or the European Commission's buildings in Brussels, to the sober environments of research in different brain projects, offices located in the long corridors of bureaucracies, or the increasingly virtual settings in which discussions today take place. Moving with my emerging knowledge of the field were not only the spaces and actors I followed, but also the timescales that were relevant to understand how the discourse of 'responsible' or 'ethical' innovation in neurotechnology was informed by events and ideas of the past – and the future –, including the historical development of different approaches and instruments in science technology policy and, as became increasingly clear, of different ideals of democratic governance, legitimate rule, and popular sovereignty and their relationship to diverging and shifting visions of the appropriate place for technoscience therein. In short, and in line with multi-sited ethnographic sensibilities, I had to find my way through things that seemed 'worlds apart', yet inherently linked to, an emerging object that I could only grasp once I compared and related these different elements to each other.

In this thesis, I construct this object as a 'macro' shift by political collectives in the reasoning and imagination of good innovation and its governance, which I derive from a comparative ethnography of 'micro' cases concerned with the crafting of normative principles and rules for innovation in neuroscience and -technology. The joint that holds these two areas of ethnography together is the notion of *soft law,* as it serves to theorize the broader transformations set in motion by changing forms of envisioning and knowing what innovation *is* and how it *ought* to be governed in socially desirable ways, as well as for understanding the situated, local practices and discourses that underwrite these constitutional re-configurations. To take this method seriously – to account for the mess of the world and of the methods through which we study it – means that this thesis can hardly represent a guide, or set of methods and methodologies, to study *soft law* in science and technology policy. Yet, some insights from my journey might be helpful for research confronted with objects that resemble those of this thesis, while others are important for understanding the specific ways through which I analyze the object of *soft law* in the pages that follow.

Performing soft law: The front- and backstage work of soft law in innovation governance

Soft law in this thesis is approached both as a text and practice, that is, authoritative knowledge generated on the ethical or responsible governance of neurotechnology becomes visible through both the documents that codify soft rules and principles, as well as the processes of deliberation and forms of reasoning engaged by actors for their settlement. Together, texts and practices can be analyzed as a particular kind of performance of *soft law*. Following the 'performative turn' in social linguistics and anthropology of the 1970s, we may think of performance as "the activity of a given participant on a given occasion which serves to influence in any way any of the other participants"[504]. Through discussing and writing the rules that ought to guide innovation toward socially desirable texts, actors also enact specific forms of work for specific types of audiences "to control the impression they receive of the situation"[505]. While this approach to performance originally enjoyed wide-spread application in STS for studies of the scientific method[506], Hilgartner has shown how it is equally productive for research on science advice. In "Science on Stage", he inquires the "apparatus through which advisory bodies produce credibility"[507] as a public drama. Experts called upon to provide knowledge on scientific issues here are seen as performing "information control" in the drafting of advisory reports with regard to both "what is contained in the text and to what is absent from it"[508]. Closely resembling a theatre, discussions held between experts 'backstage' are often messy and controversial, and to construct the credibility of advisory bodies vis-á-vis their audiences, significant work needs to be done for an issue to appear as settled 'frontstage' particularly through the curation of written texts. Therefore, Hilgartner's insights provide us with a dynamic view on the performativity of practices and text in public expert advice:

> The division between backstage and front stage is not a firmly fixed feature of organizational life but a contestable and flexible boundary that is continually being (re) constructed as competing performers actively work to 'backstage' some bits of information, while 'front-staging' others.[509]

Although performing ethical or social instead of scientific advice, the work of *soft law* bodies studied in this thesis can be approached in a similar way. What is backstaged in the written documents that these bodies produce is key for understanding how their frontstage knowledge is presented as

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[504] Erving Goffman, *The Presentation of Self in Everyday Life* (Harmondsworth: Penguin Books, 1971), 8.
[505] Ibid.
[506] For an overview of the different STS literatures concerned with performance see Christopher L. Salter, Regula Valérie Burri, and Joseph Dumit, 'Art, Design and Performance', in *The Handbook of STS*, 4th ed. (Cambridge, MA: MIT Press, 2016). in Ulrike Felt et al., *The Handbook of Science and Technology Studies, Fourth Edition* (Cambridge MA: The MIT Press, 2017).
[507]Stephen Hilgartner, *Science on Stage: Expert Advice as Public Drama* (Stanford: Stanford University Press, 2000), 6.
[508] Hilgartner, 19.
[509] Hilgartner, 18.

credible to wider publics; vice-versa, we would only gain a partial picture of their credibility construction by looking merely at the texts they produce. In practice, this means that access to and observations of the 'backstage' work of soft governance bodies is needed. While the frontstage of *soft law* (e.g., reports, guidelines, white papers, etc.) is, by its very nature, publicly displayed and accessible, the backstage work of deliberation is often less readily available, particularly as it forms part of the overall control of information exerted by soft governance bodies to be perceived as credible.

In the backstage of soft law: Observing controversy behind the scenes

In my research, I have obtained different forms of access to the backstage settings, procedures, and actors involved in the production of *soft law* for neuroscience and technology. In the OECD case, I was fortunate to be granted access as a participant-observer to deliberations of the BNCT working party, and although such a role carries its own challenges (see below), the insights gained through my participation in their meetings, workshops, conferences, drafting procedures etc. proved invaluable for interpreting the "Recommendation on Responsible Innovation in Neurotechnology" as a performative text. As a widely opaque organization with regard to who exactly represents member-state delegates and which experts are participating in deliberations beyond those named in reports and policy papers[510], the access I obtained indeed made my case study on the OECD possible. In contrast, the drafting of *soft law* documents on the ethics of neuroscience and -technology in the US is made accessible by federal law since the passage of the Administrative Procedure Act in 1946, which aimed to make public decisions more transparent to wider publics; as such, not only "U.S. citizens", but also researchers like myself, "more than in any other democratic nation, can count on having access to official information, including the evidence and reasoning relied upon by the government's extensive network of expert advisers"[511]. This unique legal situation means that deliberations by the Presidential Commission on Bioethics, or the BRAIN Initiative's Neuroethics Working Group, are usually recorded, transcribed, and open to the public, and, thus, a unique opportunity for 'backstage' research without direct access. The EU case, in turn, proved particularly challenging as its transparency politics are sitting somewhere between those of the OECD and the US. While meetings of the EU's parliamentary debates, for example, are widely recorded and publicly available, deliberations, such as those by the HBP's 'Ethics and Society' project are not. However, a wealth of public reports documenting and evaluating the different project meetings, citizen engagement exercises, and interactions between the HBP and EU institutions provide a fruitful resource for research. While such a heterogeneity can be challenging for the researcher, these different politics of visibility, accessibility, and information control form part and parcel of the civic epistemologies that characterize each setting[512], and can, hence, represent important data points in

[510] OECD meetings usually take place under so-called "Chatham House Rules", which allow the publication of meeting contents but not the names of meeting participants.
[511] Sheila Jasanoff, 'Transparency in Public Science: Purposes, Reasons, Limits', *Law and Contemporary Problems* 69 (18 October 2006): 22.
[512]Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*, 269.

analysis.

Where knowledge on the face-to-face interactions within *soft law* bodies can only partially be obtained, qualitative interviews[513] can serve as another source for gaining background insights on the issues and agendas discussed beyond text. Narrative interviews are particularly useful for these purposes, as they prompt interviewees to recount their experiences, insights, and role in a procedural way, offering interviewees significant authority over the course of an interview without pre-framed themes or ideas on the interpretation of events by the interlocutor[514]. Again, access to interviewees can be a challenge throughout research, and having a gatekeeper into the different communities of experts and participants in deliberations around soft norms and principles is a highly beneficial aspect during fieldwork. In my case, the OECD working party took on the gatekeeping role, and the participation of a great number of actors in OECD workshops and meetings allowed me to connect to many of the important stakeholders involved in the field of soft neuroscience and -technology governance. It is here that I have conducted most of the interviews for this thesis, both with OECD staff and delegates, as well as with the wider set of experts invited to participate in the drafting of the OECD's neurotechnology recommendation. Accordingly, the roughly 60 actors I could win for an interview are representative of the heterogenous field of soft governance in neurotechnology innovation, spanning high-level policymakers, academics, business representatives, patient advocates, neuroscientists and engineers, brain project managers, and others. Generously spending their time for being interviewed, I granted them anonymity and confidentiality on sensitive issues so as to build a situation of trust throughout our conversation.

As Hilgartner reminds us, from a performative perspective, observations and interviews on the often-invisible work of *soft law* bodies should nevertheless not be confounded with attempting "to reveal what the backstage is 'really' like", but should help "to explicate collective modes of information control and to illuminate their role in stabilizing and destabilizing knowledges and social orders"[515]. Background knowledge on backstage deliberations is indispensable "for systemically analyzing how different forms of transparency, inclusiveness, and participation are (or might be) constituted"[516]. Yet, the written texts that close these epistemic politics and that are presented as the joint view of soft governance bodies to the public remain central for carving out the situated ways through which political communities reason, (re)order, and (re)imagine desirable innovation and its relationship to society.

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[513] Clive Seale et al., *Qualitative Research Practice* (SAGE Publications, 2004).
[514] Ivonne Küsters, *Narrative Interviews*, 2nd ed., Studientexte Zur Soziologie (VS Verlag für Sozialwissenschaften Wiesbaden, 2009).
[515] Stephen Hilgartner, 'The Credibility of Science on Stage', *Social Studies of Science* 34, no. 3 (1 June 2004): 447.
[516] Hilgartner, 450.

At the frontstage of soft law: Analyzing and interpreting the power of text

While ethnographic observations and interviews form critical background knowledge for studying the performance of *soft law* frontstage, the textual outputs of backstage processes still form the centerpiece of understanding the power of soft governance arrangements and instruments in contemporary innovation governance. It is when shared views on what 'ethical' or 'responsible' innovation in neurotechnology *is* and how it *ought* to be governed toward socially beneficial ends reach the frontstage of a publicly credible text that we can indeed speak of *soft law* documents as quasi-constitutional texts. Read as a "legal text"[517] that codifies the normative and ontological commitments of different political communities and their imaginaries of desirable innovation governance, the diversity of policy documents produced by and around *soft law* in neurotechnology innovation form the heart of my analysis.

The locus of *soft law* in science and technology policy should not be reduced to the single set of guidelines or principles advanced by authoritative documents such as the Presidential Commission's "Grey Matters" Volumes or the HBP's "Opinions". As the norms constructed by soft governance bodies are usually distributed over several texts, document analysis[518] across cases entails gathering, coding, and analyzing a great number of grey literatures. The case studies mobilized in this thesis all have their own ecosystems of documents, ranging from working papers, policy reports, academic articles, and books, to conference proceedings, archival texts, official statements in newspapers or on websites, and those parts of meetings and workshops available in written form to general audiences. What characterizes the specific approach to *soft law* in a case emerges from reading them next to and in relationship with each other, including questions of how a view on neuroscience and -technology or ethics and public engagement has been framed, where it has travelled over time, which shifts might be observable during the historical period set for analysis, and whose views gained, or lost, authority in public reasoning on innovation and its governance. In Jasanoff's words,

> To understand how policy domains are carved out from the political sphere and rendered both comprehensible and manageable, we must employ analytic categories different from those of decision makers operating within the policy process. We need a conceptual language that can grapple with both continuity and change, while rejecting some of the rigidities of structure.[519]

Four domains of analysis in particular have been proposed by Jasanoff for approaching the co-production of public reasoning in a comparative fashion. First, policy problems and solutions are framed differently across contexts, such as the problem of insufficient attention to ethics in the US or a lack of

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[517] Jasanoff, *Reframing Rights*, 11.
[518] Prior Lindsay, 'Documents', in *Qualitative Research Practice* (London: SAGE Publications, 2004), 345–60.
[519] Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*, 23.

public participation in the EU, and their corollary resolution through the integration of Neuroethics or RRI in innovation governance. Innovation too is subject to diverging frames, presented either as a powerful fix for social and economic challenges, or as a challenge to the flourishing of societies and markets. These frames can be quite rigid and stable, or flexible and shifting, but as an "intensely social activity", they pre-condition or "fundamentally alter people's perceptions of what is real in the world around them"[520]. As discussed earlier, this is particularly the case where collective frames of innovation's future impact on society shape governance decisions and principles in the present. Second, and as becomes especially visible in co-productionist analysis of the science/law nexus, acts of framing rely on the drawing of boundaries, whether between 'facts' and 'norms', 'experts' and 'publics', or 'responsible' or 'irresponsible' innovation. Just as science mobilizes boundary work "to create a public image for science by contrasting it favorably to non-scientific intellectual or technical activities"[521], so do *soft law* bodies construct their authority over the settling of science and technology's normative governance through powerful acts of boundary-work.

Third, the ways *soft law* in science and technology policy is framed and demarcated from other types of governance is shaped by heterogeneous forms of institutional reasoning and discourse. The routines through which policy institutions such as the OECD or the European Commission "think"[522] and talk about the relationship between science, technology, and society and its governance is key for embedding 'vanguard visions' of 'ethical' or 'responsible' innovation in the public imagination via *soft law*. Lastly, while particular forms of reasoning and discourse typically are solidified in the very identities of institutions – for instance, in the OECD's self-description as a 'window to globalization' or the EC's long-held imagination to develop from an economic to a political union – they can also be re-configured through novel claims of political identity, such as the EU's aspiration to become an 'Innovation Union' or the OECD's aim to achieve 'inclusive globalization'. During these transformations, new types of knowledge, expertise, and discourse emerge that "expand social roles and alter their meanings"[523], for instance in the ways that 'lay publics' are re-imagined from passive to active agents in technoscientific development.

Tracing the reasoning on and imagination of soft law: The role of democratic fictions in innovation governance

These broader analytical dimensions, in turn, aide us in connecting specific case studies on the making of *soft law* in innovation governance to the wider political cultures in which they are embedded; at the same time, they allow us see how political cultures are re-configured, or shaped, by changing ways of reasoning and practicing the governance of emerging science and technology. A central observation of

[520] Sheila Jasanoff, 'Why Compare?', in *Designs on Nature* (Princeton University Press, 2007), 24.
[521] Gieryn, 'Boundary-Work and the Demarcation of Science from Non-Science: Strains and Interests in Professional Ideologies of Scientists', 781.
[522] Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*, 27.
[523] Jasanoff, 'Why Compare?', 29.

analysis in this thesis is that shifts to imperatives of innovation in the US, EU, and OECD are co-produced by the constitutional imagination fueled through *soft law* – that is, an imagination of democracies as a sovereign actor vis-á-vis emerging science and technology with the power to regulate innovation toward socially desirable ends. To understand the origins of these forms of imagination, analysis needs to zoom out from the epistemic, normative and ontological politics of micro-cases to the "necessary political fictions"[524] that sustain the performance of democracy in modern societies. These involve the different imaginations of desirable 'social contract', including ideals and models of legitimate government, the areas of individual freedom to be regulated through constitutional law, and the distribution of power between subjects and rulers. In this thesis, they are traced back to the political philosophies proposed before and since the great revolutions of the 18th century, such as liberalism and republicanism, or a mix of both. Rooted in the North-Western hemisphere, my cases share a broad commitment to liberal democracy, yet such commitments are interpreted quite differently across each case, through which both the contingency of political culture as well as the situatedness of democratic ideals in modern forms of imagination becomes evident.

As elaborated by Ezrahi, such an analytical move is particularly difficult vis-á-vis those forms of democratic imagination in which we are socialized ourselves, as notions such as 'sovereignty', 'representation', or 'participation' are deeply naturalized within political culture, hindering a critical eye on their performative and fictitious nature and effects. Here, we hence need to become reflexive of our own, situated visions[525] of democratic politics through approaching its different elements as empirical data rather than departing from these as given 'facts' set *a-priori*. But once such a perspective is taken, analysis can open up important insights into the democratic 'realities' of *soft law* politics, and specifically the absences of de-facto forms of democratic legitimacy of normative and ontological ordering work performed by soft governance bodies. This work is powerful because it projects particular ideals of democratically regulated science and technology and achieves to make these ideals credible – and hence also realizable – for societies. Following Ezrahi,

> In a sense, we are always shifting between fictions that have solidified in our culture as facts and those that have not (or not yet) so crystallized. When the hypostatized fictions of other cultures or societies do not converge with ours, we more readily see them as 'soft' facts or recognize them as fictitious. Western publics tend to accept the sovereignty of the people or of human rights as givens that must be universally acknowledged, although they are never satisfactorily acted upon or fully practiced. When a political fiction like that of the sovereignty of the people acquires such a degree of credibility, it becomes apparent that it is, at least partly viable. [526]

[524] Ezrahi, *Imagined Democracies: Necessary Political Fictions*.
[525] Haraway, *Primate Visions*.
[526] Ezrahi, *Imagined Democracies: Necessary Political Fictions*, 162.

How these constitutive visions are brought to bear on the governance of innovation through *soft law* then forms a next step for analysis in which democratic ideals of constitutional government are put into conversation with social contract ideals on science and technology. Here, different propositions advanced with regard to the appropriate relationship between science and democracy, particularly since the institutionalization of science policy in democratic governments during the 20th century, form important material. In my analysis, they include renowned texts, such as Vannevar Bush's "Science, the Endless Frontier", Michel Polanyi's "Republic of Science", as well as more recent approaches on the 'democratization' or 'politicization' of technoscientific innovation. Elements of these imaginaries are as self-evident and taken-for-granted in our perception of the relationship between science, technology and society as those of democratic politics, particularly when it comes to linear models of innovation, the idea that knowledge and technological development drive social progress, or the often-repeated narrative that the law lags behind relentless discovery in science. Yet, as STS analysts, we are by nature reflexive and critical of these ideals, trained in de-constructing them through symmetrical methodology, and many of us even engaged in attempts to change policy cultures that rest on these long-held beliefs. This innate skepticism is often absent in STS analysis of contemporary science and technology policy and its turn to *soft law* as governance instrument to better align innovation with democratic publics.

Staying symmetrical in the analysis of soft law: The need for critical reflexivity

To study the power of *soft law* in innovation governance from a rigorously symmetrical perspective implies (dis)engagement with our own understanding of democracy and its legitimate relationship to science and technology. While the rise of socially inclusive language and practice in science and technology policy over the last two decades could be read as success story for STS's more engaged strands, it has also received widespread critique, particularly with regard to the construction of publics in the "new governance"[527] of innovation and the bureaucratic logics and modes of self-justification therein (see chapter 2). From Brian Wynne' analysis of 'Deficit Models of the Public', in which institutional responses "hit the notes" but "miss the music" [528], Alan Irwin's "Politics of Talk"[529], and Uli Felt's and Maximilian Fochler's identification of participation exercises as "Machineries for Making Publics"[530], STS analysis has been painstakingly critical toward the construction of publics and democratic engagement in governance contexts. Critique has been voiced, for example, on the closure of issues in participation and the "instrumental" rather than "substantive" uses of participation[531];

[527] Irwin, 'The Politics of Talk: Coming to Terms with the "New" Scientific Governance'.
[528] Brian Wynne, 'Public Engagement as a Means of Restoring Public Trust in Science – Hitting the Notes, but Missing the Music?', *Community Genetics* 9 (1 February 2006): 211–20.
[529] Irwin, 'The Politics of Talk: Coming to Terms with the "New" Scientific Governance'.
[530] Ulrike Felt and Maximilian Fochler, 'Machineries for Making Publics: Inscribing and De-Scribing Publics in Public Engagement', *Minerva* 48, no. 3 (1 September 2010): 219–38.
[531] Stirling, '"Opening Up" and "Closing Down": Power, Participation, and Pluralism in the Social Appraisal of Technology'.

around the disciplining of unruly publics through the formation of "invited publics"[532]; and the questionable representativeness of such "mini-publics" for modern societies as a whole[533] and for "future societies" in particular[534]. Aimed at critique toward broader enactments of democracy through particular frames of publics in technoscientific governance, Brown, for example, has accused policymaking of an impoverished notion of politics implied by an overt focus on participatory practices[535], while Thorpe and Gregory[536] have argued that participation is primarily a placating mechanism that enrolls publics into neoliberal agendas and begets new expert elites. Participatory practices, in this critique, form part of the technocratic repertoire of deliberative democracy that is propagated by a new class of democracy-for-innovation experts and mainstreamed across places and domains[537], provoking recent calls for "remaking participation"[538].

As participants in the participatory turn in science and technology policy, it seems STS theory and engaged research have partly become victims of their own success. This is particularly true for younger generations of STS researchers like myself[539], which are confronted with the analytical dilemma that "while our mentors presented us with the idea that public participation was the *solution*, we increasingly feel that we have inherited as the *problem"*[540]. This "problematic position"[541] in and for STS derives from a widely lacking mode of reflexivity toward tacit ideals of democratic politics in research and analysis[542]. Whereas "STS *as* political theory offers a set of intellectual resources and models on the basis of which competing normative political visions of science and technology can be clarified, analyzed, and criticized"[543], it is rarely self-conscious and critical *of* the political theories that inform collective imaginaries of democracy in contemporary science and technology policy (and that

532 Brian Wynne, 'Public Participation in Science and Technology: Performing and Obscuring a Political–Conceptual Category Mistake', *East Asian Science, Technology and Society: An International Journal* 1, no. 1 (23 November 2007): 99.
533 Felt and Fochler, 'Machineries for Making Publics'.
534 Franziska Engels, Alexander Wentland, and Sebastian M. Pfotenhauer, 'Testing Future Societies? Developing a Framework for Test Beds and Living Labs as Instruments of Innovation Governance', *Research Policy* 48, no. 9 (November 2019): 103826.
535 Mark B. Brown, *Science in Democracy: Expertise, Institutions, and Representation* (Cambridge, MA, USA: MIT Press, 2009).
536 Charles Thorpe and Jane Gregory, 'Producing the Post-Fordist Public: The Political Economy of Public Engagement with Science', *Science as Culture* 19, no. 3 (1 September 2010): 273–301.
537 Jan-Peter Voß and Nina Amelung, 'Innovating Public Participation Methods: Technoscientization and Reflexive Engagement', *Social Studies of Science* 46, no. 5 (1 October 2016): 749–72.
538 Chilvers and Kearnes, 'Remaking Participation in Science and Democracy'.
539 I have presented my own doubts and queries with regard to my engagement in policy settings during a policy roundtable at the meeting of the Science and Democracy Network in 2018, see *SDN Policy Roundtable* (Harvard, 2018).
540 Ana Delgado, Kamilla Lein Kjølberg, and Fern Wickson, 'Public Engagement Coming of Age: From Theory to Practice in STS Encounters with Nanotechnology', *Public Understanding of Science* 20, no. 6 (1 November 2011): 826–45. (their emphasis)
541 Hilgartner, Prainsack, and Hurlbut, 'Ethics as Governance in Genomics and Beyond'.
542 This critique has also been voiced, amongst others, by Van Oudhesden for analysis of the "politics of RRI"; van Oudheusden, 'Where Are the Politics in Responsible Innovation? European Governance, Technology Assessments, and Beyond'.
543 Thorpe, 'Political Theory in Science and Technology Studies', 64.

STS helps to bring about through its work in the policy room[544]). To be sure, many of the key insights of STS "can be read in terms of critiques of liberal assumptions, from such diverse perspectives as communitarian and conservative philosophy, Marxism and critical theory, feminism and multiculturalism"[545], specifically with regard to the authoritative role of scientific expertise in liberal politics. But beyond the enactment of liberal ideology *through science and technology*, how does liberalism form a constitutive part of modern societies' understanding, reasoning, and envisioning of desirable social order, including, but not limited to, emerging science and technology? What differences exist across communities, countries, and institutions when it comes to these 'civic epistemologies' of liberal democracy? And which ideals of innovation are enacted *through different conceptions of liberal democratic principles* in science and technology policy?

Asking these questions throughout the analysis of *soft law* in innovation governance is key for staying reflexive toward the "democracy paradox"[546] that STS research is confronted with today. It involves attention to the co-productionist dynamics between science and political culture, knowledge of political philosophy and particularly the theories proposed in Enlightenment visions of politics and science and a thoroughly symmetrical stance – not only with regard to epistemology and material politics, but also vis-á-vis political culture and its contingent ways of performing democratic order. It is through taking symmetry toward science, technology *and* society seriously that STS research can contribute to political debates and policy on science and technology, including those concerned with the governance of innovation through soft or hard law – by showing how scientific and technological *and* political order 'could have been otherwise'. As Jasanoff concludes in a plea for STS to move beyond political questions of epistemology, "such work is political in the deepest sense, for it reshapes, however subtly or tentatively, the way we come to grips with enduring problems of truth, power, agency, legitimacy, individual rights and social responsibility"[547].

Participating and engaging in the field: Opportunities, challenges, and uncertainties

Reflexivity toward our own commitments to desirable socio-technical order also extends to engagements with and participation in the production of *soft law* in science and technology policy. A symmetrical stance toward the construction of 'democracy' or 'innovation' does not imply a 'view from nowhere' on how socio-technical order is made and re-made in public policy, nor does it demand abstention from taking part in its turn to more inclusive politics of talk in innovation governance. Rather, our subjective and situated role in crafting knowledge for policy settings represents both an opportunity and a challenge for research. It is an opportunity in a somehow opportunistic sense, in that it allows us

[544] Andrew Webster, 'Crossing Boundaries Social Science in the Policy Room', *Science, Technology, & Human Values* 32, no. 4 (1 July 2007): 458–78.
[545] Thorpe, 'Political Theory in Science and Technology Studies', 63.
[546] Eva Lövbrand, Roger Pielke, and Silke Beck, 'A Democracy Paradox in Studies of Science and Technology', *Science, Technology, & Human Values* 36, no. 4 (1 July 2011): 474–96.
[547] Jasanoff, 'Beyond Epistemology: Relativism and Engagement in the Politics of Science', 397.

access to often secluded places and people with the authority to re-configure political discourse and practice. As I have elaborated above, it is instrumental to research on policy institutions and their ways of reasoning, but also with regard to the recognition of STS as a field that holds relevant knowledge for policymakers on science, technology and society relationships, their misconceptions, and potential ways of conceiving and conceptualizing them differently. This is also a challenge, particularly when research and engagement intersect, as I have experienced first-hand in my encounters with the policy-settings involved in the production of *soft law* for innovation in neurotechnology. To move in, across, and out of the places we study "requires renegotiation"[548] of our identities as "one finds itself with all sorts of cross-cutting and contradictory personal commitments"[549]: in my case, to constructivist analysis vs. the usually positivist parlance of policy; to ideals of 'epistemic justice'[550] vs. the expert-drivenness of public deliberation; to open-ended research vs. the need to 'close down'[551] policies within a given timeframe; or simply to our own perception as humble beings vs. the authoritative role we often gain as experts in speaking for 'society' and its relationship to science and technology.

Over the years, and through its characteristic commitment to multiplicity, STS has generated different views on these opportunities and challenges which kept the field in a loop of its own controversy that did not cease until today[552]. In one of the earlier discussions around the merits of the SSK, for instance, Scott, Richards, and Martin posited that "symmetrical analysis is an illusion: the methodological claim of neutral social analysis is a myth that can be no more sustained in actual practice than can the scientist's belief in a universal and efficacious scientific method"[553]. Researchers necessarily enter controversies through their analysis and findings, which more often than not take sides with those actors or epistemological claims "with less scientific credibility or cognitive authority" – "epistemological symmetry", in this critique, in effect lead to "social asymmetry or nonneutrality"[554]. As such, STS scholars perform a role as political as that of the actors under consideration. In a similar vein, Winner accused SCOT of "opening the black box" of technology but finding it "empty" of politics[555]. He argued that symmetry largely obscures "questions that require moral and political judgement"[556] from the analyst, and claim that "one must move on to offer coherent arguments about

548 Marcus, 'Ethnography in/of the World System: The Emergence of Multi-Sited Ethnography', 112.
549 Marcus, 113.
550 Shiv Visvanathan, 'Knowledge, Justice and Democracy', in *Science and Citizens: Globalization and the Challenge of Engagement.*, ed. Melissa Leach, Ian Scoones, and Brian Wynne (London: Zed Books, 2005), 83–94.
551 Stirling, '"Opening Up" and "Closing Down": Power, Participation, and Pluralism in the Social Appraisal of Technology'.
552 See, for instance, recent debates about "STS as science or politics" kicked off by Harry Collins, Robert Evans, and Martin Weinel, 'STS as Science or Politics?', *Social Studies of Science* 47, no. 4 (1 August 2017): 580–86.
553 Evelleen Richards, 'Captives of Controversy: The Myth of the Neutral Social Researcher in Contemporary Scientific Controversies', *Science, Technology & and Human Values*, 1 January 1990, 491.
554 Richards, 40.
555 Langdon Winner, 'Upon Opening the Black Box and Finding It Empty: Social Constructivism and the Philosophy of Technology', *Science, Technology, & Human Values* 18, no. 3 (1993): 362–78.
556 Winner, 373.

which ends, principles, and conditions deserve not only our attention but also our commitment [by taking a] stand on choices to develop or limit technologies available to humankind"[557].

As STS scholars increasingly assume a de-facto role as experts in policy debates around the democratic governance of technoscientific innovation, they also tend to increasingly favor "a certain type of normativity" in STS, which Radder has summarized in the following way:

> Almost everybody will agree with the claim that, in one way or another, and to a considerable degree, science and technology shape the (material, personal, social and cultural) worlds in which we live our lives. Hence from a democratic point of view it is entirely legitimate to try to influence – within the rules of the game – the way science and technology are being practiced and used. Moreover, if science and technology studies have really gained relevant insights, including these insights can only improve the democratic debate and decision-making process.[558]

And indeed, many in the field agree that STS has much to offer to debates and policies on a democratization of science and technology. Amongst others, Bijker calls upon STS researchers to become "public intellectuals" "who can act as knowledgeable guides and members of civic society" through taking the identity of both "scholars and social engineers"[559]. ANT scholars, such as Callon, Lascoumes and Barthe, have proposed that STS can contribute to "acting in an uncertain world" through supporting socio-technical controversies that "reveal the multiplicity of stakes associated with one issue (and that) make the network of problems both visible debatable"[560], turning them into "powerful and original apparatuses for exploration and learning"[561]. And Latour famously suggested that STS can put the steam back into a "critique run out of steam" by moving from debates about "matters of fact" to "matters of concern"[562]. "To move public discussions into new directions" has also been advocated by Jasanoff when arguing that "what has to change is the *culture* of governance…and for this we need to address not only the mechanics, but also the substance of participatory politics"[563].

These propositions are important and, as we can see in this thesis, have had an enormous impact on the ways science and technology policy is framed and performed today. Yet, my own stance towards the role of STS in policy making and controversies on science and technology is more modest and ambiguous. When I began research for this thesis, I was convinced that a better inclusion of STS in the

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557 Winner, 374.
558 Hans Radder, 'The Politics of STS', *Social Studies of Science* 28, no. 2 (1998): 237.
559 Bijker, 'The Need for Public Intellectuals'.
560 Michel Callon, Pierre Lascoumes, and Yannick Barthe, *Acting in an Uncertain World: An Essay on Technical Democracy*, trans. Graham Burchell, Inside Technology (Cambridge, MA, USA: MIT Press, 2009), 30.
561 Callon, Lascoumes, and Barthe, 35.
562 Bruno Latour, 'Why Has Critique Run out of Steam? From Matters of Fact to Matters of Concern', *Critical Inquiry* 30, no. 2 (January 2004): 225–48.
563 Sheila Jasanoff, 'Technologies of Humility', *Nature* 450, no. 7166 (1 November 2007): 238.

politics of innovation is not only desirable, but that it is urgently necessary to put questions of participation, deliberation, and inclusion high on the agenda of democratic politics. Over the course of my research, however, I developed more uncertainty than approval of my agenda, particularly with regard to my own, seemingly stable commitments to 'democracy'. The more I inquired how democracy was put to work in the different contexts of my thesis, the more I started to wonder what this imaginary does to our current conception of politics, how it shapes what we perceive as a 'just', or 'fair', way of relating to each other, and whether or not we should hold this imaginary stable in a moment of history that seems increasingly at unease with holding democracy together. As of yet, I have no answers to this question, let alone an alternative vision on the re-making of democracy or its replacement by other forms of social ordering. In this sense, my reasoning toward the politics of technoscience has been deeply re-configured (or might we say co-produced?) by the people, practices, and histories that I have studied. Acknowledgement of the uncertainty that we produce through our research and of the possibility "to be moved"[564] by the things that we study, both in our normative commitments and toward their contingency, hence, seems a critical position to take in our engagements with science, technology, and society. This may not only take some burden off from our shoulders when it comes to our role as public intellectuals, but also allow us to better connect our methodological principles and theoretical insights with our practices of engagement.

[564] Marianne de Laet and Annemarie Mol, 'The Zimbabwe Bush Pump: Mechanics of a Fluid Technology', *Social Studies of Science* 30, no. 2 (2000): 253.

Conclusion

In this chapter, I have proposed a number of methods and materials for studying the making of *soft law* in contemporary science and technology policy. Through its emphasis on open-endedness, comparison, and the relational nature of phenomena constructed throughout research, multi-sited ethnography is a valuable companion to an analysis of the interaction between science, technology, and politics in the co-productionist tradition. An important benefit of this ethnographic style is that it allows us to relate micro-cases with macro-worlds, while acknowledging that linkages between these are primarily constructed through the researcher herself, including wider generalizations about the nature and effects of *soft law* in the governance of innovation. To follow and compare the multiple sites in which *soft law* gets co-produced, I suggested that approaching it as a performance is particularly useful, gearing our attention to what Hilgartner calls the 'front' and 'backstage' work of policy advice. By following actors, controversies, and forms of reasoning backstage, we can account for the ways in which *soft law* bodies craft their credibility, and more specifically, how they control their information politics in the frontstage texts presented to the public. Backstage research entails access to deliberations within these bodies, including participatory observations and interviews that prompt actors to narrate their views and experiences. Yet, I have argued that the frontstage texts produced by *soft law* bodies represent the center piece for analysis of their constitutional work, both in terms of what kinds of reasoning are deemed desirable for the governance of innovation toward socially beneficial ends, as well as for the collective visions enacted through them with regard to innovation's future impacts on society.

To understand the specific logics of current shifts in reasoning and imagining the governance of innovation in contemporary science and technology policy, I propose to read these texts as powerful devices for constituting an imaginary of democratic sovereignty vis-à-vis public imperatives of technoscientific innovation – that is, as embedded in and reconfiguring historically grown ideals of legitimate democracy. This implies tracing the origins of 'democratic fictions' in political philosophy, as well as visions of a desirable 'social contract' between science and society that have become authoritative in science and technology policy over the past century. Such analysis requires heightened reflexivity by research that goes beyond taken-for-granted narratives on the relationship between science, technology, and society to also include questioning common ideals of legitimate democracy, participation and representation, and social regulation. While STS scholars have been faithful to staying reflexive with regard to the framing and mobilization of publics in recent shifts towards more inclusive innovation governance, reflexivity toward our own, broader democratic fictions is less common in current STS research. This bias has also affected our engagements and participation with science and technology policy, leading to 'problematic positions' with regard to the multiple identities taken on during research and policy work. Whereas it is crucial to move from de-construction in STS to constructive engagements with the fields we study[565], the acknowledgment of uncertainty and ambiguity

[565] Sheila Jasanoff, 'STS and Public Policy: Getting Beyond Deconstruction', *Science, Technology and Society* 4, no. 1 (1 March 1999): 59–72.

with respect to what we deem desirable innovation governance *is*, and through which forms of democracy it *ought* to be made more inclusive of societies and their plural forms of knowledge, is no less important. I have argued that in this sense, researchers should stay open to be surprised, disappointed, and, in fact, re-configured through the fields that we study and that we aim to change for the better.

5. Constituting Public Order in Neuro-Innovation: Three Case studies

Three case studies illustrate the turn to *soft law* and *innovation* in contemporary science and technology policy that I aim to carve out in this thesis. All concerned with the emerging field of neuroscience and -technology and its embrace at the highest levels of public policy, they showcase in detail how soft governance bodies and texts serve as constitutive devices for the co-production of normative, ontological, and epistemic order around imperatives of innovation proclaimed by public institutions since the beginning of the 21st century. These micro-cases on large-scale neuroscience projects that the US and EU invested in since the early 2000s, and that the OECD sought to bring into dialogue through its efforts to draft a global "Recommendation for Innovation in Neurotechnology", are telling of the subtle ways of back- and the powerful forms of frontstage work performed by *soft law* within overall attempts to legitimize public proclamations of innovation as a shared, public good.

As we will see, such proclamations were not uncontroversial in the EU and US, as across both of these cases, a shift in reasoning and imagining desirable socio-technical order through science to a constitutive position for innovation provoked much critique, which needed to be tamed so as to gain and maintain public support for multi-billion investments in high-risk research, such as neuroscience's quest to decode the mysteries of the human brain. At the OECD, in turn, a re-configuration of long-held imperatives of innovation as an enabler of globalized markets to a joint vision on inclusive and responsible forms of innovation that 'leave no one behind' in globalization processes fueled an equally substantive controversy on the organization's *raison d'être.* Institutional crises, in all of the cases that follow, were underwritten by the difficult years of economic crisis set in motion by the crumbling of financial markets in 2008 and ensuing cuts in public spending and welfare, which proved to be a stress-test for science and technology policy and its legitimacy for democratic publics. The crisis years fueled both a turn to imperatives of innovation as powerful 'fix' to economies and societies, and the emergence of policy regimes that emphasized democratic control and, indeed, sovereignty over the governance of innovation toward socially desirable ends. *Soft law* bodies and texts in each case settled the tensions produced by these seemingly opposite poles of public reasoning and imagination by co-producing order between innovation and democracy in constitutional acts of ontological, epistemic, and normative boundary-work.

We will first follow the US BRAIN initiative's announcement as a 'moonshot' for the 21st century, promising cures, wellbeing, and economic growth to American citizens and businesses through innovative neurotechnologies. Public declarations of the many potentials of neurotechnologies beyond the bench and the bedside here were accompanied by public critique toward the misuse of science, taxpayer dollars, and technological solutionism in the name of society. Two 'ethics' bodies, one advising the highest levels of government – the "Presidential Commission for the Study of Bioethics" –, the other the governors and researchers of the BRAIN initiative itself – the "Neuroethics 'working' or 'sub'group"— were key in settling the uncertainty that marked these early years of innovation in American public reasoning on desirable science and technology. The deliberations held among their members, as well as the two bodies of texts crafted through their work, give detailed insights into the situated ways of knowledge and norm-production that is characteristic of American political culture, while at the same time shedding light on the re-configuration of American public reasoning and imagination provoked by recent declarations of technoscientific innovation as shared, public good.

Idiosyncrasy also marks the next case study, the EU's investment in the 'flagship' Human Brain Project (HBP), framed by the European Commission as a powerful instrument to sail Europe out of the crisis and for uniting European countries through joint investments in neurotechnology innovation. The HBP's set up as ICT project and its presentation to the public as neuroscience project for health caused no less controversy than experienced by its transatlantic counterpart, yet with wider-reaching effects for the maintenance of public credibility and legitimacy. Again, two forms of ordering work were essential to the tackling of this moment: one situated in the near past, in which a "Meeting of Minds" among citizens pre-constituted European reasoning on desirable neuroscience, the other installed to help the HBP in the present in the production of "Responsible Research and Innovation" through an "Ethics & Society" group. Marked from the beginning by an emphasis on public engagement, texts produced by both of these bodies were not only literally co-produced by citizens themselves, but also worked as powerful forms of co-producing a European public, or *demos*, with the capacity to craft collective order around innovation and shared rules for its governance toward social benefits. As such, the EU's case re-iterates the EU's long-held aspiration to move from an economic to a political union, at the same time as it reflects current reconfigurations in reasoning and envisioning European unity through 'responsible' technoscientific innovation.

Somewhere between and above the US and EU's production of *soft law* for innovation in neurotechnology, the last case delves into the OECD's process of producing a global recommendation on responsible neurotechnology innovation. Justified by the diverging ways the EU, US, and other member-states have put soft governance instruments to work in neuroscience projects, the OECD's BNCT working party aimed to find common ground on a shared vision for how to govern innovation in neurotechnology responsibly. For such a project to gain traction within the larger institutional context of the OECD and its Directorate for Science, Technology and Innovation, significant ordering work needed to be done to converge the organization's deep-seated econo-centric approaches to innovation with new forms of reasoning and imagining the central role of society in the production of globally inclusive science and technology governance. To gain credibility within the OECD's larger 'innovation crusade', several processes of ontological, epistemic and normative surgery were enacted, such as the integration of new forms of expertise, the delineation between issues in neurotechnology governance deserving global or local attention, and the construction of a view from 'nowhere' with regard to member-state frameworks, instruments, and interests in neurotechnology policy. As we will see, these processes represented quite an innovation in the organization's 'Innovation Imperative', while they were also embedded in wider institutional discourses and reasoning on economic globalization and free-market ideology.

In each case study, I first broadly describe the institutional contexts and historical trajectories in which the turn to *soft law* and *innovation* was situated, particularly with regard to the frames and boundaries around the relationship between science, technology, and society that have developed in each setting since roughly the 1950s. Changes in discourses on this relationship and new practices for its governance since the early 2000s are then illustrated by the micro-examples of *soft law* performance in each case, including the variegated ways that innovation in neurotechnology is proclaimed as central to the achievement of desirable futures. The widely different institutional histories, narratives, and visions, as well as heterogeneous performances of public reasoning on 'ethical' or 'responsible' innovation governance is reflected in the ways these case studies are analyzed, particularly when it comes to descriptions of the backstage work that is mobilized to control the frontstage texts that mark the disparate constitutional imaginaries enacted by *soft law* in the US, EU, and OECD. I conclude, compare and discuss them in the chapter rounding off the case studies.

6. Constituting Ethical Innovation in the US: The BRAIN Initiative and the Rise of Neuroethics

When the worldwide largest neuroscience project was announced in the US on 2 April 2013, no one less than the President himself took the stage to frame it for the public. Introduced by Director of the National Institutes of Health (NIH) Francis Collins as "our scientist in chief", President Obama's figure and his words were crucial for legitimizing an estimated total cost of 3 billion USD for a 10-year mission as ambitious as "cracking the code" of the human brain: the BRAIN initiative. Only a month earlier, the 2011 Budget Control Act had taken effect after Obama failed to reach a congressional deal on the budget sequestration of 1.2 trillion USD for mandatory cuts to defense and domestic spending[566], which confronted research, social services, and defense agencies with significant decreases in resources. The NIH itself was not exempt from the sequester, seeing its spending for the year shrinking by 5%[567]. In his introduction, Collins gently reminded the president of the delicate balancing act he was expected to perform between the project's contribution to the public good and its significance for the economy:

> The worst thing we can do in these challenging economic times is to stifle innovative thinking…It's exactly *that* innovation that holds immense potential, not just for the families whose lives it will change, but also for spurring new jobs and opportunities. The president understands this implicitly. He knows the importance of connecting scientific advances with solid science policy. And he knows the power of partnership.[568]

The BRAIN initiative had been conceived by the US Office of Science and Technology Policy (OSTP) as a grand challenge of 10 years within the wider White House Neuroscience Initiative, for which its deputy director Tom Kalil could find no humbler words than those of a "Moonshot"[569] for the 21st century. Continuing the legacy of big science projects such as the Human Genome Project (HGP), the BRAIN initiative wanted to overcome the "competition between the government and private funders"[570] that had accompanied the HGP by setting it up as a public-private partnership from the start. The HGP's quest for sequencing the human genome had seen a deep rivalry between national research institutes and the commercial genome data company Celera Genomics, which was eventually only resolved through a grand diplomatic gesture that set the US science and technology policy agenda for the future: "From this moment forward, the robust and healthy competition that has led us to this day ...

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566 Suzy Khimm, 'The Sequester, Explained', *Washington Post*, 14 September 2012.
567 National Institutes of Health (NIH), 'Fact Sheet: Impact of Sequestration on the National Institutes of Health', National Institutes of Health (NIH), 30 July 2015.
568 The White House, *President Obama Speaks on the BRAIN Initiative and American Innovation*, 2013.
569 Thomas Kalil, 'Policy Entrepreneurship at the White House: Getting Things Done in Large Organizations', *Innovations: Technology, Governance, Globalization* 11, no. 3–4 (July 2017): 4–21.
570 Rafael Yuste cited in Meredith Wadman, 'Behind the Scenes of a Brain-Mapping Moon Shot', *Nature* 495, no. 7439 (1 March 2013): 19–19.

will be coupled with enhanced public–private cooperation"[571] declared President Clinton in 2000.

A decade later, cooperation across federal, philanthropic, and private institutions in the BRAIN initiative included public institutions such as the FDA, DARPA, and the NSF; charitable "alliance members", such as the Allen Institute for Brain Science and the Kavli Foundation; and large corporations like Google, Medtronic, and General Electric. The bold design of the project, both in terms of resources and partners, was to advance knowledge about the brain *in vivo* through studying and mapping its circuits in action; better understanding the functioning and activity of the brain, in turn, was believed to enable the intervention in and treatment of brain disorders through new tools and technologies. Reaching a more comprehensive picture of the activity of 80 billion neurons in the human brain and finding ways to manipulate them not enough, Obama picked up Collins' hint and mapped the variegated and revolutionary potential of the BRAIN initiative for his audience:

> Imagine if no family had to feel helpless watching a loved one disappear behind the mask of Parkinson's or struggle in the grip of epilepsy. Imagine if we could reverse traumatic brain injury or PTSD for our veterans who are coming home. Imagine if someone with a prosthetic limb can now play the piano or throw a baseball as well as anybody else, because the wiring from the brain to that prosthetic is direct and triggered by what's already happening in the patient's mind. What if computers could respond to our thoughts or our language barriers could come tumbling down. Or if millions of Americans were suddenly finding new jobs in these fields -- jobs we haven't even dreamt up yet -- because we chose to invest in this project. That's what we're hoping for…that's why the BRAIN initiative is so absolutely important. And that's why it's so important to think about basic research generally as a driver of growth. [572]

The president's invitation for the public to imagine the many benefits of innovation in neuroscience re-affirmed the America tradition shaped by science advisor Vannevar Bush after WWII of rationalizing centralized federal spending in science by portraying it as a an "Endless Frontier" and a "pacemaker of technological progress": "since health, well-being, and security are proper concerns of Government", Bush wrote to President Roosevelt in 1945, "scientific progress is, and must be, of vital interest to Government." [573] His linear vision of scientific, technological, and social progress foresaw the role of Government to be limited to funding basic science and education – investing only in the 'front end' of the so-called innovation pipeline – from which technological inventions would flow by chance, giving industry a key role in their uptake and dissemination. Roughly 70 years later, health, wellbeing, and security were still vital for legitimizing large federal investments like the BRAIN

[571] Nature staff, 'How Diplomacy Helped to End the Race to Sequence the Human Genome', *Nature* 582, no. 7813 (24 June 2020): 460–460.
[572] The White House, *President Obama Speaks on the BRAIN Initiative and American Innovation*.
[573] Bush, *Science, the Endless Frontier*.

initiative. Yet, in 2013, the government was portrayed as a central player for ensuring the innovation pipeline worked from beginning to end, for which a partnership with the private sector in the tackling of 'Grand Challenges' such as the BRAIN initiative was seen as key[574]. Obama's engaging examples were chosen wisely in that regard, in that they illustrated neurotechnology's benefits for health and wellbeing while simultaneously emphasizing the innovative market potential of research on the brain. In other words, whereas Vannevar Bush had successfully made the case that *science* is a proper concern for government by contributing to the provision of the public good, President Obama sought to convince his audience that *innovation* is a fundamental public concern and essential to the country's economic and social health.

Framing Neuroscience as a Public Good

The announcement of the BRAIN initiative not only foresaw a particular relationship between the state, science, society and the economy it also attempted to re-position the public image of neuroscience that had been carefully crafted at the dawn of the millennium. Although the human brain has motivated biological and philosophical inquiry at least since Hippocrates, and attained philosophical fame with Descartes' anticipation of brain-mind dualism, neuroscience as a discipline did not come into existence until the 1960s. Put forward by "visionary" MIT researchers as a "big tent"[575] terminology with the aim to unite diverse perspectives from the molecular to the systems level so as to reach a coherent understanding of the brain, neuroscience quickly became a research program in several US Ivy-league departments and led to the worldwide foundation of neuroscience associations in the 1960s to represent its ambitions to funders and the public. The most powerful of these organizations, the by now 37 thousand members strong Society for Neuroscience, was key for bringing neuroscience to the federal agenda in the 1990s[576]. When its former president Dominick P. Purpura testified before the American US House of Representatives in 1990 requesting an increase in federal funding for the field, bipartisan support for the declaration of a "Decade of the Brain" had already been secured. Nevertheless, his appearance served as an important public performance for neuroscience's rightful place in public policy:

> Missions of high moral worth, such as the Decade of the Brain initiative, tell the people of the United States that their government cares about the essence of their humanity which is ensiled in the brain. Neuroscientists seek nothing more than to enrich the lives of millions of our citizens who share this concern.[577]

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[574] Dolores Modic and Maryann P. Feldman, 'Mapping the Human Brain: Comparing the US and EU Grand Challenges', *Science and Public Policy* 44, no. 3 (January 2017): 440–49.

[575] Hilary Rose and Steven Rose, *Can Neuroscience Change Our Minds?* (John Wiley & Sons, 2016).

[576] Murray Goldstein, 'Decade of the Brain. An Agenda for the Nineties.', *Western Journal of Medicine* 161, no. 3 (September 1994): 239–41.

[577] Dr. Purpura, Dean of Einstein Medical School, Congressional hearing, NINDS witness, representing society for neuroscience, United States Congress House Committee on Appropriations Subcommittee on the Departments of Labor, Health and Human Services, Education, and Related Agencies, *Departments of Labor, Health and Human Services, Education, and Related Agencies Appropriations for 1991: Hearings Before a*

Different from the 1970s US “War on Cancer”, the 1990s “Decade of the Brain” was a child of post-Cold War visions of political unification attainable through adherence to rational science and behavior. Neuroscience, as Dr. Purpura eloquently visualized, was not only about the brain but about the very core of humanity; caring for the brain, in turn, a way for the government to show care for its people. Whereas neuroscience was made credible as an “enrichment” for citizen’s lives, the speech was not pointing to the economic benefits conjured decades later by Obama but to the moral worth attainable through federal investment in neuroscience. The role of government was to recognize this worth by increasing federal funding and elevating the public appreciation of neuroscience. As two of Purpura’s colleagues contemplated in an assessment of the Decade, “(w)hen large resources are required for the pursuit of fundamental research, only continuing commitment by all segments of a democratic society can ensure success”[578].

Dr. Purpura’s framing persisted in the proclamation of the 1990s as the “Decade of the Brain”, envisioned by President George Bush as an “era of discovery” resting on the “nation’s determination to conquer brain disease.”[579] Rather than a concerted research project, a whole decade was directed “to enhance public awareness of the benefits derived from brain research”[580] coupled with increased funding for the field. Responsibility for enacting the new decade was distributed across federal agencies alone, and the role of the private sector and industry believed to be one of “augmenting” federal efforts. Unlike his successors, the vocabulary of “innovation”, “the economy” and “growth” was not mobilized once in Bush’s announcement: he presented neuroscience as a knowledge and public health-driven endeavor in the hands of government supported by business. Neuroscience in the 1990s was regarded as an “exploration, providing better insights into the what and the how of the nervous system in order to address the future”, as former NIH National Institute of Neurological Disorders and Stroke (NINDS) director Murray Goldstein put to the point: “unlike a war, it is not offering quick fixes to problems of the present.”[581]

Opening up controversial boundaries

Twenty years later, President Obama’s presentation of the BRAIN initiative as an all-hands-on-deck project driven by technology and towards economic growth, which could be augmented through governmental support of basic research, sparked an outcry in the US neuroscience community. The argument, which unfolded over a number of blog entries and newspaper commentaries by neuroscientists from all stages of career, centered around the boundaries and function of basic

Subcommittee of the Committee on Appropriations, House of Representatives, One Hundred First Congress, Second Session (U.S. Government Printing Office, 1990), 859.

578 Jones Edward G. and Mendell Lorne M., ‘Assessing the Decade of the Brain’, *Science* 284, no. 5415 (30 April 1999): 739–739.

579 George Bush, ‘Decade of the Brain: Presidential Proclamation 6158’, Library of Congress, 17 July 1990.

580 Bush.

581 Goldstein, ‘Decade of the Brain. An Agenda for the Nineties.’, 240.

neuroscience research and the entitlement of policymakers in re-drawing these boundaries for political and economic aims. What was at stake according to the project's harshest critics was the freedom of basic research, the distribution of scarce funding resources across the community, the misuse of science policy for technological development, and the reputation of the young field as a whole. 'Quick fixes' imagined in Obama's announcement were far from reachable according to some leading voices of the community, which made the motivations behind the large-scale investment a dubious enterprise: "What motivates people to pursue these big projects is not the belief that they will solve problems, says Michael Eisen, a biologist at the University of California, Berkeley. It's the belief that this is the way to get money"[582]. The governance of neuroscience through big science and the private sector was perpetuating the free pursuit of scientific research, which was a good in itself and which, different to policymaking, followed no instrumental motivations:

> Instead of Washington bureaucrats directing money towards some predetermined (and often political) goal, it should be a scientist making decisions, for the good of discovery. Leave science to the scientists, not the bureaucrats.[583]

> The BRAIN project typifies this administration's predilection for big government 'solutions' flavoured with Chicago-style politics. Central planning rarely works out well, especially not in science.[584]

The target of the critique was not only the government's trespassing of the boundaries between science, politics, and the economy, but the promissory language mobilized by Obama and colleagues to gain support for the initiative's investment. To many, the promise of immediate benefits arising from mapping the human brain was doomed to fail because of a blatant lack of basic knowledge about its inner functions: If neuroscience had not reached a comprehensive understanding of a fruit fly's brain[585] since its inception in the 1960s, how was it going to fulfil the promises of mapping *and* finding cures for the human brain in a 10-year project? Even if the project generated a return on investment for the government in monetary terms, the claims for health made in the announcement sat uncomfortably in some commentator's minds. Prof. Donald G. Stein of Emory's Emergency Medicine and editor of the critically acclaimed book "Buying in Or Selling Out: The Commercialization of the American Research

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[582] Wadman, 'Behind the Scenes of a Brain-Mapping Moon Shot', 584.
[583] Competitive Enterprise Institute, 'Obama's BRAIN Initiative: Brilliant Policy or Brute Waste?', Competitive Enterprise Institute, 15 July 2013.
[584] Meredith Wadman, 'Society for Neuroscience Quashing Dissent on BRAIN Initiative, Critic Complains', *News Blog* (blog), 15 April 2013.
[585] The fruit fly's brain was only fully mapped in 2020 – not by publicly funded neuroscientists but by Google. James Vincent, 'Google Publishes Largest Ever High-Resolution Map of Brain Connectivity', *The Verge*, 22 January 2020.

University"[586] was among the sharpest critics of what he understood as an intentional deception of the public:

> With the Brain Mapping Initiative, are we about to make a very heavy investment in a project that promises no end-points and nothing specific in the way of actual benefit? If so, we ought to be clear about it and not let the public think that 'miraculous cures' and full understanding of brain functions are just around the corner.[587]

Beyond its misperception as a cure-driven, translational endeavor, the BRAIN initiative also overpromised on the advancements of technology, according to Stein. The initiative, which had first appeared as a draft by scientists in 2012 under the title "Brain Activity Map"[588] (BAM), had turned from a mapping exercise into the "Brain Research through Advancing *Innovative Neurotechnologies*" (BRAIN) project by the time it was announced in 2013. A deep belief in tool-driven science was part of the idea from the start, when BAM's advocates used a quote from nuclear engineer Freeman Dyson to open their ideas to the community: "New directions in science are launched by new tools much more often than by new concepts"[589]. But whether neuroscience was pursued for discovery or for technological advance made exactly all the difference between good and bad science in Stein's view, who was quoted in an article on "Why Big Brain Projects are Premature" with the following statement:

> So, it's not about big science, it's about good (or bad) science. As Americans we love to think we can just throw technology at all the world's problems and all will be well. But at its best, the technology should follow the concept(s) and not the other way around.[590]

With the BRAIN initiative attacked on all fronts from within, the power of the Society for Neuroscience, which already had helped to put the field on the federal agenda in the 1990s, was once more mobilized to stabilize a positive public perception of the field. Received as a "patronizing" and "short-sighted" effort at disciplining the scientific community's open critique to the project[591], Larry Swanson, the then president of the Society for Neuroscience, wrote a concerned letter to its members. Rather than a discussion about the political economy of shifting boundaries between science,

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[586] Donald Stein, *Buying in Or Selling Out?: The Commercialization of the American Research University* (Rutgers University Press, 2004).
[587] Donald Stein, 'Obama's Brain Map Initiative Needs a Rethinking', *Livescience.Com* (blog), 5 April 2013.
[588] A. Paul Alivisatos et al., 'The Brain Activity Map Project and the Challenge of Functional Connectomics', *Neuron* 74, no. 6 (21 June 2012): 970–74.
[589] Freeman Dyson quoted in Alivisatos et al.
[590] Donald Stein, neuroscientist at Emory, in John Horgan, 'Two More Reasons Why Big Brain Projects Are Premature', *Scientific American Blog Network* (blog), 10 April 2013.
[591] Justin Kiggins, 'An Open Letter to Larry Swanson: Why It Is Important for Neuroscientists to Debate the Brain Initiative in Public', Personal blog, *Justin Kiggins* (blog), 15 April 2013.

technology, and the state, the letter reduced the controversy to the “scientific direction” of the field, which, according to Swanson, could only go in the right direction through unity in the scientific community’s support for the BRAIN initiative:

> While we should all continue to explore and discuss questions about the scientific direction, it is important that our community be perceived as positive about the incredible opportunity represented in the President’s announcement. If we are perceived as unreasonably negative or critical about initial details, we risk smothering the initiative before it gets started.[592]

[592] Kiggins.

6.1 Making Space for Bioethics

The figure of 'unreasonable critique' and its potential to stifle neuroscientific progress and the enthusiasm with which the BRAIN initiative kicked off in policy-circles remained central to the formation of epistemic and normative order around neuroscience in the years following its announcement. President Obama's praise of the project had not only fueled the public imagination of neuroscience's curing potential – for health and for the US economy – but had also anchored such vision firmly in the long-held American commitment towards reasoning about new knowledge and technologies via bioethics expertise, as well as within Obama's aspirational legacy of "ELSI" president[593]:

> Neuroscientific knowledge *could be – will be* – transformative. In the budget I will send to Congress next week, I will propose a significant investment by the National Institutes of Health, DARPA, and the National Science Foundation to help get this project off the ground. I'm directing my bioethics commission to make sure all of the research is being done in a responsible way. And we're also partnering with the private sector, including leading companies and foundations and research institutions, to tap the nation's brightest minds to help us reach our goal. [594]

The order of enumerating actors for the project's envisioned 'all-hands-on-deck' approach was not coincidental, as it located bioethics right in the middle and in-between some of the project's largest federal funders (NIH, NSF, DARPA) and those actors imagined as key for the translation of knowledge into technology (companies, foundations, R&D institutions), giving it a central role for ensuring neuroscientific knowledge eventually "will be transformative". Bioethical expertise was to be provided through the Presidential Commission for the Study of Bioethics (PCSBI), which had been created right at the beginning of Obama's presidency in 2009 through Executive Order 13521, charging its members with "identifying and promoting policies and practices that ensure scientific research, healthcare delivery, and technological innovation are conducted in an ethically responsible manner"[595]. The PCSBI quickly gained a reputation for offering "practical policy options"[596] to the government rather than mere philosophical deliberation, for which the preceding Presidential Council on Bioethics under President George W. Bush had been accused. The PCSBI had already produced various of these practical recommendations for the President, including on controversial fields such as of Synthetic Biology[597]

[593] Harvard University, *Genetics and Ethics in the Obama Administration | Alondra Nelson || Radcliffe Institute*, 2019.
[594] The White House, *President Obama Speaks on the BRAIN Initiative and American Innovation*. My emphasis.
[595] President of the United States, 'Executive Order 13521' (n.d.), Wikisource.
[596] Nicholas Wade, 'Obama Plans to Replace Bush's Bioethics Panel', 17 June 2009.
[597] Presidential Commission for the Study of Bioethical Issues, 'New Directions: The Ethics of Synthetic Biology and Emerging Technologies' (Presidential Commission for the Study of Bioethical Issues, 2010).

and Whole Genome Sequencing[598], when it received Obama's order to provide advice on the BRAIN initiative and beyond:

> I request that the Presidential Commission for the Study of Bioethical Issues engage with the scientific community and other stakeholders, including the general public, to identify proactively a set of core ethical standards – both to guide neuroscience research and to address some of the ethical dilemmas that may be raised by the application of neuroscience research findings.[599]

The PCSBI's charge to produce ethical guidelines for research on the one hand, and for the application of neuroscience on the other, was taken up quite literally by the commission during the drafting of two respective volumes entitled "Gray Matters", of which the first – "Integrative *Approaches* for Neuroscience, Ethics, and Society" – focused squarely on the integration of ethics in all levels of education and research, while the second – "*Topics* at the Intersection of Neuroscience, Ethics, and Society" – primarily revolved around potential uses of neuroscientific insights beyond the lab. As could be expected, both Gray Matters volumes did not fall short of underlining the importance of ethics for the BRAIN initiative. Yet, their ordering work was particularly important for re-stabilizing the constitutional position of science in American political culture as arbitrator of the public good, imagined to be provided through a linear model of research resulting in the provision of cures and technological innovation[600]. This position had come into renewed question during the controversy around the BRAIN initiative's technology-driven approach to basic neuroscience research, for which significant public legitimization and support needed to be mobilized.

Integrating ethics as companion to science: Gray Matters Volume 1

Preceding the publication of the Gray Matter Volumes in 2014-15, the role of ethics vis-á-vis neuroscientific research and innovation was deliberated at length during several public meetings of the PCSBI, which evolved around the balance of power between ethics and science and the possible scope of Bioethics' regulatory agency within the field. In one of the first gatherings of the commission on the Gray Matters Volumes in February 2014, arguments by chair Amy Guttman, President of the University of Pennsylvania and renowned scholar of deliberative democracy, around the reasoning for advocating better ethics integration in neuroscientific research were gently re-framed by her Vice Chair, James Wagner:

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598 Presidential Commission for the study of Ethical Issues, 'Privacy and Progress in Whole Genome Sequencing', SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, 11 October 2012).

599 Presidential Commission for the Study of Bioethical Issues, 'Gray Matters: Integrative Approaches for Neuroscience, Ethics, and Society Volume 1' (Washington D.C.: Bioethics Commission, May 2014), vii.

600 See Hurlbut, *Experiments in Democracy*, 277–78.

Guttman: "So the research needed in neuroscience is enormous, and it is worthy of the (ethical) focus. We also know as a Bioethics Commission that when you do cutting-edge research, it surges ahead when you have findings, now, and the findings are slow to come. You often don't know, and it can come to a grinding halt if there's one significant ethical lapse."

Wagner: "Amy, I'd like to amplify on a point you made, and it's a point that the working group has discussed, but I would like to comment or at least suggest something different about the order in which we discuss it, and that is this notion about good ethics and good science, and then we always say as a second comment that good ethics fosters good science. I'd like to see us flip that. Otherwise we have this notion I'm sure in a PI's mind that the role of ethics is to be regulatory. It's to set certain restrictions as opposed to understanding ethics as a companion discipline to the excellence of what's done."[601]

Throughout the meetings that brought about Gray Matters Volume 1 and 2, Wagner would repeatedly take the Principal Investigator's (PI's) 'hat' for fellow commission members with mixed backgrounds in ethics, science, engineering, and medicine, asking them to "flip" the perspective so as to ensure leaders of BRAIN Initiative's projects would not dismiss the recommendations as overtly constraining scientific freedom and respective modes of normative self-regulation. Wagner himself had changed perspectives during his career often enough: from degrees in engineering, to working on medical devices for the Food and Drug Administration, up to his appointment as Emory University's president. Engaging in significant boundary-work between ethics-as-restriction and ethics-as-companion to neuroscience, Wagner could successfully make the case for what would be henceforth circumscribed as "good science" and "good ethics", as well as the right relationship between them, in the commission's work for the BRAIN initiative:

Ethics is an important companion to science that both facilitates and enhances the scientific endeavor. Neuroscience research in general and the BRAIN Initiative in particular present important opportunities to integrate science and ethics for their mutual benefit. Successful ethics integration requires commitment, innovation, sensitivity to context, and adequate resources.[602]

Such reasoning around neuroscience and the modes through which it ought to be governed in a desirable way was constitutive for the first Gray Matters Volume, reiterating the framing of neuroscience as

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[601] Presidential Commission for the Study of Bioethical Issues, 'Transcript, Meeting 16 Opening Remarks and Session 1' (Washington, D.C., February 2014).
[602] Presidential Commission for the Study of Bioethical Issues, 'Gray Matters: Integrative Approaches for Neuroscience, Ethics, and Society Volume 1', 30.

immense opportunity for the country that had been put forth during the controversy about the BRAIN initiative's merits (see above). Ethics, in this frame, was not to be perceived as a potential regulator but as a helpful companion to science. With a focus on the neuroscience research process, the Volume and its recommendations declared a key role for "ethics integration" at all levels of neuroscience education and across all institutions involved in brain research, including federal funders and research agencies[603]. It targeted particularly neuroscience researchers grappling with "complex"[604] issues in "silos"[605], wherefore a "multidisciplinary"[606] approach was needed in which ethicists help to "prevent"[607] and inform issues arising in neuroscience R&D, and in which neuroscientists, in turn, take the "ethical lens" on their work at all stages and hence become "citizen-scientists"[608] who guard the public interest, all while ensuring the "progress of science"[609]. Importantly, the Volume not only declared ethics integration as an obligation of researchers to produce "good"[610] neuroscience in the "public interest"[611], but positioned neuroscience research itself as a moral obligation towards society:

> The potential of science to improve human welfare grounds a societal obligation to undertake and support scientific research generally. Scientists pursue knowledge both for its own sake and for the practical problems it can help to solve. Their professional role grounds a basic duty to pursue science for the public good and to consider carefully the possible consequences of their work.[612]

Despite the text's call for reform and "innovative approaches"[613] in the integration of ethics in neuroscience research, its four recommendations were foundational for re-legitimizing an order of ongoing self-governance of neuroscience which could be made even more "robust"[614] through inserting the right kind of expertise, framed as paramount for ensuring "public trust"[615] towards the BRAIN initiative and neuroscientific research more broadly. The first recommendation called for the integration of ethics "early and explicitly throughout research", the second for the evaluation of "existing and innovative approaches to ethics integration", the third for ethics integration through "education at all levels", and the fourth for the inclusion of "ethical perspectives on advisory and review bodies."[616] – all

603 Presidential Commission for the Study of Bioethical Issues, 25–30.
604 Presidential Commission for the Study of Bioethical Issues, 5.
605Presidential Commission for the Study of Bioethical Issues, 18.
606 Presidential Commission for the Study of Bioethical Issues, 25.
607 Presidential Commission for the Study of Bioethical Issues, 2.
608 Presidential Commission for the Study of Bioethical Issues, 17.
609 Presidential Commission for the Study of Bioethical Issues, 10.
610 Presidential Commission for the Study of Bioethical Issues, 11.
611 Presidential Commission for the Study of Bioethical Issues, 15.
612 Presidential Commission for the Study of Bioethical Issues, 14.
613 Presidential Commission for the Study of Bioethical Issues, v.
614 Presidential Commission for the Study of Bioethical Issues, 27.
615 Presidential Commission for the Study of Bioethical Issues, 2.
616 Presidential Commission for the Study of Bioethical Issues, 25–30.

of which delegated the responsibility to handle neuroscientific research, and particularly the ethics of its applications throughout society, to scientists and science administrators themselves. The key position of ethics in that self-regulatory system was envisioned to be primarily one of educating researchers as well as the general public in the right modes of reasoning around advances in new knowledge and technologies. Continuing the American bioethical tradition of framing and establishing rules for a Rawlsian[617] production of pluralist public reason around advances in knowledge and technologies, one of the Volume's co-authors described the PCSBI's approach in this way:

> This commission in particular was a huge proponent of deliberative democracy as a process and as a goal…They thought very strongly the integration of education into very early levels even starting with younger children integrating ethics into their education...They thought this was imperative, that we have an informed enough public to have these discussions.[618]

Gray Matters Volume 1's focus on ethics education was central to the ways the role of ethics would be taken up and democracy imagined throughout the BRAIN initiative in that it framed normative considerations of neuroscientific research as essentially a matter of educating individual scientists, policymakers, and citizens in the right modes of reasoning, rather than a matter to be settled by law or new forms of regulatory oversight. The PCSBI furthermore not only juxtaposed ethics to legislative action, rooting it firmly within the executive branch[619], but essentially portrayed it as more effective and beneficial (both for science and for society) than the law:

> We can, as a society, have laws and regulations to govern the ethics of medicine, the ethics of science, but they're not going to be effective unless every citizen has a good sense of how important ethics and science is and what ethical science is. And that requires public education.[620]

Settling the intersection of ethics, science, and innovation: Gray Matters Volume 2

Grounding the PCSBI's work on good and bad ethical "practice" would also become central to the second PCSBI Volume on Gray Matters, "Topics at the Intersection of Neuroscience, Ethics and Society", which was released in 2015 so as to respond to President Obama's second charge to the

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[617] See Hurlbut, *Experiments in Democracy*, 277–78.
[618] Interview Nr.19, October 2017
[619] Some commentators have described the relationship between the Presidential Ethics Committees as one of "Arms Length", suggesting an independent relationship between government and committees on equal footing. My analysis suggests a different reading, in that it places ethics work done through committees as central for executing the 'laws' generated by science. Jason L. Schwartz, 'A Broader Bioethics: Topic Selection and the Impact of National Bioethics Commissions', *Hastings Center Report* 47, no. S1 (1 May 2017): S17–19.
[620] Presidential Commission for the study of Bioethical Issues, *How Does the Bioethics Commission Work?*, 2014.

commission – that of ethical implications arising from new neurotechnologies, which arguably was the area where most controversy had spun during the initial stages of the BRAIN initiative. Different to the first Volume, the recommendations went beyond reasoning about ethical neuroscience research alone and instead focused on the application of such research in three selected domains: cognitive enhancement, consent capacity in research, and the use of neuroimaging techniques in the courtroom. For these "particularly controversial"[621] areas of application, which had "captured public attention"[622] in the form of "hyped, often misinformed"[623] debate, the report sought to "clarify the scientific landscape", "identify common ground" and "clear a path to productive discourse to navigate difficult issues as they arise"[624]. A productive discourse, in the eyes of chair Amy Guttman would take care of resolving uncertainties early, particularly for neurotechnologies that could not easily be classified within a continuum from technological applications for research to those for medical and treatment purposes, to uses in areas outside of benches and bedsides:

> When you draw bright lines when there's a continuum there are always these gray areas. But you just bring research to a standstill if you can't do that. And if you have uncertainty, uncertainty is the worst possible situation to be in. So this has a kind of urgency to it as well as an importance to it for the reasons that—and underscore that it has to be—by its inherent and its practical and its ethical nature, it has to be bringing the neuroscience and the ethics together.[625]

Yet, attempts at settlement of the gray zones arising from the potential large-scale use of neurotechnologies beyond medical and clinical applications expected from the BRAIN initiative provoked a number of discussions within the PCSBI's preparatory meetings themselves, which are telling of the significant backstage work[626] undertaken to control the sharp boundaries, as well as the authority and credibility, of ethics and science erected by the PCSBI's Gray Matter Volumes. Controversy between commission members arose particularly around how to define and mobilize key concepts underlying each of the areas selected for deliberation: "enhancement", the "capacity to consent", and "science and the law". Were these the right terms to frame the report – and the problems – in the first place, or were they re-creating hyped expectations towards neuroscience's application potential that the BRAIN initiative could impossibly meet? How far should the commission go in

[621] Presidential Commission for the Study of Bioethical Issues, 'GRAY MATTERS Topics at the Intersection of Neuroscience, Ethics, and Society Volume 2', 12.
[622] Presidential Commission for the Study of Bioethical Issues, 'GRAY MATTERS Topics at the Intersection of Neuroscience, Ethics, and Society Volume 2', 12.
[623] Presidential Commission for the Study of Bioethical Issues, 'Gray Matters: Topics at the Intersection of Neuroscience, Ethics, and Society Volume 2' (Washington D.C.: Bioethics Commission, March 2015), 13.
[624] Presidential Commission for the Study of Bioethical Issues, v.
[625] Guttman in Presidential Commission for the Study of Bioethical Issues, 'Transcript, Meeting 19, Session 3' (Salt Lake City, Utah, 5 November 2014), 3.
[626] Hilgartner, *Science on Stage*.

speculating about future uses of neurotechnologies, and on which evidence-base could they base their ethical assessments? And was there really anything different in neuroscience compared to gene-editing or other biomedical technologies that were already covered by existing guidelines and PCSBI's previous work? In sum, given the great uncertainty of neurotechnological development in the future, which space was there for legitimizing a new set of recommendations by the PCSBI that would reach well beyond their authority as Bioethics committee usually concerned with research and medical ethics only? Again, the science perspective provided by Vice-chair of the PCSBI James Wagner was key for setting the stage of the discussions, particularly for reminding members of the commission to not trespass the boundaries of their mandate. Opening one of the meetings, Wagner prompted the gathered experts in this way:

> If you are like me, you also have been tempted to let your mind stray a bit about thoughts and opinions maybe even beyond the scope of what our Commission is called to do. And if you have not had your mind do that, good for you. But if you have, as I have, it's probably worth a reminder that we have been assembled as we have to consider, to alert, inform, opine on what it is that matters of ethics; how it is that matters of ethics should shape the actions of researchers, policymakers, producers, service providers, health providers, and politicians. We are not ultimately policy makers, research funders, or regulators or politicians, for that matter, thankfully. In fact, I like to imagine the work we do is more foundational and more long-lasting. So with thanks for that moment of reminder, let's get on with the agenda.[627]

Informing the potential of science

Despite Wagner's reminder, commission members could not resist letting their minds "stray a bit" during the meetings as they engaged in an unusually heated debate over the potentials of neurotechnologies and the role of ethics in it. Discussions around brain "enhancement" in particular took a sharper tone in light of Guttman's provocation to think through the specific challenges of cognitive enhancement as compared to other techniques with the potential for human improvement, such as genetic engineering. As commission members went into the speculative domain of the possible parallels between both domains, they crossed the lines of Wagner's understanding of the commission's role in that they dared to bring to the fore judgements and differentiation about morally acceptable and unacceptable forms of cognitive enhancement. Member of commission Anita Allen, Professor of Law and Philosophy and Vice-Provost for Faculty at the University of Pennsylvania, for example, drew a 'scary line' around what she perceived could become a 'Dolly moment' if widespread use of neuroenhancers would become commonplace:

[627] Wagner in Presidential Commission for the Study of Bioethical Issues, 'Transcript, Meeting 19, Opening Remarks and Session 1'.

I think, (the) scary line that we may not want to cross is where you have a human being who has been manipulated such that they no longer experience negative emotions or regret, sadness; their painful memories…are dispelled. I think we would – to me that's a Dolly moment when it's possible to do that, and we are tempted to do it. And it may be that it's not a drumline change, it's a change in one person. But the idea of human beings who are just like us except they are not burdened by pain, regret, sadness, et cetera, that, to me, is something of ethical import.[628]

Dolly, arguably the world's most famous sheep, made history in 1996 for being the first cloned animal, which also produced an enduring legacy of ethical controversy around whether genetic engineering of animals, and expansion of such practice to humans (e.g., for selection of desirable mental or bodily traits), is normatively justifiable and desirable for humankind. The controversy had not only shaped the evolution of "Ethical, Legal, and Social Impacts" (ELSI) research and frameworks trialed in the HGP - the BRAIN initiative's often-cited role model in terms of scope and scale -, but quickly also resulted in a voluntary moratorium on the cloning of human babies by leading US biologists in 1997[629], which henceforth formed a constitutive *'lieux de mémoire'*[630] for American science and society relationships. The "Dolly moment" conjured by Allen brought into sharp relief the possible power of PCBSI's recommendations in the future governance of front-line neuroscience research in the BRAIN initiative. Co-chair Wagner immediately jumped in, disciplining the group to stick to their foundations and charge, which he interpreted in this way:

I'm concerned…we have drifted into a realm that I associate with something that we addressed before and actually discharged, and that was the precautionary principle that says one shouldn't even consider doing research in areas that could lead to applications that we can imagine being detrimental, right? I think we have a lot to contribute. And I hope, even if I'm wrong and we should be talking so heavily about applications, speculative and demonstrably possible, even if I'm wrong and we should be talking about those things, there is another rich conversation that we need to have in this area about where the knowledge gaps are that can help us ethically inform future uses. And in the past, our character has been to say that we don't find the pursuit of knowledge immoral in and of itself.[631]

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628 Anita Allen in Presidential Commission for the Study of Bioethical Issues, 'Transcript, Meeting 19, Session 2' (Salt Lake City, Utah, 5 November 2014).
629 Science News Staff, 'Biologists Adopt Cloning Moratorium | Science | AAAS', *Science*, 19 September 1997, sec. Biology.
630 Pierre Nora, 'Between Memory and History: Les Lieux de Mémoire', *Representations*, no. 26 (1989): 7–24.
631 Wagner in Presidential Commission for the Study of Bioethical Issues, 'Transcript, Meeting 19, Session 2', 2.

Wagner's ostensive reluctance to embrace moral evaluations by the PCSBI with regard to possible applications of neuroscience and his demarcation of the moral acceptability of free knowledge pursuit from more precautionary approaches in fact laid bare the normative ordering solidified throughout both Gray Matters Volumes: unrestrained pursuit of knowledge, even if with possibly detrimental effects, was a moral good in itself, and restricting such progress due to speculative fears of technology's impact an inherently immoral act. Fenced in by such dichotomy, the space for ethics was one of enriching the moral good by pointing to knowledge gaps that could inform the ethical use of technologies emanating from science.

Exemplified by the recommendations on cognitive enhancement which the committee eventually managed to produce, "scary lines" of controversy were resolved by several acts of ontological surgery around what cognitive enhancement *is* in the first place, and whether new ethical norms were needed depending on its definition. For instance, the increasing use of drugs such as Ritalin, Adderall, or Modafinil, as well as neurotechnologies such as Deep Brain Stimulation (DBS) in healthy individuals and for purposes beyond treatment of neurological disorders, such as for augmenting memory and learning capacities, presented exactly that "uncertain" continuum alerted to by Amy Guttman which needed to be resolved through ethics so as to not "bring research to a standstill". As advocated by some of the leading US Bioethicists and science-media in the years preceding the PCSBI's work on the matter, enhancement had been wrongly positioned as a "dirty word" in that continuum – society, according the experts, should instead embrace drugs and technologies for enhancement "in the same general category as education, good health habits, and information technology – ways that our uniquely innovative species tries to improve itself"[632].

Such views remained central in the PCSBI's settling of the matter. Most significantly, the terminology of cognitive enhancement was replaced by "neural modification" in the volume, so as to locate neurotechnologies for cognitive enhancement next to forms of modification of brain function presented as common and already in use, here understood as "low-technology strategies such as healthy diet, adequate exercise and sleep, lead paint abatement, high quality educational opportunities, and toxin-free workplaces and housing."[633] This framing not only suggested that human beings more generally engage in modifying their brains in a variety of ways (and even while asleep), but that interventions through neurotechnology were essentially undistinguishable from such normal forms of every-day neural enhancement. Such naturalization of neurotechnologies beyond medical use in turn enabled their presentation as morally unproblematic within the recommendations, through which the commission could defy those moral judgements on technologies potentially arising from neuroscience in the BRAIN initiative rejected by Wagner:

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[632] Henry Greely et al., 'Towards Responsible Use of Cognitive-Enhancing Drugs by the Healthy', *Nature* 456 (January 2009): 702.

[633] Presidential Commission for the Study of Bioethical Issues, 'Gray Matters: Topics at the Intersection of Neuroscience, Ethics, and Society Volume 2', 3.

> Altering the brain and nervous system is not inherently ethical or unethical. Ethical assessment of neural modification requires consideration of who is choosing the modifier, what is being chosen, what its purposes are, who stands to benefit, and who might be harmed. Members of the public must be well-informed to make educated, practical decisions about personal health and wellbeing, and participate in collective deliberation and decision making about societal applications of neural modifiers.[634]

Within this frame, recommendations on how novel neurotechnologies for cognitive enhancement *ought* to be governed could stay within the well-confined boundaries of ethics and science usually embraced by American political culture: science produces facts upon which ethics draws in the production of normative reason[635] around new knowledge and technologies. Recommendations in Gray Matters Volume 2 all reflected such cultural commitments to the authority of science. For the case of "novel" neural modifiers, for example, the commission identified "few data…available on the prevalence of the use of neural modification interventions for cognitive enhancement purposes", wherefore it "supports research to better characterize and understand novel neural modification techniques to augment or enhance neural function"[636]. Here, ethics recommendations served as a vehicle for legitimizing more public research on human enhancement, and for delegating responsibility to deal with potential 'dolly moments' to the individual in her freedom to choose different forms of modification and for different kinds of purposes, while adhering to utilitarian judgement on their benefits and harms.

Constituting ethical reason beyond science

At the same time, the framing of science as an enabler of publicly desirable forms of enhancement also served to carve out a space for the role of ethics in neurotechnological innovation beyond health. Under the banner of safety, the recommendations towards cognitive enhancement expanded from calling for more research to laying out the basic criteria through which large-scale enhancement of individuals with neurotechnologies, once in place, could become morally reasonable and desirable, namely through a just dissemination of such technologies throughout society:

> If safe and effective forms of cognitive enhancement become available, they will present an opportunity to insist on a distribution that is fair and just…Limiting access to effective enhancement interventions to those who already enjoy greater access to other social goods would be unjust. It might also deprive society of other benefits of more widespread enhancement that increase as more individuals have access to intervention.

[634] Presidential Commission for the Study of Bioethical Issues, 3.
[635] Hurlbut, *Experiments in Democracy*, 9.
[636] Presidential Commission for the Study of Bioethical Issues, 'Gray Matters: Topics at the Intersection of Neuroscience, Ethics, and Society Volume 2', 4.

> In addition, more widespread enhancement might help to close some gaps in opportunity that are related to neural function, such as educational attainment or employment.[637]

In this view, neural modification beyond therapeutic needs should not be reserved to elite groups such as Ivy-league students in a quest to elevate test performance[638], who received heightened attention in the years surrounding Gray Matters' Volume 2 drafting process as "Generation Adderall"[639]. In the recommendations, it was envisioned to be ethically legitimate once becoming available to society writ large, through which innovation in enhancement itself would become framed as a mode of governance for reaching distributive justice[640] in education and employment, as well as for the creation of new markets.

The presentation of Nick Bostrom, Professor of Philosophy and Director of the "Future of Humanity" Institute at Oxford University, in the PCSBI's meetings around enhancement had evidently left an enduring impression on commission members when drafting the recommendations. Bostrom, a leading figure of the transhumanist movement[641], made headlines in 2014 for his best-selling book "Superintelligence: Paths, Dangers, Strategies", through which he brought nightmares of human extinction by intelligent machines and concurrent visions of peaceful human-machine collaboration to the attention of Silicon Valley leaders such as Elon Musk such as Bill Gates, as well as on the agenda of governments and policymakers around the world. A viral defender of human enhancement through drugs and machines, Bostrom had prepared arguments advocating "smart policy" for cognitive enhancement "in the public interest" long before his appearance at the PCSBI's meeting:

> Proponents of a positive right to (publicly subsidized) enhancements could argue their case on grounds of fairness or equality, or on grounds of a public interest in the promotion of the capacities required for autonomous agency. The societal benefits of effective cognitive enhancement may turn out to be so large and unequivocal that it would be economically efficient to subsidize enhancement for the poor, just as the state now subsidizes education.[642]

But general arguments for public policy to embrace enhancements of individuals and society at large

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[637] Presidential Commission for the Study of Bioethical Issues, 4.
[638] Deborah Kotz, '1 in 5 Students at an Ivy League College Abuse Stimulant Drugs', *The Boston Globe*, 2 May 2014.
[639] Casey Schwartz, 'Generation Adderall', *The New York Times*, 12 October 2016, sec. Magazine.
[640] In this sense, the enhancement recommendations bear similarities to Hurlbut's study of experiments in Democracy in California's Proposition 71 to support stem cell research.
[641] Raffi Khatchadourian, 'The Doomsday Invention', *The New Yorker*, 23 November 2015.
[642] Nick Bostrom and Rebecca Roache, 'Smart Policy: Cognitive Enhancement and the Public Interest', in *Enhancing Human Capacities*, ed. Julian Savulescu, Ruud ter Meulen, and Guy Kahane (Oxford: Blackwell Publishing Ltd, 2014), 6.

were not enough for Bostrom. He also equipped the commission with an economic rationale for why it may be smart to re-consider human enhancement on greater scales:

> So our cognitive capacity is very important in the modern economy and in modern society…to remain competitive in the global economy I think one wants to look at the wide range of measures to improve the intellectual capital of the population.[643]

The PCSBI's reasoning around cognitive enhancement in particular, and neurotechnological innovation more generally, as normatively justifiable means for "bettering society in numerous ways"[644] also suggested a particular imagination of a "well-ordered society" that would naturally emanate from equal access to the progress of neurotechnology. Described by advocate of American political liberalism John Rawls in the 1970's as a society "…not only designed to advance the good of its members but (…) also effectively regulated by a public conception of justice[645]", adherence to principles of liberty and fairness would eventually also lead society "to take steps at least to preserve the general level of natural abilities and to prevent the diffusion of serious defects" [646] according to Rawls. This version of 'liberal eugenics'[647], shared, among others, by eminent 20th century thinkers such as philosopher of law Ronald Dworkin, would also constitute the baseline reasoning through which the PCSBI aimed to educate the public's conception and imagination of innovative neuroscience and neurotechnologies' potential for society.

However, despite the common portrayal of American political culture as inherently relying on a Rawlsian version of liberalism, American Bioethics had not always shared such notions of the public good – particularly not those experts of the Presidential Council on Bioethics preceding the PCSBI under President George W. Bush. Often described as conservative in approach and oriented more toward philosophical deliberation than policy advice, the Council also produced a report concerned with technological advances "Beyond Therapy" in 2003, in which biomedicine and particularly biotechnology were scrutinized as legitimate tools for the "Pursuit of Happiness"[648]. Here, another vision of a well-ordered society was suggested in an unusually poetic style:

> In wanting to become more than we are, and in sometimes acting as if we were already superhuman or divine, we risk despising what we are and neglecting what we have. In

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643 Bostrom in Presidential Commission for the Study of Bioethical Issues, 'Transcript, Meeting 18, Opening Remarks and Session 1' (Washington D.C., 20 August 2014), 18.
644 Presidential Commission for the Study of Bioethical Issues, 'Gray Matters: Topics at the Intersection of Neuroscience, Ethics, and Society Volume 2', 13.
645 John Rawls, *A Theory of Justice* (Cambridge, MA: Harvard University Press, 1971), 397.
646 Rawls, 92.
647 Francis Galton, 'Regulating Eugenics', *Harvard Law Review* 121 (1 April 2008): 22.
648 President's Council on Bioethics, *Beyond Therapy: Biotechnology and the Pursuit of Happiness* (Washington, D.C.: President's Council on Bioethics, 2003).

> wanting to improve our bodies and our minds using new tools to enhance their performance, we risk making our bodies and minds little different from our tools, in the process also compromising the distinctly human character of our agency and activity. In seeking by these means to be better than we are or to like ourselves better than we do, we risk "turning into someone else," confounding the identity we have acquired through natural gift cultivated by genuinely lived experiences, alone and with others. In seeking brighter outlooks, reliable contentment, and dependable feelings of self-esteem in ways that by-pass their usual natural sources, we risk flattening our souls, lowering our aspirations, and weakening our loves and attachments. By lowering our sights and accepting the sorts of satisfactions that biotechnology may readily produce for us, we risk turning a blind eye to the objects of our natural loves and longings, the pursuit of which might be the truer road to a more genuine happiness. To avoid such outcomes, our native human desires need to be educated against both excess and error. We need, as individuals and as a society, to find these boundaries and to learn how to preserve and defend them.[649]

Unlike the PSBI's work requested by President Obama, Bioethics under the George W. Bush government created very different meanings and purposes of ethical deliberation vis-á-vis innovation in the biosciences. By questioning the foundational rationale brought forth by scientists, engineers, and policymakers in the construction of the public interest around enhancement technologies, the Presidential Council on Bioethics aimed at opening up, rather than closing down, troubled boundaries of ethics and science through deliberation, raising important questions about re-conceptualizations of human nature provoked by biomedicine and providing respective normative answers to shifts in its perception[650]. The red thread of Bioethics' role in educating the public in the right modes of reasoning about science and technology pulled through Bioethics in its executive function throughout both commissions; yet underlying commitments to what some commentators labeled "bio-conservative" and "bio-liberal"[651] approaches produced different kinds of politics – the latter granting science and technology the authority to define the *is* and *ought* of the common good, the former portraying the making of knowledge, technologies, and norms as an immanently social process[652] with the power to set, preserve and defend boundaries to the pursuit of knowledge (if believed to threaten human dignity).

In light of these shifting styles of reasoning, the PCSBI's Gray Matters volumes can be read as constituted by, as well as constitutive of, a distinctively American, culturally and socio-historically

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[649] President's Council on Bioethics, 298.
[650] Rose, *The Politics of Life Itself: Biomedicine, Power, and Subjectivity in the Twenty-First Century*.
[651] Rebecca Roache and Steve Clarke, 'Bioconservatism, Bioliberalism, and the Wisdom of Reflecting on Repugnance', *Monash Bioethics Review* 28, no. 1 (1 March 2009): 1–21.
[652] For these reasons, descriptions of the Presidential Council on Bioethics work as "conservative" are probably better characterized as reflecting commitments towards humanistic philosophical traditions.

embedded understanding of the right relationship between science, technology, citizens and the state. Normative and epistemic ordering work around the *soft constitutions* sketched in this section – from the resolution of backstage controversies within the PCBI to the Gray Matters recommendations presented to the public frontstage – echo President Obama's calling for a "serious effort, a sustained effort", asking the country "to embody and embrace that spirit of discovery that is what made America, America"[653] when announcing the BRAIN initiative in 2013. Throughout the various instances of settling the gray matters of ethics and science for the American public, the "ethical" progress of neuroscience towards innovative tools was depicted as having "great potential" for establishing "justice", ensuring "participation" by individuals and society writ large, and generating "trust" within the public for novel forms of technoscientific intervention. Dissemination of innovation in the name of the public benefit thereby not only got presented as inevitable, but as a means to elevate the common good towards more just, equal, and democratic outcomes.

[653] The White House, *President Obama Speaks on the BRAIN Initiative and American Innovation*.

6.2 Differentiating Neuro- from Bioethics

The PCSBI's recommendations found their way into the BRAIN initiative through the establishment of a "Neuroethics Working Group" (NEWG) in August 2015, composed of nine distinguished members with diverse backgrounds in neuroscience, neuroethics, biomedicine, policy-making and the law, and tasked with deliberating ethical issues with regard to all things "neuro". Despite the BRAIN initiative's square focus on the neurosciences, Gray Matters had still operated within the epistemic and normative regime of Bioethics – a form of expertise increasingly institutionalized during mid-20th century controversies around genetics more broadly and recombinant DNA research in particular. With two constitutional moments in the 1975 Asilomar conference's faith in "containment" strategies for hazardous biotechnologies and the 1978 Belmont Report principles of "respect for persons, beneficence, and justice" in human subject research, Bioethics was significant for managing and taming critique towards the unforeseeable consequences of genetic manipulation of human life arising during the postwar period[654]. Bioethics had not only helped to legitimize the self-governance of the new biosciences when it came to defining ethical norms for genetic engineering; in this function, it also gave authority to the "genetic language" that would henceforth

> Render visible to others and to oneself aspects of human individuality that go beyond 'experience', not only making sense of it in new ways, but actually reorganizing it in a new way and according to new values about who we are, what we must do, and what we can hope for. [655]

The "Evangelist of Molecular Biology"[656] and director of the Human Genome Project James Watson, for example, described this shift in an elegant and widely quoted sentence: "We used to think our future was in the stars. Now we know it's in our genes."[657]

The legacy of "genetic selves" endured throughout the beginning of the 21st century but found a new competitor in the thriving neurosciences which claimed the brain as the central seat of individual identity, autonomy, and agency[658]. Novel forms of "brainhood"[659] were fueled by new imaging techniques of neural activity that would produce colorful and persuasive pictures of "neurochemical

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[654] M. L. Tina Stevens, *Bioethics in America: Origins and Cultural Politics* (Johns Hopkins University Press, 2003).; see also Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*; Benjamin J. Hurlbut, 'Remembering the Future: Science, Law, and the Legacy of Asilomar', in *Dreamscapes of Modernity* (University of Chicago Press, 2015).
[655] Carlos Novas and Nikolas Rose, 'Genetic Risk and the Birth of the Somatic Individual', *Economy and Society* 29, no. 4 (1 January 2000): 488.
[656] Algis Valiunas, 'The Evangelist of Molecular Biology', *The New Atlantis*, no. Summer/Fall (2017).
[657] Watson quoted in Leon Jaroff, 'The Gene Hunt', *Time* 133, no. 12 (20 March 1989): 62–67.
[658] Fernando Vidal, 'Brainhood, Anthropological Figure of Modernity', *History of the Human Sciences* 22, no. 1 (February 2009): 6.
[659] Vidal, 5–36.

selves"[660], believed to overcome 'folk' psychology's tendency for subjective assessments of mental states. Neuroscience provided a new language to categorize such states into various neural entities – such as normal, abnormal, depressed, poor, or criminal brains – as significant markers for individual and collective behavior[661]. Strengthening "mental capital" came to be viewed as the key success criterion for education and the workforce[662], as well as for overcoming the burden of mental diseases such as ADHD, depression, and Alzheimers observed to spread rapidly and massively across societies. In turn, a rising American crisis in mis- and overuse of opioids and psychiatric medications identified in the early 2000's, accompanied by mounting criticism of big pharma companies as major causers of that crisis, strengthened calls for new tools to alleviate suffering from mental illnesses without causing addiction and other severe side-effects[663].

Being brains

Claims around the importance of better understanding, curing, and manipulating the human brain through novel neurotechnologies were, hence, already in the making when the BRAIN initiative kicked off, yet the centralization of research efforts under a big science project reified them significantly by way of elevating knowledge of the brain to a central issue of public policy spanning health, social, and economic state programs. The BRAIN 2025 report, a founding document of the initiative which had been drafted in 2014 to prioritize research areas in the project's 10-year timeline, for example, set the stage for a strong commitment to brain essentialism which would underwrite American policy in the years to come:

> We stand on the verge of a great journey into the unknown - the interior terrain of thinking, feeling, perceiving, learning, deciding, and acting to achieve our goals - that is the special province of the human brain. These capacities are the essence of our minds and the aspects of being human that matter most to us. Remarkably, these powerful yet exquisitely nuanced capacities emerge from electrical and chemical interactions among roughly 100 billion nerve cells and glial cells that compose our brains…Our brains make us who we are, enabling us to perceive beauty, teach our children, remember loved ones, react against injustice, learn from history, and imagine a different future.[664]

A shift in ethical specialization from Bio- to Neuroethics complemented these early years of

[660] Joseph Dumit, *Picturing Personhood: Brain Scans and Biomedical Identity* (Princeton University Press, 2004).
[661] Dumit.
[662] Rose and Rose, *Can Neuroscience Change Our Minds?*
[663] One of the earliest and most prominent books of this development was presented by Robert Whitaker, *Mad in America: Bad Science, Bad Medicine, and the Enduring Mistreatment of Mentally Ill* (Basic Books, 2003); Robert Whitaker, *Anatomy of an Epidemic: Magic Bullets, Psychiatric Drugs, and the Astonishing Rise of Mental Illness in America* (Crown, 2010).
[664] Brain Initiative, 'BRAIN 2025 Report' (National Institutes of Health, 5 June 2014), 9.

public appraisal of neuroscience and -technologies, for which the advocacy of journalist and Dana Foundation's Chairman William Safire was key. Before becoming a New York Times columnist, Safire had served President Nixon as a speechwriter during which he famously drafted a Presidential speech prepared for the "Event of Moon Disaster"[665] – the non-return from the moon to earth by Apollo 11's astronauts – in 1969. A professional in easing the nation's sentiments towards likely disasters produced by scientific and technological progress, Safire allegedly coined the term "Neuroethics"[666] during a meeting with neuroscientist Zach Hall in January 2002[667]. Soon after, he organized a conference with the name "Neuroethics: Mapping the Field" in San Francisco, which would gather neuroscientists and ethicists interested in the nascent field. His introductory words to the conference, boldly titled "Our New Promethean Gift", made a convincing case for distinguishing Neuro- from Bioethics, which would revolve around the special status of the brain for human identity, calling for equally specialized expertise in normative evaluation:

> Neuroethics in my lexicon is a distinct portion of bioethics, which is the consideration of good and bad consequences in medical practice and biological research. But the specific ethics of brain science hits home as no other research does in any other organ. It deals with our consciousness, our sense of self, and as such is central to our being. What distinguishes us from each other, beyond our looks? The answer: our personalities and behavior. And these are the characteristics that brain science will soon have the ability to change in significant ways. Let's face it, one person's liver is pretty much like another's—giving rise to the expression, "What am I, chopped liver?" Our brains, on the contrary, give us our intelligence and integrity, our curiosity and compassion—and here's the most mysterious one, our conscience. Our brain is the organ of individuality.[668]

This framing of the reasons to break down Bioethics into a specialized field of Neuroethics found immediate resonance within the communities addressed by Safire and would enjoy significant reverb in the long-term institutionalization of Neuroethics in the BRAIN initiative and beyond[669].

[665] Although not directly relevant to our case, this vintage speech gives a good sense of American culture's continuous juxtaposition of metaphysics as belonging to the past vis-á-vis modern science a pacemaker of progress, shared from Safire and Nixon to Watson and Bush: "In ancient days, men looked at stars and saw their heroes in the constellations. In modern times, we do much the same, but our heroes are epic men of flesh and blood."
[666] The actual origins of the term are still subject to debate, which is telling of the many struggles within the field to find a common narrative about its history and identity. Sociologist of professions Raymond de Vries has looked most closely into this debate, see all works cited by him here.
[667] Henry Greely, 'Happy 15th Birthday, Neuroethics!', *The Neuroethics Blog* (blog), May 2017.
[668] The Dana Foundation, 'Neuroethics: Mapping the Field', in *Neuroethics: Mapping the Field* (Neuroethics: Mapping the Field, California: The Dana Foundation, 2002).
[669] For an early and long-lasting contribution to Neuroethics resting on brain essentialism, see the handbook by Martha J. Farah, *Neuroethics: An Introduction with Readings* (MIT Press, 2010).

Cognitive scientist, philosopher, and senior editor of the neuroscience journal Neuron Adina Roskies, for example, rapidly picked up Safire's arguments around the new-found terminology when she declared the relevance of "Neuroethics for the New Millenium" in the journal Neuron only months after the conference:

> It is evident that neuroethics will overlap substantially with traditional issues in biomedical ethics...But if there is to be justification for identifying and promoting neuroethics as a new and important field, it ought not be merely a subdivision of bioethics, with issues and answers parallel to those that arise in other areas of biomedical research. The intimate connection between our brains and our behaviors, as well as the peculiar relationship between our brains and our selves, generate distinctive questions that beg for the interplay between ethical and neuroscientific thinking.[670]

The neuroethical imagination evoked by such statements vis-á-vis Bioethics insisted on a departure of virtue ethics in an Aristotelian tradition that has informed medical ethics from the Hippocratic Oath onwards, which attributed physicians themselves the capacity to judge ethical issues based on individual adherence to moral values[671]. With the advent of Bioethics and its breakdown into even more specialized "hyphenated ethics"[672] such as Neuroethics, moral evaluations would become the exclusive domain of specialized experts in the US, who could not only speak for the ethics in and of medicine, but help all sorts of sciences and technologies to grapple with the "what if?" questions of their endeavors.

Taking care of the But-What-If factor

In an accompanying and often cited op-ed to the New York Times, Safire pushed the terminology of Neuroethics beyond expert communities and to broader publics by way of instantiating an exemplary list of ethical quandaries of rising neurotechnologies that would represent an additional reason to care about Neuroethics – the "But-What-If factor":

> Few will dispute the benefits of the regulated use of drugs to treat diseases of the brain. But what about drugs to enhance memory or alertness, to be taken before a test – isn't this akin to an athlete unethically taking steroids before a race? If we quiet the broadest range of inattentive, hyperactive children with compounds like Ritalin, do we weaken the development of adult concentration, character and self-control? How about a future

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[670] Adina Roskies, 'Neuroethics for the New Millenium', *Neuron* 35, no. 1 (3 July 2002): 21–23.

[671] Raymond De Vries, 'Framing Neuroethics: A Sociological Assessment of the Neuroethical Imagination', *The American Journal of Bioethics: AJOB* 5, no. 2 (2005): 25–27; discussion W3-4; Erin C. Conrad and Raymond De De Vries, 'Field of Dreams: A Social History of Neuroethics', in *Sociological Reflections On The Neurosciences*, vol. 13, 2011, 299–324.

[672] Conrad and De Vries, 'Field of Dreams: A Social History of Neuroethics'.

> use of imaging to pinpoint a brain area indicating a traumatic memory – should we expunge a victim's ability to recollect, say, a rape? Do we outlaw implantation of a memory of an event that never happened? Should brain imagers give law enforcement a ''lie detector'' far more reliable than the mechanical polygraph, and if so, is the reading of a mind of a resistant terrorist akin to torture?...Ethical rules are hard to lay down because of the 'but-what-if'' factor…The conference ''mapping the field'' of neuroethics this week showed how eager many scientists are to grapple with the moral consequences of their research. It's up to schools and media and Congress to put it high on the public's menu. [673]

Here, the evocation of the potential of neurotechnologies to redraw sensations of righteousness not only made a case for the further development of Neuroethical expertise, but also for a sustained public campaign that could inform the public about the promises and perils of innovation arising from neuroscience[674]. Next to arguments presenting the brain as a special organ deserving special forms of protection, the "But-What-If-Factor" would indeed become the preferred framing device for a host of news coverage, academic articles, conferences and policy-initiatives that brought future visions of speculative neurotechnologies and their ethics "on the public's menu".

Fueling the public's neuroethical imagination also heightened the social and economic significance of innovation in the neurosciences vis-á-vis genet(h)ics. Among the first media outlets to respond to Safire's call for action, The Economist, for example, dedicated a lengthy lead article as well as the frontpage to "The future of mind control" in May 2002, which dismissed discussions around the bioethics of genetics as outdated and superfluous, identifying neurotechnologies as clear winners in the race of tinkering with human nature:

> If asked to guess which group of scientists is most likely to be responsible, one day, for overturning the essential nature of humanity, most people might suggest geneticists. In fact neurotechnology poses a greater threat – and also a more immediate one. Moreover, it is a challenge that is largely ignored by regulators and the public, who seem unduly obsessed by gruesome fantasies of genetic dystopias. [675]

From these early days of constituting Neuroethics as the guardians of neuroscience and - technology[676], the field made a great leap in visibility and membership, ranging from the foundation of

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[673] William Safire, 'The But-What-If Factor', *The New York Times*, 16 May 2002.

[674] It is no coincidence that Safire worked as chair for the Dana foundation, an organization that has since focused greatly on promoting public education in neuroscience and neuroethics.

[675] The Economist staff, 'The Future of Mind Control', *The Economist*, 23 May 2002, sec. Neuroscience.

[676] Raymond De Vries, 'Who Will Guard the Guardians of Neuroscience?', *EMBO Reports* 8, no. S1 (1 July 2007): S65–69.

the Neuroethics Society in 2006 to a yearly-held Global Neuroethics Summit, as well as to the creation of various research and educational programs dedicated to neuroethical questions[677]. Yet, integration within the BRAIN initiative proved challenging, which was argued to be due to the liminal funding and advisory hierarchy within which the "Neuroethics Working Group" (NEWG) was placed. Beneath structural reasons, however, the newly founded field of Neuroethics needed to be molded into the overall narrative of the BRAIN initiative, which would place normative deliberation as a key enabler of its vision and goals, which, in turn, would cause major frictions within the NEWG itself.

Controlling visions on neuro-innovation

During the second meeting of the NEWG for the BRAIN initiative in August 2016 – three years after Obama's grand announcement of the project – Walter Koroshetz, then co-director of BRAIN and director of the National Institutes of Neurological Disorders and Stroke (NINDS, one of the key federal agencies involved in coordinating its research), announced that "the wheels are turning for Neuroethics" through informing NEWG's members that funding for Neuroethics projects would eventually be made available. Such funding came with a particular vision of NEWG's role within the future of the initiative, which was coming into heightened relief due to rapid advancements in research and applications. Following a list of potentially highly controversial technologies sitting at society's doorstep as neuroscience in the BRAIN initiative was moving fast from experimenting with animal models to applications for human brains, Koroshetz tried to relieve the tension in the room:

> And there may be other things so…I jokingly say that I think we could make a lot of money off the BRAIN Initiative by developing algorithms that we can then test brain circuit activity and pairs of people who are planning to get married and predict who's actually going to have a successful marriage versus an unsuccessful marriage. So facetiously, but just to throw it out that this, these are the kind of questions.[678]

Besides the dark humor, Koroshetz' remarks reiterated Safire's "But-what-if-factor" when calling upon the NEWG to imagine their role as well as the urgency of normative ordering of the likely impacts of neurotechnologies on societies for the BRAIN initiative. Different to the uncertainty of questions to be resolved by Neuroethics expertise at NEWG, the fact *that* innovation in neurotechnology was going to have large-scale dissemination and effects within society, to which neuroethics could only hope to catch up, was thereby presented as a given. In the very same meeting, Koroshetz increased the "pressure" on the NEWG significantly:

> The technology is going to march. I don't think that's something that we have to worry

[677] See 'International Neuroethics Society', accessed 25 May 2022.
[678] NIH BRAIN Initiative, *NIH BRAIN Initiative Neuroethics Workgroup Meeting Day 2*, 2016.

> about, though. What we have to worry about is if the technology gets ahead of the ethical issues or societal issues. And so, I'm not, not trying to put any pressure on you guys. We have lots of good drivers. And so we're just along for the ride…but you know we feel very responsible for the overall health of the BRAIN Initiative and that reaches down into little pieces, but also the big picture. So this is my sense of the charge to neuroethics working group.[679]

The picture painted for NEWG's deliberation here became one of controlling the seemingly unstoppable train of neuroscientific and -technological progress without harming the overall agenda of the initiative. This delicate balancing act expected of NEWG's members reflected the promissory politics of BRAIN as well as its tensions for public policy – on the one hand, bold claims of a neurotechnologically penetrated future needed to be sustained so as to gain public attention and support for the project; on the other hand, however, uncertainty persisted with regard to such visions taking a potentially controversial life of their own in the public. Taking responsibility for the overall "health" of the BRAIN initiative through Neuroethics would resolve such tensions for the public through providing accurate accounts of the promises and perils of neuroscience and -technology, which was believed to be falsely jumping on the hype ride proclaimed from the President of the country to the directors, administrators, and researchers of the project itself. In a meeting with BRAIN's major transatlantic competitor, the EU's Human Brain Project, Koroshetz brought his opinion on the role of Neuroethics vis-á-vis the public to the point:

> Some of these technologies are going to push out to the media and to the public, and fuel their fears based on science fiction, movies that they've seen in the past…if that kind of catches fire and gets out of control, then I think there'll be potentially serious backlash about what we're doing.[680]

Becoming friends, not foes

Besides brain essentialism, technological backlash, was a driver of Neurotethics within the overall project, often presented as a wildfire-type risk that could burn the enthusiasm for the BRAIN initiative's outcomes. Importantly, this scenario rested on an image of Neuroethics informing "good neuroscience" that could raise attention to, and resolve, potentially controversial issues early on rather than judging whether technologies were publicly desirable or undesirable in the first place. The boundaries of Neuroethics were set clearly through such discourse – given the authority to engage in controlling the normative framing of neurotechnology for society, its experts would also need to be controlled by the

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679 NIH BRAIN Initiative.

680 P3 STOA Neuro Workshop 29/11/16 European Parliament Multimedia Centre, *Science and Technology Options Assessment*, 2016.

overall frame of neuroscience and its applications provided by policy and research[681]. In other words, NEWG's work was expected to stay above the politics of normative claims and value judgements as much as science, and instead contribute to a presumably uncontroversial version of neurotechnology as desirable innovation for the public good (rather than science-fiction horror). Such an instrumental role was not without conflicts for some of NEWG's members, as expressed vehemently by Nita Farahany, Professor of Law and Philosophy at Duke University, when positing in the August 2016 meeting that such a framing would reduce Neuroethics to mere "risk mitigation strategies"[682]. Yet, Hank Greely, co-chair of the NEWG and Professor of Law at Stanford University, knew how to re-frame the neuroethical enterprise and eventually closed the debate:

> I think the ethics people at this table are much more drawn to 'how can we help get good research done in an ethical way', not 'can we judge and say this is good this is bad'. So, this is a plea to think of us as friends not foes, and as helpers not drags.[683]

Becoming friends, not foes, of the BRAIN initiative was realized primarily through a number of distributed publications in key Bioethics, Neuroethics, and research policy journals, as well as through the public display of NEWG's work in science media and on the BRAIN initiative's website following the August 2016 meeting. It was not until 2018 that a commentary by the group in the Journal of Neuroscience forwarded "Neuroethics Guiding Principles for the NIH BAIN Initiative"[684], which would repeat much of the PCSBI's recommendations as well as reflect the initial framing of Neuroethics' role in the project, such as the relevance of neuroscientific research for changing conceptions of autonomy and agency, or the need for greater education of the public in the right modes of reasoning around neurotechnologies. However, the guidelines found liminal embrace by the BRAIN initiative's lead, which asked the NEWG only in 2019 – four years after its establishment – to come up with a "Neuroethics Roadmap" for the remainder of the project.

Warnings for a regulatory creep

Next to the Gray Matters Volumes, the Roadmap "The BRAIN Initiative and Neuroethics: Enabling and Enhancing Neurosociety Advances for Society" served as an equally constitutive document for reasoning about neuroscience and -technology in the US. Different to the PCSBI Volumes glossy and formal appearance, the document has the allure of an informal working paper with no title page, no copy-edited formatting, no detailed information about its authors (besides the drafting group's heads Dr.

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[681] We may call this a particular form of co-regulation of actors aiming at establishing forms of knowledge control reminiscent of Steven Hilgartner's "knowledge control regimes" (Stephen Hilgartner, *Reordering Life: Knowledge and Control in the Genomics Revolution* (MIT Press, 2017).)
[682] NIH BRAIN Initiative, *NIH BRAIN Initiative Neuroethics Workgroup Meeting Day 2*.
[683] NIH BRAIN Initiative.
[684] Henry T Greely et al., 'Neuroethics Guiding Principles for the NIH BRAIN Initiative', *The Journal of Neuroscience : The Official Journal of the Society for Neuroscience* 38, no. 50 (12 December 2018): 10586–88.

Eberwine and Dr. Kahn), and, more generally, no substantial references to the literatures or claims expressed in the paper. In short, it very much looks like a white paper, a style that seemed deliberately chosen by what was then known as the BRAIN Neuroethics "Subgroup" on its quest to seek integration within the BRAIN initiative writ large.

The NEWG had been renamed after its kick-off as a "working group" into a "subgroup", reflecting wider tensions between Neuroethics and the project that would find a climax in the years of 2018-2019. In that period, the BRAIN initiative celebrated its progress halfway through its 10-year funding period and sought input from its lead members on how to move forward into the second half of the project's timeline. While scientifically the project's first years were celebrated as a success of "rapid" progress in neuroscientific discovery, Neuroethicists had gained liminal institutionalization and visibility within the project. NEWG was constituted by non-funded voluntary experts, and funding for "integrated" neuroethics research projects as part of the BRAIN initiative was only kicked off much later than neuroscience projects in 2017, with 1.8% from the overall BRAIN budget committed to them (as compared to the 5% for Ethical, Legal and Social Implications funding in the BRAIN's role-model HGP). As part of its mid-term evaluation, the BRAIN initiative's lead institution, the NIH had called upon a "BRAIN initiative Working Group *2.0"* in 2018 to review the scientific progress of the project and decide which areas to prioritize while moving forward. In parallel, the BNS had been charged with drafting a "Neuroethics Roadmap" for the years ahead, both to be presented at the NIH's Advisory Committee to the Director (ACD) in June 2019. The meeting, hosted under the auspices of NIH director Francis Collins, would once more bring to the fore the underlying controversies around the boundaries, breadth and depth of ethics integration in the BRAIN initiative's research endeavors. Both groups, scientists and ethicists, were required to make their reports open to public comment before the meeting, and to integrate comments and feedback into reviews of the documents.

One contentions issue in the process was the question of public engagement on the Neuroethics roadmap, suggested by Neuroethicists themselves. A public comment on one of the chapters in the Roadmap assembled over 300 signatories from the neuroscience community to demand the chapter be deleted completely. Focusing on the BNS's Roadmap's call for attention to the ethics of using animal models in neuroscience research, and particularly neuroscience research with non-human-primates (NHPs), the protesters described the chapter as "overreach[ing] any reasonable scope of action for the BNS", "offering a set of highly questionable principles for the conduct of neuroscience research with animals" while "rais[ing] no ethical questions that are either new or unique", and asking that it "be deleted in its entirety from the roadmap"[685].

Ensuing discussions at the June 2019 ACD meeting cast light on the subtle control-work around the authority of science and ethics in the BRAIN initiative, as most visibly articulated in neuroscientist and participant Anne Churchland's heated reaction towards the report more generally as well as on the controversial chapter in particular. Churchland questioned the call for an increase of the budget for

[685] NIH VideoCast, *ACD BRAIN 2.0 Working Group Neuroethics Subgroup Workshop*, 2019.

Neuroethics from 1.8% to 5% of the BRAIN initiatives' funding, which she eloquently translated into the number of full-time employees for which she was not "sure what all 250 Neuroethicists would be doing for the BRAIN initiative"[686]. Such funding, the scientist further argued, would lead to a "duplication of regulation and oversight that exists already", and while Neuroethicists were right in pointing to the changing landscape of animal research and the use of animal models, reflecting upon such reform would first and foremost need the right kind of expertise at the table. In her view, Neuroethicists were not qualified to do such a job, arguing that primatologists, veterinarians and scientists would be in a better position to judge the need for new rules in NHP research. As a member of the BNS Winston Chiong nicely summarized in an assessment of the meetings' significance for the field of Neuroethics, "many neuroethicists were disheartened by the criticisms of Churchland and the 300+ signatories…These seemed to envision neuroethics narrowly as a matter of burdensome, duplicative regulation threatening to hinder scientific research, and also challenged neuroethicists' claims to disciplinary expertise"[687].

Five years into the project, the "integrative" vision of Neuroscience and Neuroethics becoming "companions" and "friends" in the BRAIN initiative had not materialized and the roadmap, meant to achieve "real" ethics integration, backfired on the community, leaving them with the air of an "outsider"[688] – an external critic and bad cop of neuroscience. What had materialized, however, was a performance of Neuroethics that would not substantially interfere with the priorities and practices of neuroscientists. Neuroethics, in this sense, was not different to the disciplining of Bioethics into a particular role for science and technology governance which had long been practiced in the US, delegated to the "soft" space of regulating normativity which ought not result in 'regulatory creep' for which it needed to be strictly separated from science as well as from politics[689].

Enabling innovation through Neuroethics

Against this background, "The BRAIN initiative and Neuroethics: Enabling and Enhancing Neuroscience Advances for Society" can be read as a constitutive document about the US's commitment to particular epistemic and normative orders in the past and present, as well as an illustrative roadmap for how American imaginations of such orders are thought to be achievable in the future. What the ACD and NIH director Francis Collins eventually embraced as recommendations for the second half of the BRAIN initiative in October 2019 was not one united roadmap presented jointly by both working groups as envisioned back in 2019. The BNS instead presented a revised version of the document in parallel to the scientific recommendations made to the project's leadership, a version which does not run short on

[686] NIH VideoCast.
[687] Winston Chiong, 'Insiders and Outsiders: Lessons for Neuroethics From the History of Bioethics', *American Journal of Bioethics Neuroscience* 11, no. 3 (2020): 155–66.
[688] Chiong.
[689] Hurlbut, *Experiments in Democracy*.

having integrated the demands of neuroscientists voiced during the 2019 controversy[690]. In a section of the roadmap that gives answers to "what is neurethics and why is neurethics important?" the BNS argued that:

> At two extremes, neuroethics is misunderstood as esoteric or punitive. Importantly, neuroethics is not a set of rules or compliance mechanisms, and its role should not be seen as limited to implementing oversight of the responsible conduct of research. Rather, fully integrating neuroethics with neuroscience offers tremendous opportunity for new research insights, inviting new fields including the humanities into scientific discourse, bringing science and its discoveries to align with societal values and aspirations for science – in addition to its vital role of protecting research participants and guarding against potential malign intent by rogue actors.[691]
>
> In summary, neuroethics is integral to the BRAIN Initiative and cannot be separated from it. Neuroethics provides an opportunity for deliberation, analysis, and research that both catalyzes, improves, and enables neuroscience. This Neuroethics Roadmap proposes a way forward to maximize innovation and value from the BRAIN Initiative in a way that prioritizes benefits for humanity at large.[692]

Despite the sharp boundaries drawn between science and norms during the Roadmap's controversy, Neuroethics figured as an integral part of the BRAIN initiative in that it was presented as an enabler, a catalyzer, an opportunity for researchers to make their work be valued and accepted by, as well as beneficial for society – not questioning *if* neuroscientific innovation, as for example controversially pursued by the US Defense and Advance Research Agency (DARPA), ought to reach society at large, but *in what ways*: "Neuroethics analysis of military use of neuroscience suggests that the question is not if the military will use neuroscience, but how – and thus ethical accountability is critical"[693]. The report's repeated mantra, often arranged in a "but" syntax following the enumeration of neuroscience's and the BRAIN initiative's various merits, reveals the quite explicit forms of boundary work pursued by the BNS to prove its legitimacy within existing and future orders of a neuroscientifically and technologically penetrated world. This is the language of benefits and risks, of innovation's potential to create "a better future" for all (consumers, soldiers, citizens, students, and criminal defendants) and of Neuroethics' function in anticipating, identifying and judging possible risks

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[690] As De Vries describes Neuroethics' position more generally, "The work of neuroethicists reflects the ambivalence created by their social location" De Vries, 'Who Will Guard the Guardians of Neuroscience?', 68.
[691] 'The BRAIN Initiative and Neuroethics: Enabling and Enhancing Neuroscience Advances for Society', 2019, 12.
[692] 'The BRAIN Initiative and Neuroethics: Enabling and Enhancing Neuroscience Advances for Society', 21.
[693] 'The BRAIN Initiative and Neuroethics: Enabling and Enhancing Neuroscience Advances for Society', 53.

that might hamper the dissemination of science and technology.

> In each scenario, we can imagine a better future as a result of neuroscience: happier consumers, more efficient and safer combat, a smarter and more morally competent citizenry, better educational methods and tools, and fairer legal outcomes. But in each of these scenarios, we can also see potential for harm: wrongful convictions based on inaccurate brain science; invasions of privacy; inadequate consumer protections; and development of inappropriate dual uses in military settings. Moreover, miscommunication and over-promising what neuroscience can actually do may inappropriately raise hopes about what neuroscience can deliver. An important goal for neuroethics in these domains should be to introduce deliberative structures that allow for neuroscience-based benefit without companion harms.[694]

The Roadmap was hence vital to carve out a space for showcasing the benefits of Neuroethics integration, at the same time as it produced a powerful vision of integrating neurotechnologies to the benefit of society. Risks and harms became a question of inappropriate use understood as application of technology for interested, political purposes versus morally justified uses that were only beneficial in outcome and hence not guided by malign intents:

> There is a moral imperative to use the knowledge gained from the BRAIN Initiative to alleviate suffering from brain diseases and disorders. Intellectual freedom for scientists must be coupled with individual and institutional responsibility to assure responsible behavior.[695]

A reliance on neuroscientist's adherence to the "moral imperative" of directing knowledge towards the resolution of brain diseases – here framed as a mechanism of (self-) governance – thereby helped to bypass normative judgement of those applications arising from research oriented towards non-medical uses, which forms a substantial part of the BRAIN initiative's partnerships (such as DARPA's various research programs on Brain-Computer-Interfaces for "able-bodied"[696] individuals or for "accelerating memory function for skill learning"[697]). The roadmap's chapter "Beyond the bench", for example, left "unresolved questions of accountability and potential regulatory gaps" mostly unanswered, providing reasons for more Neuroethics research in those realms:

[694] 'The BRAIN Initiative and Neuroethics: Enabling and Enhancing Neuroscience Advances for Society', 74.
[695]'The BRAIN Initiative and Neuroethics: Enabling and Enhancing Neuroscience Advances for Society', 40.
[696] DARPA Public Affairs, 'Nonsurgical Neural Interfaces Could Significantly Expand Use of Neurotechnology', 16 March 2018.
[697] DARPA Public Affairs, 'DARPA Aims to Accelerate Memory Function for Skill Learning', 27 April 2015.

> Given these novel uses of neuroscience in new sectors, a number of ethical questions arise. For instance, should a scientist-entrepreneur in a private-sector setting be held to the same standards as a scientist in an academic setting? Does a scientist who knows that her or his research may be used in a setting beyond research and medicine have an ethical obligation to engage with stakeholders in that setting? Should NIH-funded researchers consider potential unintended uses of their scientific discoveries and technological developments? Do some partnerships – for instance those that raise concerns about militarizing neuroscience – run counter to the NIH mission to promote human health?[698]

Enhancing brainhood

Enabling innovation also extended beyond the technological domain in the Roadmap, which would equally grapple with enhancing innovation in philosophical conceptualizations of the brain and its significance for notions of personhood in a chapter entitled "Studying Ourselves: The Uniqueness of Neuroscience". Notwithstanding a call for "careful balance between mechanistic and humanistic approaches"[699], the text reifies the brain essentialism already evoked during the founding days of Neuroethics by reviewing essential literatures of rational agency that would classify "persons by virtue of their ability to make decisions independently and rationally"[700]. The "moral imperative" to pursue knowledge for the public benefit would have to be accompanied by substantiating the "moral significance" of the brain, which could vary across cultures, yet its link to rationality, identity, and agency was a reasonable baseline according to the Roadmap's authors: "the moral significance of the human brain likely derives from its role in defining personhood, rational agency, personal identity, and personal interactions – all of which are crucial for grounding our everyday moral judgments of ourselves and others."[701]

That such claims would be rounded-off by a (in)famous quote of John Locke, who stated that a person is "a thinking intelligent being, that has reason and reflection, and can consider itself as itself, the same thinking thing, in different times and places"[702], seemed self-evident to the BNS. Locke's ideas on the nature of the self as well as society and government had significantly inspired the American Declaration of Independence's slogan of "life, liberty, and the pursuit of happiness" as well as the drafting of the US constitution's principles in the 18th century. Evoking Locke in this context embedded Neuroethics in a continuum of commitments to liberal political theory and American republicanism with its core values of popular will, sovereignty and a balance of power in government. At the same time, conjuring Locke's view on the self, which rested primarily on an empirically derivable existence of

698 'The BRAIN Initiative and Neuroethics: Enabling and Enhancing Neuroscience Advances for Society', 46.
699 'The BRAIN Initiative and Neuroethics: Enabling and Enhancing Neuroscience Advances for Society', 23.
700 'The BRAIN Initiative and Neuroethics: Enabling and Enhancing Neuroscience Advances for Society', 22.
701 'The BRAIN Initiative and Neuroethics: Enabling and Enhancing Neuroscience Advances for Society', 22.
702 'The BRAIN Initiative and Neuroethics: Enabling and Enhancing Neuroscience Advances for Society', 22.

(continuous) consciousness rather than other metaphysical entities such as the soul, would also legitimize a break with and colonization, reduction, and dismissal[703] of long-held philosophical discussions from Aristotle, Descartes[704] and Kant to Chalmers, Searle, and Chomsky (to name but a few) around the seat of human cognition and the distinction of mind and matter[705].

This perspective – that human consciousness, and, hence, notions of identity, the self, and agency, are primarily determined by physical, observable processes within the brain – would also inform the framing of neuroethical issues to be prioritized in the Roadmap, such as changes in capacity to consent in human subject research due to the loss of mental faculties. In a list of "considerations for performing neuroscience research involving human participants", for example, researchers were advised to "specify in advance potential psychosocial risks to potential research participants. These include changes in self-identity, effects of personality changes and interpersonal relationships, and others."[706]

The differentiation of Bioethics from Neuroethics in the BRAIN initiative generally, as well as the stabilization of Neuroethics expertise as enablers and enhancers of the project through the Roadmap in particular, displayed a co-productionist dynamic par excellence: it created the reasoning around neuroscience and -technology as socially beneficial innovation (beyond health) that could be guarded against misuse through the right kinds of expertise, at the same time as it provided the conceptual and moral language necessary to sustain such a socio-technical imaginary as publicly desirable. Within the short history of Neuroethics as a 'subfield' of Bioethics, and through the performance of quite meaningful boundaries for the newborn expertise in settling the normative questions of the BRAIN initiative, the demarcation of science, ethics, and politics authorized novel visions of material and social order – today and for the future. As the 21st century was moving from the naturalization of humans as genetically determined to "being brains", and from science as the arbitrator of the public good to technological innovation as a key area of its expression, neuroscience and ethics created new forms of individual and collective identity and subjectivity complemented by novel modes of 'self- and soft' governance that were regarded as legitimate substitutes for the state's role in protecting its citizen's health and wellbeing through the law. Most importantly, ethics and neuroscience- and technology would be depicted as institutions that could co-regulate each other in taming the project's epistemic and normative uncertainty to legitimize an unquestioned imperative of innovation in the name of the public. Neuroethics reasoning would not deviate from fundamental ontological categories provided by science and technology so as to be granted full-fledged integration within BRAIN, and even enhance

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[703]John Cromby, 'The Greatest Gift? Happiness, Governance and Psychology', *Social and Personality Psychology Compass* 5, no. 11 (2011): 211.

[704] French philosopher René Descartes arguably first described the problem with mind-body dualism, where mental phenomena were classified as distinct from physical ones.

[705] To be sure, it was not only through the BRAIN initiative that such debates found closure, but Neuroethics helped greatly to sustain the rise of cognitive sciences as evidence-based approaches to the brain, inviting representations of a "mechanization of the human" and the "brainification of machines" Jean-Pierre Dupuy, *The Mechanization of the Mind: On the Origins of Cognitive Science, The Mechanization of the Mind* (Princeton University Press, 2021), 20.

[706] 'The BRAIN Initiative and Neuroethics: Enabling and Enhancing Neuroscience Advances for Society', 24.

neuroscientific understandings of personhood and the vision that neurotechnology enables the provision of the public good. Neuroscience, in turn, would authorize the further institutionalization of Neuroethics as a natural companion to research and development, yet only within the bounds of 'soft' power that would not risk 'hard' regulatory intervention by the state.

7. Constituting Responsible Research and Innovation in the EU: The Human Brain Project and the Turn to RRI

On the other side of the Atlantic, a bold move for neuroscience was made almost at the same time as in the US, when the European Commission (EC) declared the Human Brain Project (HBP) as a "flagship" for the continent on January 28th, 2013. Having successfully made its way through the EC's funding labyrinth, the HBP was the winner of a three-year selection process within the "Information and Communication Technologies" "Future and Emerging Technologies" program's search for "flagship projects", the EU's "largest research excellence award in history"[707]. Next to a consortium on the "wonder material" Graphene[708], the HBP's aim to create a digital simulation of the complete human brain and its functions had convinced reviewers and funders that it was worthy an investment of 1 billion Euro to be split among the Commission, EU member-states, and industry over the course of 10 years. Now it was up to the EC's policymakers to convince the heads of its 27 members and private investors to form a partnership which could sustain the project for a decade, a difficult task fought fierce fully by vice-president of the Commission and Head of Europe's "Digital Agenda" Nellie Kroes. In a press conference announcing the HBP's award, she addressed her audience with a fair warning: "Make no mistake: it is innovation that drives growth…And in these economic doldrums, this is exactly the investment we should focus on."[709]

The scenario of a joint investment in Europe's innovation-led growth pictured by Kroes was standing in stark contrast to the political and economic "doldrums" perceived in Brussels around that time. In 2013, the Union's future looked once again ambiguous, struck by enduring economic effects of the 2008 financial crisis and an increasing chant of EU skepticism across countries that questioned the benefits of a common European market and integrated economic policy. An enduring public controversy over the bailout of the crisis-hit Greek economy, both within Greece and among the EU's publics, saw the EC's President Jose Manuel Barroso conjuring a "European public space" during these years, "where European issues are discussed and debated from a European standpoint"[710]. Yet, Barroso's vision was widely disappointed by further cracks in the EU's political unity. Only three days before awarding the HBP its "flagship" status, UK's prime minister David Cameron made his plans for a referendum on "Brexit" public by arguing that "there is a growing frustration that the EU is seen as something done to people rather than acting on their behalf…this is being intensified by the very solutions required to resolve the economic problems."[711]

Notwithstanding the severe economic and political tensions that were marking the EU's

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707 European Commission, 'Graphene and Human Brain Project Win Largest Research Excellence Award in History, as Battle for Sustained Science Funding Continues', *European Commission,* 28 January 2013.
708 European Commission.
709 James Panichi, 'Calls for EU States to Cough up Science Funding', *Deutsche Welle,* 5 February 2013.
710 President of the European Commission José Manuel Barroso, 'State of the Union 2012'.
711 The Guardian staff, 'David Cameron's EU Speech', *The Guardian,* 23 January 2013, sec. Politics.

integrity in the beginning of the 2000s, European ministers remained convinced that shared investments in science and technology presented a viable path forward. As agreement on the multi-annual financial framework for 2014-2020 was only reached through a "historic budget deal"[712] as low as never before in the EU's history, some budgets, including the "modern, future-oriented"[713] research and innovation framework program "Horizon 2020" of which the HBP formed part, remained unscathed from growing political cracks in the EU and, in fact, were exponentially increased[714]. Following a steady rise of spending for research from the Cold War onwards[715], Horizon 2020 would jolt the EU's science and technology funding from 1,3 to up to 10 billion Euros per year, which were envisioned to realize an "Innovation Union" that would "rebuild a broken link in the chain that links research with the market"[716] and "innovate Europe out of the crisis"[717]. Máire Geoghegan-Quinn, Commissioner for Research, Innovation, and Science from 2010-2014, described the rationale guiding the novel tasks of EU's institutions within that period, in which a commitment to investments in budgets like Horizon 2020 was presented as a powerful force for re-storing trust in as well as for preventing further damage to the European economy:

> The 30 % budget increase for Horizon 2020 is a real vote of confidence in the power of research and innovation...the research and business communities…spoke out loud and clear on the risks to the European economy if research and innovation was cut.[718]

The exact wording mobilized by the Commissioner was important, in that it re-framed an understanding of risk central to the EU's research policy culture, which had been shaped in particular around the controversial GMO legislation[719] of the 1990s that produced a regulatory regime of risk assessment centered on "precaution" and that had been perceived by trading partners as "Coalition of the Ignorant"[720] turning against science and progress. The "precautionary principle" had been introduced primarily for decision-making on new science and technologies with unknown risks to the environment and human health, "where a scientific information is insufficient, inconclusive, or

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712 Graeme Wearden, 'EU Leaders Reach Historic Budget Deal', *The Guardian*, 8 February 2013, sec. Business.
713 Ben Deighton, 'The Scale of Horizon 2020 Is a Vote of Confidence for Research', *Horizon*, 19 March 2015, sec. Research and Innovation.
714 President Barroso, 'Statement by President Barroso on the Future Budget, Trade and the Southern Neighbourhood Following the European Council'.
715 Thomas J. Misa and Johan Schot, 'Introduction', *History and Technology* 21, no. 1 (1 March 2005): 1–19.
716 European Commission, 'Turning Europe into a True Innovation Union', *European Commission*, 6 October 2010.
717 European Commission. Directorate General for Research and Innovation., 'The New Renaissance: Will It Happen? Innovating Europe out of the Crisis: Third and Final Report of the European Research Area Board.' (LU: Publications Office, 2012).
718Deighton, 'The Scale of Horizon 2020 Is a Vote of Confidence for Research'.
719 European Commission, 'Questions and Answers on the Regulation of GMOs in the European Union', *European Commission*, 26 March 2007.
720 Mark Lynas, 'With G.M.O. Policies, Europe Turns Against Science', *The New York Times*, 24 October 2015, sec. Opinion.

uncertain”, including assessing the risks for “the decision to fund a research programme”[721] (for a detailed discussion of the precautionary principle, see chapter 2). In turn, Horizon 2020, and particularly its “flagship” projects, was devoted to research and innovation in high-risk areas with promising, yet uncertain outcomes for the European economy. As a memo accompanying the HBP’s announcement argued,

> This is about investing in Europe’s future. Tackling grand challenges necessitates, in certain cases, large scale projects which require large scale investment. The European Commission is supporting ambitious and risky projects which promise a large return in the long term. Supporting these projects will help Europe maintain its position as a global player, particularly in priority areas which could create jobs and growth.[722]

Horizon 2020’s set-up, including large-scale projects and investments such as the HBP, would not only mark a subtle turn in the framing of scientific and technological risk within the EU; the authority of governing innovation at EU-level, as well as the large resources provided to do so, also put to question two other fundamental principles enshrined in the Union’s *acquis communautaire*[723] that had guided European integration efforts up until that moment: in particular, that of *proportionality*, in which the “content and form of the action (by EU’s institutions) must be in keeping with the aim pursued”[724] laid down in the Maastricht treaty, as well as that of *subsidiarity* which “aims to ensure that decisions are taken as closely as possible to the citizen and that…action at the EU level is justified in light of the possibilities available at national…level”[725] as reified by the Lisbon Treaty. Through the increasing uptake of an “innovation principle”[726], however, technoscientific innovation in itself came to be envisioned as an adequate means for the EU to “protect its citizen’s health and the environment”[727], sustained by a risk-taking, centralized, and financially over-proportional approach to research as compared to other policy-domains. Horizon 2020 “flagships” such as the HBP represented important political arenas within this turn, imagined as bridges between research and new markets, and advanced as proper instruments for turning the European economy’s tide as an EC press memo explained:

[721] European Commission, ‘Questions and Answers on the Regulation of GMOs in the European Union’.
[722] European Commission, ‘FET Flagships: Frequently Asked Questions’, *European Commission*, 28 January 2013.
[723] The *acquis communautaire* is the the EU’s body of law constituted by its several treaties, acts and court rulings.
[724] EUR-Lex, ‘Consolidated Version of the Treaty on European Union - TITLE I: COMMON PROVISIONS - Article 5 (Ex Article 5 TEC)’, text/html; charset=UTF-8, Official Journal 115 , 09/05/2008 P. 0018 - 0018; (OPOCE).
[725] EUR-Lex.
[726] European Commission, ‘Ensuring EU Legislation Supports Innovation’, European Commission, accessed 25 May 2022.
[727] European Commission, ‘Innovation Principle Makes EU Laws Smarter and Future-Oriented, Experts Say’, *European Commission*, 25 November 2019, sec. Research and Innovation.

Flagships are uniquely positioned to bridge the gap between science-driven research and industry; they will deliver exciting new technologies that will have a transformational impact on industry and the economy. Flagships include scientists and researchers as well as industry, standing together to turn the tide in European innovation and to accelerate the path for bringing new technologies and services to the market.[728]

Framing neuro-innovation as European good

The HBP's consortium and mission fitted squarely into the new European innovation agenda. Despite its name's focus on the human brain, the project aimed well beyond better understanding and healing it; more importantly, being funded under the ICT branch of the Commission's Directorate-General for Research and Innovation, such knowledge would equally drive the development of brain-like computers which promised high impacts on the European ICT industry as well as its consumers. Backed up by 131 partner institutions from 24 European countries, the HBP had been designed as a multi-disciplinary, -country, and -agency collaboration envisioned to also prompt pre-competitive research and cooperation with industry[729], a virtuous circle of economies of scale, and "boost" for European competitiveness in computation[730]. At the heart of the HBP's idea was a large-scale simulation of the human brain through supercomputing which would allow convergence between ICT and biology, unify dispersed European neuroscience and ICT communities, and enable translation of brain research from bench to bedside. The project's three pillars – Future Neuroscience, Future Medicine, and Future Computing – aimed to integrate heterogeneous research and development data through several platforms (e.g., the Neuroinformatics, Brain Simulation, and Medical Informatics Platform) which could "perform *in silico* experiments impossible in the lab"[731]. Possible applications derived from such research, in turn, such as neuromorphic computing and neurorobotics, promised the emergence of a market "as large as the market for the current generation of ICT"[732].

Key to the performance of the HBP's legitimate place in EU policy was its "charismatic"[733] leader Henry Markram from the École Polytechnique Féderale de Lausanne (EPFL), who for years preceding the HBP's "flagship" status widely advocated a "methodological paradigm shift"[734] towards *in silico* and away from *in vitro* and *in vivo*[735] neuroscience that would bring scattered neuro- and data scientists to speak to each other to achieve a digital simulation of the whole human brain. Markram's

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[728] European Commission, 'FET Flagships: Frequently Asked Questions'.
[729] The Human Brain Project, 'The Human Brain Project', April 2012, 25.
[730] The Human Brain Project, 13.
[731] The Human Brain Project, 11.
[732] The Human Brain Project, 25.
[733] Eve Marder, 'Charismatic and Visionary Leaders', *ENeuro* 8, no. 2 (2021).
[734] Kai Kupferschmidt and Martin Enserink, 'Updated: European Neuroscientists Revolt against the E.U.'s Human Brain Project', *Science*, 11 July 2014.
[735] In vivo neuroscience studies the brain of animals still alive, in vitro neuroscience looks at brain tissue kept alive in a petri dish, whereas in silico neuroscience approaches digital simulations of the brain 'as if' they were a living brain.

vision was a scientifically controversial endeavor, not least since computational legend Alan Turing had waged in 1950[736] on such a goal to be unreachable in the near future[737]. Despite Markram's relentless public work to prove Turing wrong, his critics insisted that a whole brain simulation would be impossible to realize, and, even in the event of such a scenario, would question that *in silico* neuroscience would add any value to understanding or curing the brain and its diseases[738]: if *in silico* neuroscience had only reached a simulation of parts of the nervous system of the roundworm C. elegans in decades of research, explaining little about its simplest behaviors[739], how was it going to reach a functional simulation of the complete human brain, understand it *and* find cures for healing it within the near future? Yet, Markram had successfully convinced the EU's funders that his revolutionary vision not only could, but had to happen. Celebrating their successes right after the project's announcement, commissioner Kroes and Markram staged the following interview:

> Kroes: Professor, congratulations! It is remarkable that your very incredible, complex and ambitious project is now in the winner's seat. I'm deeply impressed. When was the first moment that you thought "perhaps we could make it", that prize, that award?
>
> Markram: Well for us it was uncertain, pretty much all the way through, because we're fully aware that it's a very big challenge, it's very ambitious, it is high risk…but we are so passionate that this must happen, and it must happen now. And the technology is there to make it happen. So a few days before we thought we were not the winners, and we just felt like a planet that is moving in the wrong way in the universe, because this must happen.[740]

Whereas *in silico* neuroscience represented a highly uncertain and risky scientific field for public investment, the technology able to run simulations of nervous systems was indeed already there to make Markram's ambitions vision 'happen'. Markram held a long-standing relationship with the US American IT behemoth International Business Machines Corporation (IBM) with a popular legacy in the development of ground-breaking computers. From the first computer winning a chess game to Watson's strike in *Jeopardy!*, IBM had always rested on challenging and transgressing the frontiers

[736] A. M. Turing, 'I.—Computing Machinery And Intelligence', *Mind* LIX, no. 236 (October 1950): 433–60.
[737] Touring predicted such goal to be more realistically achieved in a century Turing, 253.
[738] See e.g., Sebastian Seung, *Connectome: How the Brain's Wiring Makes Us Who We Are* (Houghton Mifflin Harcourt, 2012)., in which he argues that Markram's "glitzy supercomputer should not distract us from a potentially fatal flaw of his research: the lack of a well-defined criterion for judging success." Seung, amongst other critics, is part of the "top-down" branch of neuroscience that measures neural activity and patterns against a-priori hypotheses of the working of cognition; Markram's approach, in turn, is described as building such hypotheses "bottom-up" through the assembling of as much data about the brain as possible, eventually revealing the cognitive whole. The controversy between both paradigms is documented well in the documentary Noah Hutton, *In Silico*, Documentary, 2020, who followed the HBP for its 10-year duration.
[739] Sebastian Seung, 'Another Perspective on Massive Brain Simulations', *Scientific American*, 11 June 2012.
[740] European Commission, *Neelie Kroes & Prof Henry Markram: Human Brain Project*, 2013.

between humans and machines, a theme held dearly by Markram throughout his efforts to gain funding and acknowledgement for the HBP. These efforts had started in 2005, when Markram initiated the "Blue Brain Project" at his home institution EPFL in Switzerland through the purchase of IBM's Blue Gene, which was ranked as the most powerful and efficient system of supercomputers in the world with an estimated price of 1.5 million USD. Blue Brain had been a beta-side for IBM to experiment with Blue Gene's capacities as well as a chance for Markram to gain a larger audience for his vision by showcasing the simulation of one brain region, the neocortex, with the supercomputer. In a 2009 TED talk, Markram illustrated his fascination for combining brain research with computation, and science and business, in the following way:

> There literally are only a handful of equations that you need to simulate the activity of the neocortex. But what you do need is a very big computer. And in fact, you need one laptop to do all the calculations just for one neuron. So you need 10,000 laptops. So where do you go? You go to IBM, and you get a supercomputer, because they know how to take 10,000 laptops and put it into the size of a refrigerator. So now we have this Blue Gene supercomputer. We can load up all the neurons, each one on to its processor, and fire it up, and see what happens. Take the magic carpet for a ride.[741]

But while Markram's "magic carpet" flew well with the EC's Horizon 2020 innovation agenda, it did less so with the wider community of neuroscientists that closely watched HBP's rise to the highest levels of EU science and technology policy. Only a year after the HBP's announcement as European flagship, neuroscientists severely accused it of monopolizing Europe's diversity in neuroscience by concentrating efforts solely on ICT, and for illegitimately selling an ICT development project as a basic research project on the brain with respective uncertain contributions to knowledge for health – a controversy which would change the project's, and particularly Markram's, fate for the good.

Opening the HBP's black boxes

In July 2014, an "Open message to the European Commission concerning the Human Brian Project" supported by over 750 signatories expressed the protest that had mounted around Markram's self-fashioning as the neuroscience vanguard, his vision of ICT-driven brain research, and the centralized "flagship" approach by the EC that supported it. Describing the inherent skepticism of the neuroscience community against the HBP, one of its signatories, Herwig Baier from the Max Planck Institute of Neurobiology in Germany, commented the message with the sarcastic assessment that "almost everyone with a human brain knew from the start that the Human Brain Project was deeply flawed."[742] The

[741] TEDGlobal, *A Brain in a Supercomputer Henry Markram*, 2009.
[742] 'Comments to Open Message to the European Commission Concerning the Human Brain Project', *Comments*, 13 July 2014.

message's website, aptly titled "neurofuture.eu", would become an important space for opening the HBP's several black boxes for the public. In particular, it focused on two concerns: first, the project's narrow scientific focus on computational as opposed to experimental, cognitive, and *in vivo* neuroscience; second, the consortium's opaque decision-making structures and Markram's strong leadership role therein, both of which the signatories called to be taken into consideration during the upcoming review of the project's first year by the EC. As the letter succinctly summarized, the HBP was seen neither as an adequate project for furthering European neuroscience, nor did it represent the governance structure deemed appropriate for neuroscientific collaboration in Europe:

> We wish to express the view that the HBP is not on course and that the European Commission must take a very careful look at both the science and the management of the HBP before it is renewed. We strongly question whether the goals and implementation of the HBP are adequate to form the nucleus of the collaborative effort in Europe that will further our understanding of the brain.[743]

The adequate nucleus for neuroscience in Europe, according to the letter's authors, would lie in a distributed form of governance allowing participation of several neuroscientific approaches to the brain to advance its diverse understanding – a form of governance committed to the "democratic" values of science *and* of the Union rather than its "oligarchic degeneration" as one commentator to the letter portrayed the entanglement of the HBP with Brussel's politics:

> The right criterion that science should obey is "democracy", allowing the plurality of researchers who will contribute to knowledge in a free and autonomous way. In this sense, the flagship of "excellence" yields an oligarchic organization of science, that contrasts the basic principle of western democracies of allowing for and sustaining free thought. Unfortunately, I feel that in Brussels this oligarchic degeneration does not concern only science.[744]

Visions of unification under a single, non-pluralistic European *in silico* approach to the human brain had thus not united but driven further apart different branches of neuroscience, and the EC's bet on a grand, tech-driven research project sustained by a top-down governance structure undermined its intention as an integration device for a more democratic EU. Rather, it was seen as deeply flawed with conflicts of interest and closed-shop decision making. As the message and its signatories convincingly demonstrated, critique of the HBP was inextricably linked to criticisms of the EU's political apparatus

[743] 'Comments to Open Message to the European Commission Concerning the Human Brain Project'.
[744] Comment by Herwig Baier, Max Planck Institute of Neurobiology, Germany 'Comments to Open Message to the European Commission Concerning the Human Brain Project'.

and its democratic deficit[745], which not only questioned the national sovereignty of member-states and their role in the EU, but also the EU's commitment to the freedom of science and its constitutive role for European democracies[746]. Another commentator to the open letter, for instance, asked "Shouldn't we scientists know better? Better than politicians (for example) in devising a fair system, in which every scientist is provided with an opportunity to participate in science?"[747] Following the critics, the governance of neuroscience through the EC and its bold claims for innovative outcomes and markets was an intrusion into the free pursuit of basic research considered as a European good in itself[748], which should be strictly separated from the instrumental politics of EU's market integration agenda:

> I guess some clever people saw in this a way to get enormous funding out of lobbying the EC executives to make them believe in a completely utopistic project. Bravo for the artists! But there are millions of other, just as important ways to understand the brain and its disorders, that will now come to a stop due to lack of funding. The punchline is that politics and science should be completely separate.[749]

Key to the critique of a trespassing of the boundaries between science and politics was the HBP's sole focus on simulations of the brain instead of research on the human brain itself[750], rendering the

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[745] Throughout its history, the European integration process and its various institutional arrangements have been characterized as suffering from a democratic deficit, described by John McCormick as "the limited ability of Europeans to influence the work of the major EU institutions". John McCormick, 'The EU and Its Citizens', in *Understanding the European Union: A Concise Introduction*, ed. John McCormick, The European Union Series (London: Macmillan Education UK, 1999), 147–74.
In particular, the Union is said to suffer from such deficit both in terms of input as well as output legitimacy of European policy-making: on the one hand, the European Parliament is the only body directly elected by citizens of the European Union, yet its power to initiate and shape legislation is limited as compared to the executive functions of the European Commission compromised of elected representatives of citizens in member-states. On the other hand, a bias in outputs of European policy-making with regards to the promotion of deeper market integration ("negative integration") that lacks respective provisions for regulatory and social welfare protection ("positive integration") is seen as counter to the functions of democratic governance, which, according to Fritz Scharpf, has as its main task the balancing of liberal markets with protection of social welfare. Fritz Scharpf, *Governing in Europe: Effective and Democratic?* (Oxford: Oxford University Press, 1999).
For a review on the different positions regarding the democratic deficit of the EU, as well as counterarguments to it, see Andrew Moravcsik, 'Reassessing Legitimacy in the European Union', *JCMS: Journal of Common Market Studies* 40, no. 4 (2002): 603–24.
[746] Article 13 of the The European Charta for Fundamental rights, as well as many other European member state Constitutions, commit to the protection of academic freedom. For a detailed history, as well as examination of its tensions, see Yaron Ezrahi, *The Descent of Icarus: Science and the Transformation of Contemporary Democracy* (Harvard University Press, 1990).
[747] Serafim Rodrigues, Plymouth University, UK 'Comments to Open Message to the European Commission Concerning the Human Brain Project'.
[748] For a discussion of arguments whether science should, indeed, considered a public good by economists, i.e. a good which cannot be provided by the market (alone) but one that needs special protection by the state, see Michel Callon, 'Is Science a Public Good? Fifth Mullins Lecture, Virginia Polytechnic Institute, 23 March 1993', *Science, Technology, & Human Values* 19, no. 4 (1 October 1994): 395–424.
[749] Comment by Jean-Claude Baron, INSERM, France 'Comments to Open Message to the European Commission Concerning the Human Brain Project'.
[750] Yves Frégnac and Gilles Laurent, 'Neuroscience: Where Is the Brain in the Human Brain Project?', *Nature* 513, no. 7516 (1 September 2014): 27–29.

HBP a project "driven by technology and not hypothesis" as one signatory summarized[751]. Several comments to the letter joined him in accusing the HBP as being "hijacked by technological determinism", "turning brain research into a fetish for public opinion and decision makers alike, while obsessing with an IT R&D only agenda", and eventually making of European neuroscience a "scientific laughing-stock"[752]. Promises of a greater common good enabled through technology rather than through basic research were deceiving the public according to these commentators, who felt called to arms to correct a false impression of neuroscience's potential as communicated by the HBP and its funders:

> The flagship was not meant to focus on low-hanging fruits, and the Commission should not be content with proving some menial returns can be obtained in IT industry by investing €1.2billions public money under the label "human brain". Let's prove the public we can live up to our words, scientists and politicians alike. We are stretching out our hands with this letter.[753]

The EC immediately reacted to the message in a reply entitled "no single roadmap for understanding the human brain"[754], followed-up by the project's leadership response stressing "the vital role of neuroscience"[755] in the HBP. Both letters would sharply defend the project's scientific course and governance set-up, repeating the mantra that "at the end there are huge potential benefits for our society, our economy and for science" that were still waiting to be unlocked by future progress of the HBP. Satisfaction of the letter's calls for a deeper change in HBP's course, however, would only come through the installment of a Mediation Committee (MC) headed by Wolfgang Marquardt, Chairman of the Board of Forschungszentrum Jülich, who published a lengthy report recommending that "in order to significantly increase the HBP's chances of success in delivering innovative and valuable research results and technology platforms substantial reforms are considered essential"[756]. In particular, the recommendations stressed that "the separation of functions and responsibilities and a robust system of strong checks and balances will have to be implemented", which led to a complete re-organization of the project's governance structure, including Markram's withdrawal from the board of directors. They also resulted in a change of scientific direction, including the reintegration of cognitive neuroscience within the project. Next to structural and epistemic adjustments, the MC moreover assessed the HBP's promissory politics as a major source of conflict and crisis. To render the HBP more credible to scientists

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751 'Comments to Open Message to the European Commission Concerning the Human Brain Project'.
752 Comment by Andrea Cesura, Independent Consultant, Switzerland 'Comments to Open Message to the European Commission Concerning the Human Brain Project'.
753 Comment by Marco Mana, SCImPULSE Foundation, Switzerland 'Comments to Open Message to the European Commission Concerning the Human Brain Project'.
754 European Commission, 'No Single Roadmap for Understanding the Human Brain', *Digital Single Market* (blog), 7 August 2015.
755 Human Brain Project and European Commission, 'The Vital Role of Neuroscience in the Human Brain Project' (Human Brain Project, 9 July 2014).
756 Mediation of the Human Brain Project, 'Human Brain Project Mediation Report' (Germany, March 2015), 2.

and society alike, the report further argued, "sound expectation management", humility and honesty would have to become central to the project's showcasing of value in the future:

> Most of the members of the MC agree that the way the HBP was presented to the public and to the scientific community lacked self-reflection, and thus contributed to a loss of credibility of the HBP in the scientific community. They pointed out that the HBP's leadership neglected its responsibility to prevent this through adjustment of the HBP's public relations and to introduce sound expectations management. It was largely agreed that there is a need to communicate the goals of the HBP clearly, honestly and more modestly. Most of the members of the MC agreed that major changes are necessary to create value for the scientific community as well as for society.[757]

Shifting from European neuroscience to innovation

The controversy that shook the HBP's foundations as legitimate European investment reflected the scientific community's wider reluctance toward the EU's gradual policy shift from science to innovation in the late 20th century. Against significant resistance by member-states to transfer powers over science and technology policy to the EU[758], it was only in the 1980's that the "Single European Act" codified joined goals to "strengthen the scientific and technological basis of European industry and to encourage it to be more competitive at international level[759]". Further steps in policy integration were reached through the "Lisbon Strategy" in the early 2000s, through which the EU imagined itself as becoming "the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion"[760]. The accompanying declaration of a "European Research Area" (ERA) at the turn of the millennium was constitutive for the endorsement of shared competence[761] among the EU and member-states in the governance of research and development, as well as for stabilizing the role of science and technology as a powerful tool for meeting market demands for a European project. Here, science and technology came to figure as

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[757] Mediation of the Human Brain Project, 17.

[758] As Lucca Guzzeti describes, "in the immediate post-war period, in a Europe which was physically and morally in ruins, science and technology were not major government preoccupations. However, in the eyes of some pro-Europeans and scientists, scientific co-operation could make a contribution both to reconstruction and to uniting the continent". Luca Guzzetti, *A Brief History of European Union Research Policy*, Studies / European Commission, Science, Research, Development 5 (Luxembourg: Office for Official Publ. of the Europ. Communities, 1995), 2. Over the course of the next two decades, nuclear energy research would become a central concern for the nascent union, as manifested in the creation of CERN and EURATOM – yet "the first timid steps towards an energy policy…were not taken until the 1970s" Guzzetti, 11.

[759] Vincent Reillon, 'Research in the European Treaties' (European Parliamentary Research Service, March 2016).

[760] 'Presidency Conclusions Lisbon European Council' (Lisbon, 23 March 2000).

[761] Under the principle of conferral established through the Lisbon Treaty, the EU's competences to rule over national legislation are distinguished according three categories: exclusive EU competences (in which the EU alone can legislate), shared competencies (in which countries have authority to legislate in particular areas where the EU has not) and supporting competences (supplementing national legislation).

important sources of economic growth and international competitiveness, solidifying the vision of a "Single European Market" in conjunction with a "single, borderless market for research, innovation, and technology across the EU"[762]. During these first enthusiastic years for research in Brussels, some policymakers, such as Commissioner for Science and Research Janez Potocnik, even imagined knowledge to become a "fifth freedom" to be amended to the EU's "four freedoms" of movement of capital, goods, services, and people that built the cornerstones of the EU's Single Market system[763].

The framing of a joint European research policy as vital instrument for the creation of a competitive European market would persist for the first decades of the EU's massive investment in research and development in Horizon 2020 and its "flagship" projects amidst the breakdown of European solidarity during the financial crisis in 2008 and beyond. Yet, not only had the Lisbon strategy been diagnosed in 2004 to have failed in reaching its aim to significantly increase spending and voluntary coordination on joint R&D activities and respective growth of GDP across member-states[764]; it was particularly accused of a "lack of determined political action" needed for overcoming fragmented national efforts in research and technology which would make the European knowledge-economy reality[765]. Learnings from Lisbon, according to a Report from the High-Level Work Group chaired by former Prime Minister of the Netherlands Wim Kok, could be summarized by a simple message:

> If we are to deliver the Lisbon goals of growth and employment then we must *all* take action. To achieve them will require everyone to engage. This means more delivery from the European institutions and Member States through greater political commitment, broader and deeper engagement of Europe's citizens, and a recognition that by working together Europe's nations benefit all their citizens.[766]

Difficulties in achieving greater political support from member-states for the Lisbon agenda were also reflected in funding and endorsement of neuroscience at EU level. Concerns of a fragmentation of the nascent field in the 1990s, as well as of a gap with the rapidly evolving community in the US, were first voiced by the European Neuroscience Association (ENA), one of the earliest advocacy groups for a unification of neuroscience research across Europe. The organization's reasoning behind a greater support by the EU's research funding bodies had primarily centered around a lack of

762 European Commission, 'European Research Area (ERA)', *European Commission* (blog), accessed 25 May 2022.
763 CORDIS EU research results, 'Make "knowledge" a Fifth Community Freedom, Says Potocnik at Green Paper Launch', *European Commission* (blog), 5 April 2007.
764 Jakob Edler, 'Research and Innovation and the Lisbon Strategy', in *The EU's Lisbon Strategy: Evaluating Success, Understanding Failure,* ed. Paul Copeland and Dimitris Papadimitriou (London: Palgrave Macmillan UK, 2012), 168–88.
765 As described by the often-cited Kok report, which evaluated the Lisbon Strategy in 2004 European Commission and Secretariat-General, *Facing the Challenge : The Lisbon Strategy for Growth and Employment : Report from the High Level Group Chaired by Wim Kok* (Publications Office, 2004).
766 European Commission and Secretariat-General, 6. Their emphasis.

international leadership in neuroscience due to silo-approaches deemed inappropriate for the advance of basic knowledge about the brain. In keeping with the EU's motto of being "united in diversity", the EU's role was primarily envisioned by ENA as support of the unification of diverse knowledges on the brain across the continent. Different to the Declaration of a Decade of the Brain in the US, the EU had not yet made a grand gesture toward the significance of neuroscience for European publics, as Wolf Singer, German Neurphysiologist and President of ENA, lamented in 1994:

> Declaring the last decade of the century the Decade of the Brain reflects the growing awareness that neuroscience has become a scientific discipline in its own right and will be one of the leading sciences in the next century. However, in Europe, these political declarations have had little impact. The European community still recognizes neurosciences as subdisciplines of medical and biological research, and there are no indications for better, or at least more co-ordinated funding. This is particularly unfortunate because brain research, more than any other scientific endeavor, requires an extremely diversified approach. There is an urgent need for better communication and concentration efforts.[767]

In Singer's view, a joint approach to neuroscience in Europe needed to rest on the diversity reflected by the neuroscientific community, which was also reiterated in the re-naming of ENA into the "Federation of Neuroscience Societies" (FENS) a few years later – bearing no small resemblance to the vision for a "Federation of Europe" advanced by the EU's founding father Robert Schuman. Such framing helped significantly in bringing neuroscience on the agenda of Brussel's policymakers, who began to endorse research on the brain as a relevant site for concentrated action at the turn of the century[768]. In particular, European neuroscience integration became the pet-project of Philippe Busquin, by then Commissioner for Research, Science, and Innovation, and designer of the "European Research Area" (ERA) targeted by the "Lisbon Agenda" in the early 2000s. Through ERA, Busquin sought to overcome fragmentation and lack of technological outputs from national research through an integration of European research activities and budgets, as well as by reconciling Europeans with science and technology after they had put a "brake on genetic research in plants"[769] throughout the public resistance to Genetically Modified Organism's (GMO) in the late 1990s. As biotechnology became a hotly debated topic rising to the infamous EU-US trade dispute over GM food filed at the WTO, Busquin mobilized a field of research yet untouched by European centralization efforts in science and technology and hence

[767] Wolf Singer, 'Neuroscience in Europe: The European Neuroscience Association', *Trends in Neurosciences* 17, no. 8 (1 January 1994): 330–32.
[768] Its third president, Pierre Magistretti, Professor of neuroscience at EPFL and director of the BRAIN Mind Institute (home to Markram and the drafting of the HBP proposal), for example, would serve as an important spokesperson for introducing the idea of a mutual benefit between brain simulations and supercomputers to Europe's audiences. See TEDx Talks, *Brainergy: Pierre Magistretti at TEDxCHUV*, 2012.
[769] EMBO reports, 'A European Research Identity', *EMBO Reports* 1, no. 2 (1 August 2000): 96–99.

unpolluted by controversy, politicization, and intrusion of European public opinion: neuroscience. One of his central projects for showcasing the expected future benefits of ERA became the creation of a "European Brain Research Area"[770] (EBRA) that would put the benefits of joint efforts in brain research on Europe's public agenda:

> In this field like in many other fields of research, Europe is faced with a costly paradox…Europe has world-class brain researchers who interact on an individual basis across Europe. Yet, those that fund brain research hardly interact, let alone co-ordinate investments at a European level. The brain and neurosciences are a field where Europe can do much more by working better together…Is it not surprising how little we know about the brain and how little awareness there is among the public of the health benefits and economic development that brain research can bring?[771]

The figure of a "costly paradox" of inaction in research collaboration alerted to by Busquin would also be picked up in the EC's future reasoning around the HBP as a high-risk yet desirable project for Europe's citizens and businesses. Different to the portrayal of neuroscience's value as a potential driving force of European knowledge integration that could also benefit Europe's health and the economy, however, the promise of computer-driven neuroscience put forward by the HBP re-imagined the worth of such knowledge to materialize in jointly produced innovative markets that by themselves would constitute a European good. This shifting reasoning around the grounds to care for the brain co-produced a particular role for European institutions and their publics in the governance of neuroscience as well as for computational neuroscience pioneered in the HBP as a meaningful site for the constitution of European unity in scientific and technological progress[772].

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770 European Commission, 'EU Calls for More and Better Co-Ordinated Brain Research at European Level', *European Commission*, 18 September 2003.
771 European Commission.
772 Tara Mahfoud, 'Visions of Unification and Integration: Building Brains and Communities in the European Human Brain Project', *New Media & Society* 23, no. 2 (1 February 2021): 322–43.

7.1 Producing a United European Public for Neuroscience

Shifts in envisioning science and technology as instruments for European economic integration - from ERA and EBRA to Horizon 2020 and the HBP "flagship" – were accompanied by equally significant re-configurations in imagining the realization of a European political union and its public through science and technology governance. The early years of European science policy were marked by the controversial uptake of biotechnologically engineered food and organisms across the EU, in which "problematic publics"[773] and their "uninvited participation"[774] were primarily understood in terms of deficits of "public understanding"[775] of science. Up until the early 2000s, the EU's institutions had relied on "ELSI" arrangements in the governance of new life sciences (see chapter 2), including through expert committees such as the "Group of Advisors on the Ethical Implications of Biotechnology" and the "European Group on Ethics in Science and New Technologies". Yet, ethics expert's assumed representation of a European public and its preferences with regard to biotechnology had widely contributed to the perception of a "passive-preservationist" relationship among science governance and the EU, in which member-states would still form the locus of deliberation, regulation, and policy[776]. At the beginning of the new millennium, a Eurobarometer Survey[777] confirmed a "mixed picture" in European public opinion on science, "ranging from confidence and hope to lack of interest in scientific activities or even fears regarding some of their impacts"[778], and reflecting ongoing tensions in the public appraisal of biotechnology and GM food, as well as rising concerns of a similar disaster for the nascent market of nanotechnology[779] in the early 2000s.

New modes of "taking European knowledge society seriously"[780] started to gain traction in the Lisbon Strategy and its goal to create ERA. A "Science and Society Action Plan" would for the first time explicitly integrate programs and funding for a better integration of citizens in the "6th Framework

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[773] Aidan Davison, Ian Barns, and Renato Schibeci, 'Problematic Publics: A Critical Review of Surveys of Public Attitudes to Biotechnology', *Science, Technology, & Human Values* 22, no. 3 (1 July 1997): 317–48.
[774] Wynne, 'Public Participation in Science and Technology: Performing and Obscuring a Political–Conceptual Category Mistake'.
[775] Wynne, 'Misunderstood Misunderstanding'.
[776] Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*.
[777] The Eurobarometer, one of the EU's central tools for mapping public opinion in Europe, started to take into consideration science and technology during rising protests to agricultural biotechnology, as documented by Les Levidow and Claire Marris, 'Science and Governance in Europe: Lessons from the Case of Agricultural Biotechnology', *Science and Public Policy* 28, no. 5 (October 2001): 345–60. For a sublime and in-depth analysis of the role and function of the Eurobarometer in representing and, indeed, making of European "public opinion", see Claudia Schrag Sternberg, *The Struggle for EU Legitimacy. Public Contestation, 1950-2005.* (Palgrave Macmillan, 2013).
[778] European Commission, ed., *Science and Society: Action Plan* (Luxembourg: Office for Official Publications of the European Communities, 2002), 7.
[779] Macnaghten, Kearnes and Wynne, for example, argued that "the emergent, undetermined nature of nanotechnologies calls for an open, experimental, and interdisciplinary model of social science research" in Phil Macnaghten, Matthew B. Kearnes, and Brian Wynne, 'Nanotechnology, Governance, and Public Deliberation: What Role for the Social Sciences?', *Science Communication* 27, no. 2 (1 December 2005): 268–91.
[780] Felt and Wynne, 'Taking European Knowledge Society Seriously'.

Program" (running from 2002-06), which granted 0.5 percent of the EC's overall research budget[781] to promoting a "scientific and education culture" in Europe, "bringing science policies closer to citizens", and putting "responsible science at the heart of policy-making."[782] In this plan, the proper relationship between science, society, and the EU would not rest on scientific or normative expertise to represent the public interest, but was envisioned to be conceived by European citizens themselves through deliberation and participation in decision-making on science governance. Philippe Busquin, then Commissioner for Research who also prototyped the EBRA for ERA during these years (see above), spearheaded the policy-turn towards societal participation. In the foreword to the "Science and Society Action Plan", he reasoned the need for a better integration of citizens in a knowledge-based Europe on the grounds of informed choice in democratic governance:

> In a knowledge-based society, democratic governance must ensure that citizens are able to make an informed choice from the options made available to them by responsible scientific and technological progress…The aim of the EC's Science and Society Action Plan is therefore to pool efforts at European level to develop stronger and more harmonious relations between science and society.[783]

Nearly a decade after, the EU's governance frameworks for harmonizing science and society assembled around a novel frame of reference with the appealing title "Responsible Research and Innovation" (RRI). Embedded within the EC's larger goal to move from a European knowledge- to an innovation economy through Horizon 2020, the discourse around society's role in scientific and technological development had moved from Busquin's "science *and* society action plan" to the institutionalization of a dedicated unit for "Science *with* and *for* society" in the EC's research directorate, including a "recoding" of rationales for public deliberation in the governance of science into imperatives of responsibility for the production and societal uptake of innovation[784]. At a 2012 conference for "Science in Dialogue – Towards a European Model for Responsible Research and Innovation" in Denmark, Commissioner for Research Maíre Geoghegan-Quinn, who had already framed the risks for the European economy if funding for research and innovation was cut in the EC's budget (see above), would also take the chance to frame the risks of not investing in RRI at EU-level for Europe's policymakers:

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781 For a helpful comparison between the different European "Action Plans" in Science and Society, see Cristina Palma Conceição et al., 'European Action Plans for Science–Society Relations: Changing Buzzwords, Changing the Agenda', *Minerva* 58, no. 1 (1 March 2020): 1–24.
782 European Commission, *Science and Society*.
783 European Commission, sec. Foreword.
784 For a compelling and structured overview of the incremental steps from science and society to science with and for society in the EC and related epistemic communities, as well as shifts from deliberation to production in policy-discourses on participatory science and technology governance, see Hadrien Macq, Élise Tancoigne, and Bruno J. Strasser, 'From Deliberation to Production: Public Participation in Science and Technology Policies of the European Commission (1998–2019)', *Minerva* 58, no. 4 (1 December 2020): 489–512.

After 10 years of action at EU level to develop and promote the role of science in society, at least one thing is very clear: we can only find the right answers to the challenges we face by involving as many stakeholders as possible in the research and innovation process. Research and innovation must respond to the needs and ambitions of society, reflect its values, and be responsible. To my mind, there are a number of keys to doing this.[785]

The keys to collectively unlock the development and promotion of science *with* and *for* society suggested by Geoghegan-Quinn formed the heuristics of the RRI framework, which was implemented as a cross-cutting issue throughout Horizon 2020's funding scheme revolving around the elements of "public engagement, open access, gender, ethics, and science education"[786] for which the EC would share 424 million EUR[787] of its overall research budget. Several proposals had been circulating between the EC's Directorate General for Research and Innovation and academic communities concerned with Science, Technology, and Society (STS) in the years preceding the EC's commitment to RRI and its five "keys", ranging from calls for new ways of "articulating a collective normative capacity in the settling of trajectories for research and innovation"[788], to the construction of socially "robust" knowledge in the governance of science[789], and the need for actors in research and innovation to become more responsive to "grand challenges of our time for which they share responsibility"[790], amongst others. Taking an important role in the formulation of the RRI framework, these scholars had successfully argued the EC's "deficit model" of public understanding of science[791] permeating ERA policies to shift towards understandings of the public as an active partner in knowledge co-creation, as well as to reason its motivations for greater public engagement in normative and substantial, rather than purely instrumental terms[792].

A number of high-level declarations reflected and cemented the EU's commitment to solving "grand social challenges" with "responsible" research and innovation, among which the "Rome Declaration on RRI in Europe" drafted in late 2014 gained particular prominence. Here, RRI was defined as "the ongoing process of aligning research and innovation to the values, needs, and expectations of

[785] Directorate-General for Research and Innovation (European Commission), *Responsible Research and Innovation :Europe's Ability to Respond to Societal Challenges* (LU: Publications Office of the European Union, 2014).
[786] Directorate-General for Research and Innovation (European Commission).
[787] For the larger place of SwafS and RRI in Horizin 2020s budget see European Parliament, Directorate-General for Parliamentary Research Services, and V Reillon, *Horizon 2020 Budget and Implementation : A Guide to the Structure of the Programme : In-Depth Analysis* (European Parliament, 2016).
[788] Felt and Wynne, 'Taking European Knowledge Society Seriously', 82.
[789] Nowotny, Scott, and Gibbons, 'INTRODUCTION'.
[790] von Schomberg, 'A Vision of Responsible Research and Innovation'.
[791] Wynne, 'Misunderstood Misunderstanding'; Hackett and Rhoten, 'Engaged, Embedded, Enjoined: Science and Technology Studies in the National Science Foundation'.
[792] Owen, Macnaghten, and Stilgoe, 'Responsible Research and Innovation', 757.

society", which "requires that all stakeholders, including civil society, are responsive to each other and take shared responsibility for the processes and outcomes of research and innovation"[793]. Reminiscent in title and in aspiration of the "Treaty of Rome" that had laid the foundations for the European Economic Community (EEC) in 1957 by tasking member-states "to promote throughout the Community a harmonious development of economic activities, a continuous and balanced expansion, an increase in stability, and accelerated raising of the standard of living…"[794], the "Rome Declaration" laid the foundation for RRI's rationale as a uniquely European way to promote technology acceptance, improve scientific quality, reach sustainable innovation, and a raise in standards of excellence across the Union:

> More than a decade of research and pilot activities on the interplay between science and society points to three main findings. First, we cannot achieve technology acceptance by way of good marketing only. Second, diversity in research and innovation as well as the gender perspective is vital for enhancing creativity and improving scientific quality. And third, early and continuous engagement of all stakeholders is essential for sustainable, desirable and acceptable innovation. Hence, excellence today is about more than ground-breaking discoveries – it includes openness, responsibility and the co-production of knowledge.[795]

Constituting a European public will on neuroscience: The Meeting of Minds

The embrace of neuroscience through EBRA and of neurotechnological innovation through the HBP represented important sites for experimenting with and, in fact, re-constituting the EU as a democratic union through participatory science and technology governance. The gradual turn to public participation and a rising imaginary of a European public engaged in the governance of science and technology toward collectively desirable ends was first reflected within the EU's attempts to co-produce new knowledge on the brain and a shared will on how to govern the moral implications of the rising neurosciences. Taking place ten years before the announcement of the HBP, the "Meeting of Minds", a "European Citizen Deliberation on Brain Science" was an important precursor in the production of European public reason around neuroscience and the ordering of neuroscience-society relationships in the EU. Engaging 126 citizens from nine European countries over the course of two years, the MoM was one of the largest participatory exercises ever conducted on brain science, which had been supported by the EC, orchestrated by the King Badouin Foundation from Belgium, and operated by twelve organizations specialized in technology assessment, science communication, and public engagement formats.

Initiated as a "pan-European debate"[796] among citizens on the ethical issues provoked by the

[793] European Commission, 'Rome Declaration on Responsible Research and Innovation in Europe'.
[794] European Commission, 'The Treaty of Rome', 25 March 1957. Part 1 Principles Article 2.
[795] European Commission, 'Rome Declaration on Responsible Research and Innovation in Europe'.
[796] Meeting of Minds Partner Consortium, 'European Citizens' Assessment Report Complete Results' (Brussels: European Parliament, 23 January 2006).

novel neurosciences, the MoM developed a set of recommendations envisioned to represent Europe's public opinion and to feed into evolving European policies on brain science. The ambitious process, eventually completed in 2006, was not only the first of its kind in terms of bringing Europe's diverse publics together to deliberate on the what's and how's of neuroscience and its desirable governance; it was also considered an innovation in science governance itself[797] with role-model potential for the wider democratization of EU's expert[798] policy-culture as a flyer accompanying the MoM explained:

> For the first time, citizens of the European Union are leading debates that shape public policy. This ambitious and innovative process of citizen participation…represents an unprecedented opportunity to give ordinary people - from nine countries and with different cultural and linguistic backgrounds - a role in guiding the EU in the earliest stages of policy development in a complex scientific field. (MoM) marks a breakthrough in participatory governance that holds promise for policy development in many other fields and at various levels of government.

The MoM was performed as a grand showcase for how to put a *consensus gentium* on emerging (neuro)science and technology across Europe into action. From the start, the deliberation had been designed as representative[799] and, in fact, productive of a European public. Participation of citizens in the MoM, for example, would be based on "sortition", the random selection of representatives by lot that had been practiced in the city-democracies of Athens to Florence, which was believed to not only increase diversity in opinions but also to decrease corruption of deliberations by pre-formed majority views. Albeit sortition would guarantee the disinterestedness and diversity of participants in shaping the recommendations' content, a certain degree of self-selection could not be avoided. Many participants shared an interest in brain science and a background in having been affected by brain disorders either personally or in their environment, rendering their views on the topic of deliberation authentic and authoritative. As Robert, a creative director from the UK, summed up his motivation in and experience with participating in the MoM:

> For quite a number of years I have been interested in the creative potential of the brain. There are also a number of brain science issues (mental health, degenerative brain disorders) that have affected my immediate family. I have been very impressed by the structure of this process. It has enabled the perspectives of a great variety of people to be represented in a balanced yet powerful way.[800]

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[797] de Saille, 'Innovating Innovation Policy'.
[798] Meeting of Minds and King Baudouin Foundation, 'European Citizens' Deliberation on Brain Science', n.d.
[799] Mark B. Brown, 'Survey Article: Citizen Panels and the Concept of Representation', *Journal of Political Philosophy* 14, no. 2 (2006): 203–25.
[800] Meeting of Minds Partner Consortium, 'European Citizens' Assessment Report Complete Results', 13.

Next to guaranteeing representativeness of EU's diverse public and its various perspectives, also the structure of the deliberation process had been planned to mirror and immerse participants into the EU's complex ways of decision-making across national and European levels. Employing the methods of a "21st Century Town-Hall Meeting", "Consensus Conference" and "Carousel", the MoM kicked off with an initial "1st European convention" in which key themes and questions were identified, discussed in two rounds of "national assessments" in the participant's home-countries, and taken back to a "2nd European Convention" for a final round of deliberation and voting, which would then be codified in a report to be handed over to policymakers. Apart from national rounds of assessment that replicated debate of European policy in national parliaments, the meeting gathered minds in Brussels, the EU's headquarters, supported by simultaneous interpreters and 'facilitators'. Hence, the step-wise process of the MoM[801] not only faced the practical hurdles of deliberation between local, national, and supranational settings, including communication across nationalities and their languages, but would very much replicate what the Maastricht Treaty labelled "co-decision" and the Lisbon Treaty the "ordinary legislative procedure" for finding consensus and establishing joint rules in the EU. Through co-decision, the European Parliament had been endowed with the power to amend, approve, and veto legislative proposals by the EC and concurrent legislation declared by the Council of the European Union, the "heart of EU decision-making"[802]. Similar to the simple majority needed among the 705 Members of the European Parliament to decide on legislative acts through co-decision, participants in the MoM's "European Conventions" - plenary sessions in which national representatives gathered to discuss and find common ground on themes and recommendations – would reach conclusions through a complex process of amending and voting on recommendations. A report documenting the deliberations explained the elaborate system of decision-making performed by the MoM:

> On Sunday 22 January, the European citizens' panel assembled in one plenary ses- sion to review the reports from each of the carousels in order to agree on a final report … The citizens received translations of the pre-final versions of the recommendations as concluded in the carousels and edited by the writers' group. At this point the recommendations already contained the input and represented the views of a large number of the panelists. The citizens were given a final chance to make adaptations to the recommendations. They were seated in their national panel groups for language reasons, but were asked to keep their focus European…The amendments were presented in the plenary and voted on by the entire European panel. Amendments were accepted

[801] For a detailed description of the process, see Meeting of Minds Partner Consortium, 11. "How did the Meeting of Minds Work?" and p. 21 Table on "Overall flow of design"
[802] Jeffery Lewis, 'The European Council and the Council of the European Union', in *European Union Politics*, 7th ed. (Oxford, New York: Oxford University Press, 2022), 155.

if supported by a simple majority (half of all votes plus one).[803]

Immersion into the processes of legislative approval practiced within the European Parliament presented MoM's organizers and participants with the EU's in-built challenge of balancing national versus European interests in decision-making on recommendations. The tensions of EU's ambiguous institutional set-up, operating partly as intergovernmental *Staatenverbund* within the Council, and partly as a polity of its own constituted by a directly elected European Parliament[804], indeed would not escape the MoM's deliberations: discussion tables organized around shared languages, for example, triggered participants to compete for their amendments to 'win' over suggestions made by other tables structured around nationality[805], and citizens argued passionately over the idea to refer to a "common European ethics" in their recommendations, which, according to the French table, simply did not exist[806]. But the repeated rounds of deliberation across tables eventually helped keep MoM's focus 'European' and in finding consensus on the final list of recommendations. As technology-assessment experts Rüdiger Goldschmidt and Ortwin Renn evaluated the citizen's performance throughout the process, they

> […] acted not only as representatives of their country, [but] understood themselves as European participants. The process promoted a European dialog and, as a consequence of this, an emerging European group identity among the citizens…[it] successfully connected the individuals with the process and its objectives.[807]

Karin van Erp Mauriks, one of the MoM's participants from the Netherlands, reiterated their assessment when commenting the process with the following appraisal: "even though it started slowly I felt the people involved in this convention have a very passionate will in finding a common European perspective"[808].

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[803] Meeting of Minds Partner Consortium, 'European Citizens' Assessment Report Complete Results', 26.
[804] This hybrid nature has received different interpretations of which some question the idea of the European Parliament as a polity of its own due to its limited power to initiate legislation. The landmark case BVerfG, Judgment of the Second Senate of 30 June 2009 - 2 BvE 2/08 -, paras. 1-421, for example argued that "The concept of *Verbund* covers a close long-term association of states which remain sovereign, an association which exercises public authority on the basis of a treaty, whose fundamental order is, however, subject to the disposal of the Member States alone and in which the peoples of their Member States, i.e. the citizens of the states, remain the subjects of democratic legitimisation. The European Union must comply with democratic principles as regards its nature and extent and also as regards its own organisational and procedural elaboration" Bundesverfassungsgericht, 'Act Approving the Treaty of Lisbon Compatible with the Basic Law; Accompanying Law Unconstitutional to the Extent That Legislative Bodies Have Not Been Accorded Sufficient Rights of Participation', Pub. L. No. 2 BvE 2/08 (2009).
[805] R. Goldschmidt and Ortwin Renn, 'Meeting of Minds - European Citizens' Deliberation on Brain Sciences : Final Report of the External Evaluation', 2006, 26.
[806] Meeting of Minds Partner Consortium, 'European Citizens' Assessment Report Complete Results', 27.
[807] Goldschmidt and Renn, 'Meeting of Minds - European Citizens' Deliberation on Brain Sciences', 45–46.
[808] Karin van Erp Mauriks (Netherlands) in Meeting of Minds Europe, 'Meeting of Minds European Citizens' Deliberation on Brain Science: Report on the 1st European Citizens' Convention', 2005, 7.

Resurrecting the EU's failed Constitution

The slow but steady stabilization of a common European "will" described by van Erp Mauriks had also penetrated the imaginaries of political leaders throughout EU's integration process, from the neo-functional vision of a mutually reinforcing relationship between a union of markets and a union of people advanced by Jean Monnet and Robert Schumann in the 1950s, to the federal-republican aspirations of Jaques Delors and Joschka Fischer to create a "Single European State bound by one Constitution"[809] in the early 2000s. Fifty years into the European unification process, the EU had successfully established an Economic Constitution[810] to govern the Single Market and its laws – yet, a European *demos* was still found largely missing according to some of the most prominent thinkers commenting on European integration at the beginning of the 21st century[811]. The difficult project of moving from an intergovernmental, confederal system for the shared governance of markets[812] to an "ever closer union"[813] of European citizens in political terms regained hope the same year the MoM kicked-off, when a draft of the "Treaty establishing a Constitution for Europe" was presented to member-states for national deliberation and ratification in 2004.

But while the macro-politics of the federalization project ran against closed doors of commitments to national sovereignty, as expressed vehemently in the rejection of the draft Constitution by France and the Netherlands through popular referenda in summer 2005, the Union would re-constitute itself in the micro-democratic exercises of the MoM and its performance of a joint European

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809 Fischer quoted in The National Platform EU Research and Information Centre, 'What the EU Constitution Does: A 14-Point Critical Summary' (Dublin, Ireland, 2005).

810 Ernst-Joachim Mestmäcker, 'Zur Wirtschaftsverfassung in Der Europäischen Union', in *Ordnung in Freiheit: Festgabe Für Hans Willgerodt Zum 70. Geburtstag*, ed. Rolf Hasse, Josef Molsberger, and Christian Watrin (De Gruyter Oldenbourg, 2016), 263–92.
Christian Joerges describes Mestmäcker's ordoliberal vision of a European Economic Constitution as a "querelle allemande" that has produced the very crisis of Europe's democratic legitimacy: "These querelles allemandes anticipated a steadily deepening dilemma for the European project, namely the unresolved tensions between the juridification of the 'economic' according to the 'logic of the market', on the one hand, and the primacy of democratic legitimacy, on the other. This tension can in hindsight be characterised as the most problematic legacy of the foundational period of the European project" In: Christian Joerges, 'Constitutionalism and the Law of the European Economy', in *Beyond the Crisis* (Oxford: Oxford University Press, 2015).

811 One of the first voices identifying the "socio-psychological dimension of the EU's democratic pathology" – a lack of a European 'demos' – next to to the EU's "institutional" democratic deficit was Dimitris Chryssochouu in his well-known book on "Democracy in the European Union" Dimitris Chryssochoou, *Democracy in the European Union* (Bloomsbury Publishing, 2000). See also Dimitris N. Chryssochoou, Stelios Stavridis, and Michael J. Tsinisizelis, 'European Democracy, Parliamentary Decline and the "Democratic Deficit" of the European Union', *The Journal of Legislative Studies* 4, no. 3 (1 September 1998): 109–29.

812 The confederal model of European integration "suggests that democracy in the EU is better served by establishing a democratic society for European states, rather than forging a new polity and EU democracy" – a 'system of governments'. Dimitris Chryssochoou, 'Europe's Contested Democracy', in *European Union Politics*, 3rd ed. (Oxford, New York: Oxford University Press, 2010), 364. and has been described by analysts as the theoretical perspective closest to the EU's de-facto form of governance (as it is claimed to not fulfil all characteristics of a parliamentary, federal, consociational or republican model of democracy). For further reading into the discussion of confederralism, see Murray Forsyth, *Unions of States: Theory and Practice of Confederation* (Continuum International Publishing Group Ltd., 1981). and Frederick Lister, *The European Union, the United Nations, and the Revival of Confederal Governance* (Westport, Conn: Praeger, 1996).

813 The figure of an "ever closer union among the peoples of Europe" has been anchored in the EU's most important treaties from Rome to Lisbon, suggesting that Europe will gradually merge from an economic to a political union.

public. Whereas the EC's president Jose Manuel Barroso described the atmosphere in the EU's institutions during these days as a "difficult moment for Europe"[814], followed up by the expression of fears by German chancellor Gerhard Schröder that "the situation must not become Europe's general crisis"[815], citizens participating in the MoM showed great enthusiasm for the European project and their participation therein. As a Greek and a Flemish participant, impressed by the MoM's deliberations, described their feelings after at the "1st European Convention" in 2005:

> This is the first time Europe has asked my opinion. Today, I feel truly European.[816]

> A unique process for the European community, a unique opportunity for European citizens to get to know how similar they are in their diversity.[817]

Whereas public consultation on a shared European Constitution had failed to bring Europe's citizens closer together on greater scales, the MoM enacted a process to express shared civic identity able to produce joint reason towards a specific issue, its recommendations reflecting a quasi-constitutional order for neuroscience resting on a sovereign European will "to build a common future"[818]. This new-found polity did not envision a radically different constitutional commitment to European neuroscience than that suggested by proponents of the failed Constitution drafted for the EU as a whole. As citizens debated on how to build a desirable future based on "our newfound knowledge of the brain"[819], they showed deep faith in the Union's values that had been codified by the draft Constitution, such as "dignity, freedom, democracy, equality, the rule of law, and respect for human rights, including the rights of persons belonging to minorities"; as well as "pluralism, non-discrimination, tolerance, justice, (and) solidarity."[820] In the 37 citizen's recommendations, "dignity of life," for example, would be deemed central to "every piece of research and every treatment" involving neuroscience[821], as well as to "medical assistance…for chronically ill patients"[822], and to the possibility to "choose, or refuse, early testing and diagnosis"[823]. "Freedom of choice", according to the citizens, should become the leading ideal when "choosing a trusted person" to take decisions in the event of

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814 Barroso quoted in Staff, 'Dutch Say "devastating No" to EU Constitution', *The Guardian*, 2 June 2005.
815 Schröder quoted in Staff.
816 Meeting of Minds Partner Consortium, 'European Citizens' Assessment Report Complete Results', 12.
817 Hai-Chay Jiang – Flemish Community Belgium in Meeting of Minds Europe, 'Meeting of Minds European Citizens' Deliberation on Brain Science: Report on the 1st European Citizens' Convention', 6.
818 The Treaty establishing a Constitution for Europe begins with Article I-1 Establishment of the Union stating that "Reflecting the will of the citizens and States of Europe to build a common future, this Constitution establishes the European Union, on which the Member States confer competences to attain objectives they have in common".
819 Meeting of Minds Partner Consortium, 'European Citizens' Assessment Report Complete Results', 10.
820 European Commission, '52003XX0718(01) Draft Treaty Establishing a Constitution for Europe', Eur-LEX (OPOCE, 2003), Article I-2.
821 Meeting of Minds Partner Consortium, 'European Citizens' Assessment Report Complete Results', 85.
822 Meeting of Minds Partner Consortium, 95.
823 Meeting of Minds Partner Consortium, 98.

impaired consent capacity, and when educating society about risks to brain health[824]. They would insist, moreover, on "equality" in the "access to treatment across Europe"[825], and on "tolerance towards children and adults with psychiatric or neurological conditions" as well as on the promotion of "diversity as a source of richness in society"[826]. In sum, the MoM's recommendations would take an oath on the "humanist inheritance of Europe" conjured by the Constitution's preamble, as well as on its further promotion in a desirable future informed by the new brain sciences.

Settling humanist principles for neuroscience

Humanist ideals enshrined in the failed Constitution[827] would also shape the MoM's recommendations in their support of progress in brain research, as well as in their reasoning around human identity and agency as categories that were deeply re-shaped by neuroscientific advance. Guided by experts in the field of neuroscience who accompanied the deliberations, MoM's participants granted brain research the position of an "important building block for our societies", for which "as much financial support must be made available as possible" that would give people "access to a range of high-quality treatments which can be tailored to their individual needs"[828]. Reasoning around more funding would stem from the acknowledgment that the "brain represents our identity, personality and mind"[829] and thus demanded special forms of protection as well as care by individuals and institutions. But despite the attribution of neuroscientific language to individual agency, citizens weighed neuroscience's categorization of brain functioning into normal and abnormal states against the dangers of an overmedicalization and 'brainification' of society; in particular, their recommendations would ask for clarification of the boundaries of "which variations exist within 'normality' and what should be interpreted as 'real' disease in order to avoid unnecessary treatment and medicalization of society"[830]. The countering of an assumed bias of research towards the narrow simplification and determination of human identity sitting in the human brain would also have to be key in informing society about progress in the sciences of the brain, for which the citizens recommended the "organization of a European information strategy" that would include ethical, legal and social dimensions in education about the brain:

> We recommend developing an overall strategy at European level in order to make information about brain science as well as related ethical, social and legal aspects available to a wider public. This information must be unbiased. In order to ensure this, the information should be distributed using public funds. One element of this strategy

824 Meeting of Minds Partner Consortium, 90.
825 Meeting of Minds Partner Consortium, 94.
826 Meeting of Minds Partner Consortium, 87.
827 Article I-3 of the Treaty establishing a Constitution for Europe foresees that the Union "shall promote scientific and technological advance".
828 Meeting of Minds Partner Consortium, 'European Citizens' Assessment Report Complete Results', 88.
829 Meeting of Minds Partner Consortium, 86.
830 Meeting of Minds Partner Consortium, 87.

should be awareness-raising campaigns. Moreover, research institutions should be required to publish annual reports which are made available to the public.[831]

Next to the provision of "unbiased" and transparent information through public bodies, the public finance of research gained a prominent role in the citizen's recommendation, which dedicated a lengthy article to the biases emanating in neuroscience due to "pressure from economic interests". In the participants eyes, neuroscience research and its applications should be "used strictly for treatment and not for any manipulation of the brain"[832], a risk they saw arising particularly due to the larger resources available to private industry, and specifically big pharma companies, in fields of brain-research "which promise to yield quick returns on investment"[833]. The ontological and normative surgery conducted by the MoM around the realms of the public and the private affected by brain research, considered as deeply bound to underlying motivations for investments in neuroscience, here was constructed along the boundaries of science's constitutional position in relation to the common good: "we want research that is governed by the health needs of individuals, and not by the profit motives of the industry", the citizens demanded, "we want it to be studied where in the field of brain science funds for research are lacking although the public interest is high"[834]. In such vision, the pursuit of science in the public interest could only be ensured through locating it firmly in the public sphere, as well as through a regulation of private interests that would incentivize pharmaceutical companies to invest in research on "rare diseases" with "low-profit potential"[835].

Declaring neuroscience as a European *res publica*

Through the drawing of these boundaries, neuroscience was not only declared as a *res publica* by citizens, as a matter belonging to the public, but also as a matter worthy of provision and protection by public bodies and in particular the EU's institutions[836]. Claims for a firm hand in the public regulation of neuroscience expressed in the recommendations echoed the Constitution's aspirational language to work for "a highly competitive social market economy" resting on scientific and technological advance[837]. At the same time, they bore witness to critiques of the EU's nature as a democracy *of the People* but not *for the People,* as an ordoliberal government concerned primarily with laws of and for

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[831] Meeting of Minds Partner Consortium, 87.
[832] Meeting of Minds Partner Consortium, 86.
[833] Meeting of Minds Partner Consortium, 92.
[834] Meeting of Minds Partner Consortium, 92.
[835] Meeting of Minds Partner Consortium, 92–93.
[836] Meeting of Minds Partner Consortium, 92.
"We recommend that the EU sets aside money for research in the whole area of brain science. This specifically includes non-pharmaceutical solutions for problems related to the brain as well".
[837] European Commission, '52003XX0718(01) Draft Treaty Establishing a Constitution for Europe'., Article I-3 (3) "The Union shall work for the sustainable development of Europe based on balanced economic growth and price stability, a highly competitive social market economy, aiming at full employment and social progress, and a high-level protection and improvement of the quality of the environment. It shall promote scientific and technological advance."

the market but not for the welfare of its citizens[838]. By calling upon the EU to provide its public with research in its interest, citizens participating in the MoM would re-imagine the social contract with their governors in Brussels, in which the European polity would express its common will through participation in decision-making on science, which would, in turn, be safeguarded by the EU's regulatory power to steer science as well as markets towards socially desirable ends:

> Regulation of brain research and treatment must be independent of political and economic interests. We citizens are essentially concerned with this because the brain represents our identity, personality and mind. Therefore, we want to be involved at the different levels of decision through various forms of participation.[839]

Questions about the appropriate role and governance of neuroscience in society were hence closely related to questions about the past, present, and future of the EU in the MoM's recommendations[840]. The text would simultaneously serve as a recollection of Europe's shared roots in science and humanism, as a critique of the perceived contemporary democratic deficits of the Union in providing its people with the social good beyond market goods, and as a powerful political fiction of the ideal relationship between science and citizens under the aegis of a European welfare "superstate"[841]. By settling the normative boundaries of neuroscience within and through these entanglements with the making of Europe, the MoM not only produced political subjects performing as active "scientific citizens"[842] interested in the coming into being of the European common good. It also co-produced the modes of participation deemed appropriate for reaching popular sovereignty over the brain sciences and their relationship to the body politic. The result, which can be read as a first step toward an emerging European *demos* for emerging neuroscience, envisioned nothing less than the coming into being of a European republic for science, an imaginary fueled by broader political aspirations of reinventing the social contract between the EU and its citizens that marked the early 2000s. As a flyer documenting the MoM's success described,

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838 Political economist Fritz Scharpf has documented and advanced the critique of an "output" deficit in the EU's democratic legitimacy best. See one of his earliest Working papers: Fritz W. Scharpf, 'Interdependence and Democratic Legitimation', Working Paper (MPIfG Working Paper, 1998).
839 Meeting of Minds Partner Consortium, 'European Citizens' Assessment Report Complete Results', 86.
840 After struggling for quite a while on how to put the relationship between the MoM's performance and the parallel making of the EU into words, Sheila Jasanoff's chapter "A Question of Europe" was an important inspiration. Here, she describes similar "analytical difficulties" in disentangling the relationship between a Union in "flux" and the shaping of life science policies in and across its member states: "to answer what Europe should strive to achieve in the field of biotechnology, it proved necessary to address what kind of union Europe was – or wanted to be – both in relation to its member-states and as a player on the world stage." See Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*, 92.
841 The figure of a European "superstate" is key to Jasanoff's analysis of biotechnology regulation in the EU in *Designs on Nature,* yet usually used by critics of the European federalization agenda. For a recent critique of the EU's latest attempts to "become a welfare superstate", see The Economist staff, 'The EU Is Trying to Become a Welfare Superstate', *The Economist,* 15 May 2021.
842 Alan Irwin, 'Constructing the Scientific Citizen: Science and Democracy in the Biosciences', *Public Understanding of Science* 10, no. 1 (1 January 2001): 1–18.

The European Citizens' Deliberation is an important achievement, establishing that citizen participation is possible on a European scale. It demonstrates that it is not only possible, but desirable, to draw on citizens' intellectual and creative capital in shaping a common future in which all can feel a part. The success…, moreover, shows that this exciting innovation can work across many countries and cultures, and can be adapted to other fields of research, and thus put a European public face on areas previously stamped 'experts only'. [843]

[843] Meeting of Minds and King Baudouin Foundation, 'European Citizens' Deliberation on Brain Science'.

7.2 Ordering Responsible Neuro-Innovation

While the MoM's recommendation found little official reverb and uptake within the long corridors of Brussel's headquarters, the participatory discourse and practices it prototyped had an important performative effect on the framing of innovation-society relationships within the HBP. Against its perception as a largely top-down, centralized, and market-driven project, the HBP dedicated 4.5 percent of its funding to the creation of an "Ethics & Society" Subproject 12 (SP12) as the "hub of RRI in the HBP"[844], including a dedicated focus on bottom-up public engagement and collective dialogue. Reaching a similar budget as the HGP's dedication of 5 percent to research into ELSI – often cited as pioneering exemplar of combining big science projects with ethical expertise –, the HBP championed a diversity of RRI mechanisms that went well beyond the integration of social science and humanities experts only: neuroethics, philosophy, and the building of researcher awareness around the social implications of their work formed as much part of SP12 as did tools for gender diversity among researchers, foresight, and public engagement on future scenarios of HBP's applications in society. These broader areas for the alignment of society with the HBP were put into action by an Ethics Rapporteur Programme, an Ethics Advisory Board, a number of cross-European citizen and stakeholder meetings, several foresight workshops and reports, and a large group of illustrious philosophers, social scientists, and citizen deliberation experts[845]. Among them, Professor Nikolas Rose from King's College London, acclaimed sociologist of poststructuralist perspectives on the life sciences who had just published a book on "Neuro: The New Brain Sciences and the Management of the Mind"[846] when kicking off with the HBP's "Foresight Lab", described the underlying logic for mobilizing such a great variety of tools, people, and perspectives in the HBP's SP12 at length in a promotional video for the project:

> The HBP is committed to what it calls responsible research and innovation. It wants its research to do good and not do harm: To put it very bluntly, how will it know if the research that it is doing will create beneficial effects? It has to kind of think through what the implications of that research might be for different aspects of society, economic development, industrial development, mental health, and so on. And in order to be able to think through those things, it needs to do research and to try and understand what the likely implications are, as the research flows through translation pathways into society. The idea of responsibility is not that individual scientists should be responsible individual researchers, because we're sure that they are responsible as individual human beings, but that the project itself should be steered in such a way that it does produce

[844] Human Brain Project, 'The Human Brain Project: A Report to the European Commission', April 2012, 206.
[845] For a full overview of the different dimensions of HBP's RRI work, see the Human Brain Project, 'Framework Partnership Agreement', 2015.
[846] Nikolas Rose and Joelle Abi-Rached, *Neuro: The New Brain Sciences and the Management of the Mind* (Princeton University Press, 2013).

the beneficial effects, the beneficial impact that it's claimed…The human brain project has made quite bold claims in the beginning about the kinds of consequences that it would like to have for information communication technologies, for medical technologies, and for our understanding of the brain and its disorders. And to take responsibility implies having an understanding of how you can maximize those benefits, what kinds of decisions can you make in the present that might produce benefits in the future? Or what kinds of decisions should you not make in the present because they are unlikely to produce those outcomes that you desire? We try and operate through our feedback loop mechanism. So we produce reports, we have seminars, we have workshops, we try and involve the researchers from those who direct different aspects of the project, the main board of the human brain project, the people who run the different sub projects, through to the researchers who are actually doing the work, we try and feed back our results. But more importantly, we try and enhance their capacity to understand how their research might trickle through. Like translate might move into the social and other applications so that they themselves can reflect on their work, and they themselves can make more informed decisions.[847]

Rose's detailed summary was telling of the multiple dynamics expected to result from the "feedback loop" between research, society, and innovation enacted by the implementation of RRI across the HBP, which was imagined to run along several normative boundaries of neuroscience's application in society: reaching "beneficial" rather than "harmful" effects by delivering on the HBP's "bold" claims, achieved through a collective, rather than an individual, effort that would then feed into "informed decisions" in the individual work of researchers, as well as in the overall "translation pathways" of the HBP from research to society. His reflections on the temporality of the RRI process, which granted decision-making in the present a key role for the realization of HBP's promises in the future, echoed the academic and policy discourse around RRI as an "upstream" approach to research and innovation, which claimed that "only by opening up innovation processes at an early stage can we ensure that science contributes to the common good"[848]. Indeed, the upstream work conducted in SP12 would support the HBP in stabilizing the project's doubted legitimacy as contribution to the downstream provision of the public good beyond market goods – here, a "contamination" of scientific knowledge through normative input was framed as an essential element for guarding legitimacy and relevance early on, as the HBP's Framework Partnership Agreement with the EC illustrated with regard to SP12's "Ethics & Society" potential:

The 'laws of progress' built into scientific forecasting methods presuppose a linear

[847] Human Brain Project, *The Likely Implications of The Human Brain Project - Nikolas Rose*, 2019.
[848] Wilsdon and Willis, *See-through Science*.

societal development and cannot embrace the complexity of factors influencing a society over time. To gain relevance, objective scientific knowledge must be 'contaminated' by normative evaluations, incorporating the complexity at stake. The import of norms into science must happen in a transparent and socially responsible way. Including citizens in the evaluation of societal development means that scientific advice is supplemented by the tacit knowledge of those affected by political decisions…Today, inclusion of citizens' perspectives is often seen as necessary for maintaining the legitimacy of science in society and science-based policy.[849]

Yet, commitments to a blurring of boundaries between knowledge and norms through citizen participation, constructed against the grounding of "objective" advice on science's "laws of progress" and towards the "import" of citizens perspectives in tackling the complexity of social development caused by science, would not liberate the HBP's RRI imaginations from a certain kind of determinism guiding the reasoning around the relationship between public participation and the downstream uptake of the project's output by society. The rejection of scientific rationales and their progressive agenda, instead, enabled another progressive rationale in which 'pure' science was pitted against "tacit knowledge" resting in citizens, and through which public participation would become presented as pre-condition for taking decisions in the project that would guarantee the acceptance of products flowing from the HBP in the future. While the contribution of society in the governance of neuroscience and innovation was framed as essential to the project's success, it was primarily oriented toward the role of citizens in the commercial exploitation of the HBP's expected outputs:

SP12 will build public awareness of the economic and social potential of HBP research and encourage public participation in priority setting and decision-making. Public acceptance of and participation in the Project is a pre-condition for effective commercial exploitation of Project results.[850]

While public participation in decision-making about science had also been the declared goal of ERA policies and the MoM's deliberation on the brain sciences, such reasoning around the need to engage the public in questions of governance and application of HBP's research neatly reflected the turn towards technological innovation that characterized Horizon 2020 policies, including funding of HBP's vision to promote a revolution in supercomputing for the continent. SP12's work on citizen engagement would further contribute to the shift to innovation and its promotion as a "responsible" enabler of the European public good.

[849] Human Brain Project, 'Framework Partnership Agreement', 204.
[850] Human Brain Project, 208.

Forming European Opinion on Dual Use Neurotechnology and Beyond

In particular, three "Opinions" produced by SP12 focused squarely on the normative issues arising from the future widespread use envisioned to result from HBP's research, being concerned with "Data protection and privacy", "Responsible Dual Use", and "Trust and Transparency in Artificial Intelligence"[851]. Drafted jointly by the different units of the subproject, their respective areas of expertise, as well as through the input of public engagement exercises, the development of "Opinions" not only helped to position SP12's work as contributing to the normative robustness of the HBP, but also helped to legitimize such positioning as inherently normative in itself, as part of a variety of viewpoints on HBP's research and its likely effects on society, and thus as an invitation for their further deliberation and elaboration rather than a fixed set of rules. Their role in the epistemic, ontological and normative ordering of *in silico* neuroscience and its applications was constitutive for the designation of meaningful boundaries between the HBP as "responsible" research and innovation project for the benefit of society, and its imagined "irresponsible" counterpart risking the project's public legitimacy and, hence, also the exploitation of commercial opportunities resulting from its research.

Ordering work along these lines proved particularly salient on questions of "Responsible Dual Use" in neurotechnology innovation. Different to its transatlantic counterpart, the HBP officially did not, and in fact, could not conduct dual use research under EU legislation, setting its research squarely in the civilian domain as compared to the BRAIN initiative's strong involvement of DARPA and respective hopes for innovation in the military and security domain. Yet, the SP12's "Opinion on Responsible Dual Use" reflected wider developments within the EU toward the permissibility of dual use research in particular, and the coming into being of a "European Defense Union" more generally. What could be understood as preparatory work in the background of the EU's larger aspiration to move beyond its constitution as a "peace project"[852], in turn, served the powerful demarcation of boundaries by the HBP to present itself as "responsible" project geared toward socially beneficial goals.

While research for military use was neither eligible for funding under the EC's Horizon 2020 program, which foresaw "only research and innovation activities focusing on civil applications"[853], nor represented by the HBPs partner institutions, none of which was explicitly geared towards military R&D, the crafting of the dual use "Opinion" echoed the sweeping tensions that were felt in Brussels on dual use issues during the early years of the HBP. From the founding days of the European Coal and Steel Community (ECSC) onwards, research and technology had primarily figured as a means to turn European industrial sectors that had driven WWII into drivers of a European "solidarity in

[851]All reports by the Neuroethics and Society Subproject can be found in Human Brain Project, 'Social, Ethical & Reflective Work in the Human Brain Project: Scientific Publications Contributing to Responsible Neuroscience in the Human Brain Project 2013- 2021', 2021.

[852] Vicki L Birchfield, John Krige, and Alasdair R Young, 'European Integration as a Peace Project', *The British Journal of Politics and International Relations* 19, no. 1 (1 February 2017): 3–12.

[853] European Commission, 'Guidance Note — Research with an Exclusive Focus on Civil Applications' (European Commission, 7 January 2020).

production”[854] that would eventually also promote peace among countries. As famously proposed by Robert Schumann in his 1950 declaration for the creation of the ECSC, the theme envisioned to guide European integration should be that “the contribution which an organized and living Europe can bring to civilization is indispensable for the maintenance of peaceful relations”[855]. Accordingly, Article 223 in the Treaty of Rome left spending and policies on defense and security to member-states[856], and despite the slow but steady re-formulation of the EU’s role in defense policy in the following decades, the EU’s identity rested strongly on its identity as a “conflict-transcending and peace-enhancing”[857] institution, with a unique approach to overcoming national hostilities through economic collaboration and harmonization. Indeed, only shortly before awarding the HBP its flagship status, the EU had been awarded the Nobel Peace Prize in 2012, which the chairman of the Nobel Committee grounded on the “fantastic” history of peaceful integration of European countries: “What this continent has achieved is truly fantastic, from being a continent of war to becoming a continent of peace. In this process the European Union has figured most prominently. It therefore deserves the Nobel Peace Prize.”[858]

The EU’s noble identity as a “continent of peace” was informative for restricting EC’s rules for research funding in civilian domains only, yet an emerging “European Security and Defence Identity”[859], including the Maastricht Treaty’s commitment to a “common defence policy, which might in time lead to a common defence”[860], increasingly blurred the boundaries of the EU’s tasks and authority between the promotion of peace and that of security and defense. Against the perception of terrorist threats and an increase in non-lethal weaponry in the cyberspace, the “European Defence Agency” was created in 2004, which included the development of a “European Defence Technological and Industrial Base” strategy[861]. Plans for the creation of a European Defense Fund that would further enhance such strategies were announced by the EC’s President Jean-Claude Juncker in his 2016 State of the Union Address, in which steps towards “a better Europe” were framed around a “Europe that protects”, “that empowers our citizens”, and “that defends at home and abroad”[862].

The creation of a common budget for a “European Defence Fund”, in turn, was seen as primarily supporting an innovative defense industry, which could receive a “turbo boost [in] research and innovation” if investments were allocated accordingly. A Communication from the Commission published in 2013 explained what such a boost would mean for the restrictive rules of dual use research

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[854] Schumann declaration.
[855] European Union, ‘Schuman Declaration May 1950’, *European Union* (blog).
[856] Birchfield, Krige, and Young, ‘European Integration as a Peace Project’.
[857] Harry Anastasiou, ‘The EU as a Peace Building System: Deconstructing Nationalism in an Era of Globalization’, *International Journal of Peace Studies* 12, no. 2 (2007): 31–50.
[858] European Union, ‘The Nobel Peace Prize Announcement’, NobelPrize.org, 2012.
[859] This terminology was coined by the NATO “to strengthen European participation in security matters while reinforcing transatlantic cooperation” EUR-Lex, ‘European Security Defence Identity’, EUR-Lex Access to European Union Law.
[860] Treaty of Maastricht, Article B Treaty on European Union.
[861] Dr Benedict Wilkinson, ‘The EU’s Defence Technological and Industrial Base’ (Belgium, 10 January 2020).
[862] ‘State of the Union Address 2016: Towards a Better Europe - a Europe That Protects, Empowers and Defends’ (Speech, Strasbourg, 14 September 2016).

in Horizon2020's funding schemes: "While the research and innovation activities carried out under Horizon 2020 will have an exclusive focus on civil applications, the Commission will evaluate how the results in these areas could benefit also defence and security industrial capabilities."[863] Upon closer inspection of the EC's Horizon 2020 funding rules, they indeed reflected the EU's ambiguous re-framing of its civilian mission when advising applicants that "If research is intended to develop or improve dual-use technologies or goods, it may still qualify for funding, as long as the goods or technologies are intended for civil applications" [864].

The grey areas left open by the EC's gradual opening toward admissibility of dual use research were at the heart of the HBP's "Responsible Dual Use" Opinion, with its introductory paragraphs reasoning on the EC's new definition of "dual use" as unsuitable and binary categories for catching the potential application of neuroscientific knowledge in "political, security, intelligence and military (PSIM) domains."[865] Through broadening neurosciences' possible use beyond the military to the concept of PSIM domains developed in the Opinion, and by turning to the World Health Organisations's and US NIH's approach to "dual use research of concern" (DURC) as more appropriate terminology, the Opinion sought to locate ethical and social deliberation on HBP's research within the potential future "irresponsible" scope of dual use research. Such demarcation, in turn, also helped to delineate "responsible" regard of uses other than civilian purposes in research within the HBP. As the Opinion argued,

> In this Opinion, we suggest that we can increase our ability to identify which programmes and projects of research, development and innovation are 'of concern' by applying the principles of Responsible Research and Innovation (RRI) to the concept of 'dual use' and distinguishing between 'responsible' and 'irresponsible' systems of research and technological development. We therefore use the term 'dual use research of concern' (DURC) to refer to neuroscience research and technological innovations, and brain inspired developments in information and communication technologies, for use in the political, security, intelligence and military (PSIM) domains, which are either directly of concern because of their potential for use in ways that threaten the peace, health, safety, security and well-being of citizens, or are undertaken without responsible regard to such potential uses.[866]

The criticized binary of dual "use" definitions opened up possibilities to re-frame DURC

[863] 'Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions towards a More Competitive and Efficient Defence and Security Sector' (EUR-Lex Access to European Law, 2013).
[864] European Commission, 'Guidance Note — Research with an Exclusive Focus on Civil Applications'.
[865] Human Brain Project, 'Opinion on Responsible Dual Use from the Human Brain Project', 21 December 2018, 4.
[866] Human Brain Project, 5.

research for use in PSIM domains around the equally binary boundary of responsible versus irresponsible "systems" of research and technological development, in which various actors beyond the military alone would be responsibilized for potential dual use research and its future application within society. This rhetoric of "Responsible dual use" systems presented security and defense use as inevitable, as, according to the Opinion's authors,

> For the present and foreseeable future, armed conflicts between nations will endure, …, demands will continue for novel technologies to enhance internal and external security, and a powerful arms industry will seek to develop and market technologically enhanced products as drawing on research in neuro-science and information and communication technologies.[867]

Moreover, the Opinion openly acknowledged the "important social benefits from research and development in security, military, and defense domains", such as the internet and GPS, or neuroprosthetics developed for war veterans, which would only create ethical and social "concerns"[868] if questions of RRI were not considered early on in PSIM research domains. It, thus, naturalized the need for as well as the translation of neurotechnologies in areas beyond civil use, such as clinical and medical domains, at the same time as it presented potential "Responsible Dual Use" research as legitimate expression of the public interest in non-civilian applications. By re-defining the meaning of dual use for neuroscientific research and technology, the Opinion not only created a legitimate space for RRI inquiry and governance into domains yet untouched by the HBP, but also produced a legitimate public role for neuroscience to carry out research in PSIM applications "responsibly". Behind this complex ordering work, an avowal to responsible DURC research would only find open appreciation in a footnote, which explained to the Opinion's meticulous readers "that this approach recognises the social and ethical legitimacy of responsible research and innovation in the domain of security and defence, provided that it does indeed contribute to peace and the well-being of citizens"[869].

Mobilizing citizen's expertise in their own life

How "Responsible Dual Use" could be imagined as beneficial to European citizens was answered by the public deliberation process accompanying the drafting of the SP12's Opinion on the matter. Public engagement for the Opinion was carried out by the Danish Board of Technology (DBT), a "pioneer in trouble", as it had been among the first science advisory bodies in Europe working with citizen deliberations at parliamentary level, representing an "international role model for democratic dialogue".

867 Human Brain Project, 9–10.
868 Human Brain Project, 10.
869 Human Brain Project, 9.

Yet, the Danish government had decided to cut its funding to zero in 2012[870], only a year before it would be taken up again by the HBP and its SP12. Its renaissance as the DBT "foundation" re-positioned its public engagement expertise as a useful partner in Horizon2020's commitment to deliberation in RRI, including the large-scale citizen consultations conducted across Europe for HBP's Opinions: the operationalization of HBP's face-to-face discussions around "Responsible dual use" in eight European countries with 241 citizens, as well as online consultations with 2048 participants from twenty countries[871], could in fact benefit from the DBT's vast experience in getting public engagement on science and technology up and running. As the DBT's director Lars Klüver described his expertise of working with citizen engagement for more than thirty years, "the practice of participatory policymaking is quite mature and ready for use in practice"[872], a practice which would consider citizens as equals with scientific experts in discussions and deliberations around the normative dimensions of emerging science and technology. In this vein, the information material handed prior to the HBP's deliberations around "Responsible Dual Use" in Denmark, England, Italy, Lithuana, Malta, Portugal, Germany, and Slovakia addressed participants as citizens as well as experts in their "own life", asked about their opinion rather than about substantial technical or scientific knowledge on the issue:

> The key focus is to understand how citizens view research that could have dual use. What great possibilities you see. What you are concerned about. What you would like policymakers and researchers to discuss further and take a stand on. We do not expect that you have any prior knowledge or a specific interest in the subject. We have not invited you as an expert in this field, but as a citizen - an expert in your own life. We look forward to hear your opinion![873]

As had been the case in the MoM, citizens participating in the HBP's dual use deliberations were chosen as representative of Europe's diverse people, ranging from different ages, genders, and educational backgrounds to geographical zones[874], and their discussions would be organized in similarly complex ways of different rounds of discussion and voting that led up to synthesis of their opinion in a lengthy report[875]. Different to the MoM, however, citizens were asked to reflect along the whole innovation trajectory of neuroscience research, its application in three domains set *a-priori* (Medicine, AI, and Brain-Computer Interfaces), and its potential implications in a future yet to come. This linear

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[870] Michael Jørgensen, 'A Pioneer in Trouble: Danish Board of Technology Are Facing Problems', *EASST* (blog), accessed 25 May 2022.
[871] Nicklas Bang Bådum and Marie Louise Jørgensen, 'European Citizens' View on Neuroscience and Dual Use Synthesis Report of Citizen Workshops' (Human Brain Project, n.d.).
[872] AFINO Research Centre, *Participatory Policy-Making When the Crisis Roars (Lars Klüver),* 2020.
[873] Human Brain Project, 'Citizen Consultations on Possible Dual Use of Brain Research', n.d., 10.
[874] Bådum and Jørgensen, 'European Citizens' View on Neuroscience and Dual Use Synthesis Report of Citizen Workshops', 23.
[875] Bådum and Jørgensen, 'European Citizens' View on Neuroscience and Dual Use Synthesis Report of Citizen Workshops'.

idea of the different stages from research to innovation to governance very much pre-structured the several rounds of discussions: “questions of principal character regarding research” centered primarily around “nuances that dual use adds to the research and the moral and ethical questions that it gives rise to”[876], “potential applications of neuroscience research” “point(ed) to the dilemmas (citizens) saw concerning research and its use”[877], whereas a list of “top ten questions” addressed potential future governance issues such as “how to prevent abuse and malicious use of research”[878]. Importantly, across these domains, citizens were not asked directly about HBP’s research and its predicted outcomes, whose intentions were framed as civilian only, but about the use of its civilian research by other actors in PSIM domains, which gave their “opinions, values, hopes and worries” from research to innovation and its governance a set idea of the HBP as a “responsible system of research and development”, whereas its potential “irresponsible” dual use application outside of the HBP would form the basis of deliberations:

> The focus of the workshops was the ethical, moral and practical questions that arise if neuroscience research intended for civilian use, as in the HBP project, can be used by others for political, security, intelligence or military purposes; dual use for short. Thus, the workshops sought to explore the opinions, values, hopes and worries of European citizens with regard to neuroscience research considering that it could have dual use.[879]

The three “thought examples” provided to citizens on DURC in Medicine, AI, and Brain-Computer Interfaces followed such a commitment of what civilian “responsible” research and innovation and its “irresponsible” counterpart is, which respectively shaped deliberations on how they ought to be put to use for society. For example, conclusions from “Round 1 – Principles of Research and Dual Use”, saw participants overall reasoning “in favor of neuroscience research being carried out”, qualified by the utilitarian assessment that it needs to be “of benefit to society”[880], which formed a declared aim of the HBP. In line with this view, the take-up of neuroscientific research in PSIM domains was judged in terms of “how it was used, (rather) than who uses it, which was also to say that military use could be acceptable”. Dual use neuroscience here was not only depicted as generally uncontroversial outside of its context of use, but that dual context of use was also understood as “inevitable, regardless of what anyone did, the military or other PSIM organisations would make use of it, if they found it relevant to do so.”[881] Somehow unsurprisingly then, while there was performance of concern about dual use research “of concern”, “the citizens were still in favor of continuing it”[882].

To overcome more substantive stances on the desirability of war and peace more generally, such

[876] Bådum and Jørgensen, 6.
[877] Bådum and Jørgensen, 7.
[878] Bådum and Jørgensen, 15.
[879] Bådum and Jørgensen, 4.
[880] Bådum and Jørgensen, 5.
[881] Bådum and Jørgensen, 6.
[882] Bådum and Jørgensen, 6.

as the German view expressed throughout the meeting that “we do not want more wars; we are against Military research because it’s dangerous; other uses as those planned are abuses”[883], the deliberation process had indeed been set up as an agora where citizens would co-discipline each other in producing a balanced view on dual use neurotechnology and its public desirability: “in order to see if the citizens had changed their opinions in the course of a days’ deliberation, they were asked to fill out the same questionnaire at the end of the day”, which presented participants with a scale of “concern” around the use of HBP research for PSIM purposes from “extremely concerned” to “not concerned at all”, as well with the question “if publicly research has dual use potential, should it be allowed?”[884]. A statistical examination of changes in opinion to those questions before and after the deliberations would not only “show…that physical consultations provide more than in-depth knowledge of citizens’ opinions, but revealed that citizens could effectively “influence each other to create a deeper nuance of their opinions”[885]. As the Synthesis Report of the meetings pondered on the results of the questionnaires, such nuance was representative of general concerns with regard to, yet also of acceptance of research and technological development in dual use areas:

> It seems that the more time the citizens spent discussing and learning about the perspectives of dual use of neuroscience research the more concerned they become about its possible dual use, but at the same time they become more accepting of the research as such and they also become more accepting of collaboration with organisations financially related to defence agencies.[886]

The overall green light for such research expressed through the public engagement process, further stabilized in the other two rounds of deliberation on “Potential applications of Neuroscience Research” and “Questions to address in the future”, was achieved by weighing future risks versus benefits of further dual-use research in the domains of “AI”, “Medicine”, and “Brain-Computer Interfaces”. Here, concerns were once again framed not in terms of if research by PSIM actors should be granted permission or not, but primarily how such actors would put their neuroscientific research and applications into use. For the domain of Medicine, for example, discussions revolved around the potential influence of neuroscience on perceptions of normality, “the streamlining and homogenization of society and a standardization of behavior through medication”[887], and “the perspective of creating less sensitive or empathetic people through medication”[888]; “These worries could be summed up as a fear of getting out of touch with humanness and human nature, or a dehumanization of society”[889] the

[883] Bådum and Jørgensen, 131.
[884] Bådum and Jørgensen, 17.
[885] Bådum and Jørgensen, 19.
[886] Bådum and Jørgensen, 18–19.
[887] Bådum and Jørgensen, 7.
[888] Bådum and Jørgensen, 7.
[889] Bådum and Jørgensen, 8.

Synthesis report explained. They would not address dual use research specifically, but serve to weigh the capacity of medicine to "improve treatments", accuracy, and precision in diagnosis, and cure "brain diseases and mental ailments"[890] against envisioned threats at societal level caused by neural modifiers and their effects on changing notions of social order and human nature. Such boundary work around the capacity of neuroscientifically informed medicine and citizens placed notions of "Responsible Dual Use" squarely in the civil arena, which was constituted as an important agent in the governance of neuroscience towards a desirable form of society as well as a desirable understanding of the human.

The citizen workshops hence constituted "irresponsible" dual use research and applications as any form of use that is not directed to the benefit of society, which, in turn, co-produced a powerful vision of the desirability of innovation in neuroscience, as well as of its desirable governance through public bodies such as international organizations envisioned to engage in the production of *soft law* such as ethical guidelines. As the organizers summed up the results of the citizens deliberations,

> The overall conclusion of the face-to-face workshops was that the citizens, despite their concerns, were in favour of continuing neuroscience research even if it could have dual use, as long as it contributes to developing society, science and technology in a beneficial way. They generally considered the positive aspects of neuroscience research to outweigh the negative ones, and emphasized the potential benefits related to medicine, particularly in relation to medical treatment and diagnostics. The citizens' support for continued neuroscience research was contingent on the development of international legislation and ethical guidelines for the research and use of neuroscience, and they suggested setting up a monitoring and enforcement body. To citizens, policymakers should play a central role in defining what neuroscience research and use is acceptable. [891]

Yet, citizen's support of neuroscience research for the benefit of society, bound to concrete applications such as treatments and diagnostics, was located at quite a different level of reasoning than the rather abstract "fear" of a dehumanization of society by knowledge and applications derived from neuroscience, a worry that was difficult to address through the rather practical recommendations given to the HBP, policymakers, and other stakeholders in the "Responsible Dual Use" Opinion. Its recommendations primarily spoke to questions on how governance processes ought to "re-examine the relationship between civil and military research funded by the European Union and its agencies"[892]. Vigilance towards the manifold possibilities of neuroscience's irresponsible dual use was to be guarded by the creation of several new bodies according to the Opinion, such as a "HBP Working Group on Dual

[890] Bådum and Jørgensen, 7.
[891] Bådum and Jørgensen, 4.
[892] Human Brain Project, 'Opinion on Responsible Dual Use from the Human Brain Project', 16.

Use” to communicate with policy makers, the establishment of a “Standing Committee” to oversee research funded by the EC with PSIM potential, the installment of ethical review panels in industry and corporations, and the development of an educational program for HBP researchers. But while these recommendations were important for localizing agency in the governance of dual use research and the protection of its benefits in public institutions and particularly in the EU, they would leave the profound concerns expressed by citizens about neurosciences’ biopolitics to re-define human nature largely open and unanswered. How could worries about neuroscience’s ambition and potential to re-order fundamental ontological categories of “humanness” be tamed in parallel to ensuring the acceptance of applications arising from novel neurotechnologies in PSIM domains and beyond?

Neuralizing norms, culturalizing the brain

Ontological and normative surgery on these substantial questions was not achieved by the Opinions, but through parallel work going on in another subdivision of HBP’s “Ethics & Society” SP12. Its “Neuroethics & Philosophy” branch formed a vital counterpart to the policy-oriented reasoning behind RRI in the HBP presented in the Opinions. Here, an approach to Neuroethics committed to the “foundational concepts and methods used in the neuroscientific investigations of notions like…identity or consciousness” was favored over an “applied neuroethics” approach, that is, the “ethical theory and reasoning to address practical issues raised by brain research[893], which marked normative reasoning in the US. Ontological and moral questions on the link between neural structures and functioning and human agency and identity had already been raised in the MoM ten years earlier, and re-appeared in the “conceptual” work undertaken within SP12’s “Neuroethics & Philosphy” group. Its ordering of reasoning on what the human brain is and what measures should be taken in governance to protect it once again catered to the overall framing of normative principles for and distribution of responsibility in the EU’s RRI framework: different to the BRAIN Initiative’s bioconstitutional ordering through science, “Ethics & Society” in the HBP developed an approach to the human brain as inherently shaped by, and hence also subject to, the wider social context in which it is embedded. This ontological classification carried an important normative correlate, in that it effectively collectivized the responsibility for the protection and flourishing of human lives, while catering to the HBP’s and EU’s vision of RRI for the benefit of society.

A key figure in the conceptual research undertaken in “Neuroethics & Philosophy” was the work by the group’s leader, Professor of Philosophy Kathinka Evers at Uppsala University in Sweden, who, over the course of the project, advanced a distinctive perspective on the role of neuroscience in shaping and determining notions of identity and humanness and the risks of scientific reductionism of the brain herein as addressed by the citizens in their deliberations (both in the MoM and throughout the engagement in the Dual Use Opinion). This view presented the theory of “proactive epigenesis” against deterministic neuroscientific explanations of brain functioning and evolution, and argued instead for a

[893] Human Brain Project, ‘Neuroethics & Philosophy’, accessed 25 May 2022.

"neurobiological-cultural symbiosis" that would insist on the influence of culture on the brain, as well as on the origins of cultural norms resting in the brain, by claiming that:

> In view of this neurobiological–cultural symbiosis, we can describe this process both as a "neuralization" of the normative process itself, and as a "culturalization" of the brain through the selective stabilization of neuronal circuits. Our cultural and social structures—including our normative reasoning—are important products of the neuronal structures of our brains, but these neuronal structures are also important products of our cultures and societies, and their history.[894]

The broader goal of the HBP's RRI agenda to bring neuroscience, -technology, and society closer together, was, thus, also reflected in its philosophical ontology of the brain, which was argued to be shaped as much by biology as by its epigenetic interaction with society. To make such theory on the dual nature of the brain and its functions credible and robust, Evers teamed up with popular neuroscience legend Jean-Pierre Changeux, honorary professor at Collège de France and part of the HBP, considered "one of the fathers of modern neurobiology" due to his discovery of neuroreceptor mechanisms and the epigenetic evolution of brain functions, as well as a *"maître à penser* and humanist of the 21st century"[895]. Changeux's ideas on "synaptic epigenesis" were key for proposing "proactive epigenesis" together with Evers, as he had shown through various studies and publications that the interplay between the brain and its environment is enabling the social and cultural evolution of "Neuronal Man"[896], which he, in turn, also conceived as shaping the brain's synapses to "fit" to their environment. As Changeux acknowledged himself, his views on the brain were greatly inspired by Darwin's theory of the evolution of species, which he applied to the evolution of synapse selection in the brain in tandem with processes of learning:

> In post-natal life, an important part of the activity in the network results from inputs from the environment and so the epigenetic selection of synapses represents learning in the network as the organism is shaped to fit its environment. In this sense, learning can be considered as a Darwinian process, because it depends on elimination of the 'unfit' synapses.[897]

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894 Kathinka Evers and Jean-Pierre Changeux, 'Proactive Epigenesis and Ethical Innovation', *EMBO Reports* 17, no. 10 (1 October 2016): 1362.
895 This description, at least, formed the reasoning around awarding Changeux with the Balzan Prize for Cognitive Neurosciences in 2001, see 'Jean-Pierre Changeux: 2001 Balzan Prize for Cognitive Neurosciences', International Balzan Prize Foundation, accessed 28 May 2022.
896 Jean-Pierre Changeux, 'Synaptic Epigenesis and the Evolution of Higher Brain Functions', in *Cultural Patterns and Neurocognitive Circuits*, vol. Volume 2, Exploring Complexity, Volume 2 (World Scientific, 2016), 21–34.

897 Changeux.

In their 2016 article on “Proactive epigenesis and ethical innovation: a neuronal hypothesis for the genesis of ethical rules”, Evers and Changeux proposed that individuals and their brains were not only shaped by synaptic epigenesis*,* the continuous dialogue between “genetic endowments of the child and her/his experience of the external world”[898] developed progressively into adulthood. Such an understanding of the “culture-bound brain”[899] would also lend to their argument of “epigenetic proaction” normative weight, as it presented individuals and their brains as “neurobiologically predisposed toward specific values, such as self-interest, empathy, sociality, and so on…”[900], norms that could be conditioned, in turn, by attending to the brain’s “cultural circuits”[901]. In the article, Evers and Changeux spelled out how their idea might imply the creation of new structures and institutions for the application of ethical and social norms informed by epigenetics to shape the brain “with the use of culture”[902]. In particular, they would suggest “novel educational/management programs with long-term influences across generations” to “modulate our biology in order to achieve a “better, or a good life”[903]. Their argument thus made a bold case for an increase in interaction between philosophy and neuroscience, as well as for an “educated ethical innovation” in the ways of seeing and shaping the brain for the benefit of society:

> Given neuronal plasticity and the underlying epigenetic mechanisms, we may influence, both biologically and culturally, how the brain responds to and constructs ethical and social norms. The fundamental idea of epigenetic proaction is therefore trying to understand and influence the genesis of new ethical and social norms in light of what we know about the brain. Being epigenetically proactive also means adapting and creating social structures, and even institutions, to constructively interact with the developing neuronal architecture of our brains. This can be described as an educated form of *ethical innovation*.[904]

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[898] Evers and Changeux, ‘Proactive Epigenesis and Ethical Innovation’, 1361.
[899] Kathinka Evers, ‘The Culture-Bound Brain: Epigenetic Proaction Revisited’, *Theoria* 86, no. 6 (2020): 783–800.
[900] Evers and Changeux, ‘Proactive Epigenesis and Ethical Innovation’, 1362.
[901] Evers and Changeux, 1332.
[902] Evers and Changeux, 1332.
[903] Evers and Changeux, 1332.
[904] Evers and Changeux, 1332. Their emphasis.

Enhancing the epigenetic society

The theory of "proactive epigenesis" suggested by Evers and Changeux indeed represented an innovative contribution to broader cautious moves towards the recognition and active consideration of the social and cultural in biology more generally, and in the neurosciences in particular, at the beginning of the 21st century. The understanding of human biology and change in neuronal architecture as determined purely by genes and the "hardwiring" of the brain had paradoxically found an end through the completion of the Human Genome Project (HGP), which revealed "that the view of the gene as a discrete and autonomous agent powerfully leading traits and developmental processes is more of a fantasy than actually being founded on scientific evidence"[905]. In fact, genetic determinism and its chasm between the biological and the social had rather been an exception than the rule throughout the history of biology and medicine, which, from Aristotle's ideas on embryonic epigenesis to concerns about genetic degeneration in 20th century eugenics largely adhered to the importance of biosocial processes informing human nature[906]. The re-birth of a context-dependent understanding of the biology of the brain and behavior in the HGP's post-genomic aftermath was coupled with leaving behind the "psychophobia" permeating the study of brain and mind in the 20th century, which Evers described as neuroscience's "ideological" neglect of studying consciousness and its relationship to the mind as esoteric categories that favored dualist and naïve functionalist theories of the brain, its circuits and evolution[907]. This ontological commitment on what the human brain is and how it functions, in turn, also sustained a normative ideal towards the appropriate governance of "epigenetic" brains. As Evers and Changeux claimed in their article, "the theory of epigenetic proaction suggests that we may be able to facilitate evolution in the desired direction, implementing selected values that are adequate to the future of the human species on a universal scale"[908].

Their classification of the human brain as bound to its socio-cultural environment hence went hand in hand with their views on how to enhance the wellbeing of societies in a desirable direction. For example, the development of "new cultural circuits" to control violent behavior through new social structures and norms was envisioned as potentially leading to "more peaceful societies". Importantly, such an improvement of human nature would not be framed as individual enhancement, which was rejected as "quick fix" with "potentially dangerous short- and long-term consequences", but as a process that needed to occur at societal level, with no option for individuals to get ahead in brain capacity by opting in or out of the epigenetic enhancement process:

> Epigenetic proaction can have important effects on the individual person, and on the individual generation, but it is not conceived as an individual shortcut in the same way

[905] Maurizio Meloni, 'The Social Brain Meets the Reactive Genome: Neuroscience, Epigenetics and the New Social Biology', *Frontiers in Human Neuroscience* 8 (2014).
[906] Ruth Müller et al., 'The Biosocial Genome?', *EMBO Reports* 18, no. 10 (1 October 2017): 1677–82.
[907] Evers, 'The Culture-Bound Brain'.
[908] Evers and Changeux, 'Proactive Epigenesis and Ethical Innovation', 1131–1363.

> that moral education is. Since epigenetic proaction is a process on the societal level, it is not an individual opt-in/opt-out matter. When educational structures are being adopted in a democratic society, or when laws are being passed, people are invited to express their views through political elections, public debates, consensus conferences, and so on, but they are not invited to opt in or out; we do not ask each citizen for informed consent. The implementation of epigenetic proaction in a specific society would likewise be a matter for public debates and political decisions, not for individual decision-making.[909]

Different to the demarcation of ethics and science in "applied ethics", the "conceptual" ethics advanced by the HBP constructed the relationship between norms and knowledge to be inherently interconnected, and argued for its strengthening as adequate avenue for the production of joint universal imperatives for the responsible conduct of individuals as well as of society. The creation of such imperatives was envisioned as the task of both science and philosophy, and of the collective rather than the individual, inviting an open public debate about the application of "epigenetic proaction" and its potential to re-shape educational structures, norms, and laws in conjunction with the re-wiring of brains and minds.

The "Neuroethics & Philosophy" ordering work hence settled concerns of a "dehumanization" of society expressed by citizens in the "Responsible Dual Use Opinion" not by further demarcating, but by significantly dissolving the boundaries between scientific and normative reason, the neurologically and culturally conditioned mind, and the nature of moral rules and those of the brain's neuronal circuits. By overcoming previous demarcations in neuroscience's understanding of the brain and mind, the philosophical "conceptual" inquiry undertaken in the HBP produced its own kind of constitutional politics, in which philosophy and science were depicted as co-regulatory institutions that could effectively provide and protect the human part of human nature vis-á-vis innovation in the neurosciences. This re-ordering work undertaken by the reasoning on synaptic epigenesis and its "proactive" use for the development of desirable societies was constitutive for presenting neuroscience's potential as an effective tool for creating, and even enhancing a humane society resting on the rules of science and social norms alike: in fact, rather than neuroscience *or* philosophy dictating the *is* and *ought* of newfound knowledge on the brain and its meaning for society, "proactive epigenetics" imagined ethics and science, and the brain and its environment, as co-constitutive forces for the achievement of collectively desirable social order.

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[909] Evers and Changeux, 1364.

8. Constituting Global Reason on Responsible Innovation: The OECD's Recommendation on Neuro-Innovation

A sense of "wind of change" was blowing through the halls of La Muette, the OECD's grand château in the prestigious 62nd arrondissement of Paris, when my field- and consultancy work for the OECD's Directorate for science and technology began in June 2017. Although I had an official invitation and despite the grand electric doors opening in front of me with the slogan of "bridging divides", getting into the building was by no means an easy endeavor. Large construction works were impeding the rapid processing of visitors, all dressed in business-casual indicating they were not here for tourism but for work, causing long queues and impatient faces in front of the building. After my credentials were checked several times by different receptionists, I was only let into the foyer after they had been reassured that an official from the Directorate for Science and Technology, which had issued my invitation, would pick me up soon to guide me to my destination. "ENTRÉE RESERVÉ AUX AGENTS DE L'OCDE - OECD STAFF ONLY" a bold sign in front of the next hurdle of checks alerted visitors, which was a good explanation of why I needed an insider to grant me access to the inner circles of the OECD's premises with the help of his chipcard. Having a guide for finding my way through the long corridors of the château and its modern annexes, which resembled more of a labyrinth from the inside than its transparent glass facades promise from the outside, moreover, was crucial for a notoriously disoriented person like myself as I would painfully realize over the next couple of months, during which I would be walking (and sometimes running) several times in the wrong direction, offices, and people in my quest to attend meetings and conduct interviews to make the most of my time at the OECD.

While I was waiting for my pick-up, several exhibitions displayed on the foyer's walls caught my attention. One exhibition showcased the meetings of the OECD's incumbent Secretary-General Angel Gurría with the leaders of nation-states from across the world over time, captured in moments of handshakes, hugs, and friendly gestures. *Gurría really had met them all!* I thought to myself as I detected some familiar faces such as those of US President Barrack Obama, German Chancellor Angela Merkel, Chilean President Michelle Bachelet, and Prime Minister of Greece Alexis Tsipras. Equally impressive, another compilation of pictures showed the history of the château itself, which I learned had been transformed from a hunting lodge into a royal castle in the 16th century, and which had not only been the birthplace of historical figures such as Tsar Peter the Great of Russia, but which had also served as honeymoon for King Louis XVI and his Marie Antoinette in the 18th century. Under the auspices of Louis XVI, the first flight of the Montgolfiere brothers in their hot air balloon had taken place in the building's gardens, and after the King's execution by guillotine, a family of renowned piano manufacturers bought La Muette and eventually re-sold it for the construction of more modern houses in the neighborhood. The actual château I was waiting to get into had been built from scratch by Baron Henri de Rothschild in 1912, head of one of the most wealthy and powerful banking families in Europe, in the original park of La Muette, whose coat of arms with the text "*Concordia, Integritas, Industria*" (unity, integrity, diligence) is still welcoming visitors today. The building, in turn, had only become the OECD's headquarters upon its founding in the troublesome post-WWII years, which is when the allied powers took the château over from German occupation and when the Rothschild family eventually sold the premises to the OECD[910].

The OECD's headquarter had, hence, not only been witness of some of the greatest figures and changes in Western history; it was a place of power, as well as of struggles over power, within international politics over centuries. As the Rothschild motto reminded me, it was particularly the power of unification that the OECD was trying to resurrect when reforming La Muette and decorating its entrance door with the simple but powerful message of "bridging divides". Power had not only been part and parcel of the OECD's building, it was the 'soft' power of globalization I encountered in every corner of the organization's work in the next couple of weeks. The integrity of this power, as the OECD's Secretary-General had acknowledged only a couple of months before my first arrival of the OECD, was undergoing deep transformations. In the foreword to the report "Fixing Globalisation: Time to Make it Work for All"[911], Gurría claimed that:

> Much of the current discontent in our societies can be traced back to the global economic crisis, and while that was a complex event, some of the policies associated with globalisation played a role in bringing it about. Also, while evidence suggests that globalisation alone played only a small role in increasing income inequality in OECD economies over the past few decades, collectively we may have paid insufficient attention to how globalisation and technological change have interacted to leave a large number of people experiencing stagnant living standards or worse… Moreover, it has become increasingly clear that many of our citizens not only feel aggrieved by the outcomes of globalisation, they also consider that some of the processes by which it is advanced are fundamentally flawed...It is time for better globalisation, more inclusive globalisation, globalisation that regains its ultimate sense of improving all people's lives. The OECD stands ready to support governments in this endeavour. Together, we can design, implement and deliver better policies for better lives in a globalised world.[912]

The diagnosis of the state of globalization given by the organization's leader was at the same time devastating as it was hopeful. The 2008 economic crisis, and its birthplace in the disruption of global flow of capital and goods through unbound financial markets, had caused a major global

[910] For further intriguing details about the château's history, see OECD, *A History of the Château de La Muette*, 1999.
[911] OECD, *Fixing Globalisation: Time to Make It Work for All* (Paris: Organisation for Economic Co-operation and Development), accessed 26 May 2022.
[912] OECD, sec. Foreword by Angel Gurría.

recession, as well as widespread discontent with globalization's effect on rising inequality, even if such a responsibility was largely unevidenced as Gurría argued. Technological change, and rapid advances in digitalization more specifically, added to the crisis by leaving increasing numbers of people across countries without jobs. Both globalization and innovation were increasingly perceived by citizens as being the source of their problems. The project of globalization and its market-liberal agenda, as well as its built-in imperative of reaching social progress via new knowledge and technologies – both hallmarks of OECD identity – had not fulfilled its promise, quite the contrary. As some of the largest protests at the beginning of the 21st century took the streets of cities that hosted central get-togethers of the world's leaders such as the G7 and G20, consent of citizens towards business as usual in the global sphere was far from assured.

But there was hope, particularly as the OECD was an experienced survivor of crises and effective machinery for providing policy solutions to the world's most pressing problems. Its work could not only "help governments and the international policy dialogue to advance a fairer and more inclusive globalization, to ensure that the benefits are more widely shared, and the rules of the game are more ambitious"; it also had "much to contribute in the area of global standards", which had "become global, recognized for their innovative features, evidence-based approach and strong peer-review mechanisms"[913]. Following Gurría's assessment, this was indeed a constitutional moment for global politics demanding the negotiation of a new social contract among the designers of globalization processes and their constituents, primarily envisioned as governments, but increasingly also recognizing the agency of citizens in the fate of world affairs; a moment for acknowledging the deficits that globalization and technoscientific change had produced, and for re-envisioning the sense of globalization as a socially inclusive project that in fact can deliver on "better policies for better lives". Providing standards for a better alignment between social expectations and needs with technological innovation was now regarded as key for "fixing globalisation" and "making it work for all".

The "Neurotechnology and Society" project I was following at the OECD, located at the Directorate for Science, Technology and Innovation (DSTI) within its Working Party on Bio, Nano and Converging Technologies (BNCT), provided a micro-case for studying the larger construction of deficits and solutions set in motion by the OECD during the post-crisis years, to which the project would make a significant contribution. Such contribution would primarily consist of developing the first OECD *soft law* instrument that included society and citizens as relevant actors in the governance and production of innovation, the "OECD Council Recommendation on Responsible Innovation in Neurotechnology" adopted in 2019. In taking on the Responsible Innovation Recommendation, the OECD continued its mandate conjured by Gurría to harmonize its member-states' heterogenous policies through the production of international *soft law*. But also the three-year process leading up to agreement on the Recommendation among OECD and academic experts, member-state representatives, and entrepreneurs from businesses as well as from civil society, was constitutive for the re-ordering of knowledge and

[913] OECD, sec. Foreword by Angel Gurría.

instruments at the OECD on how to settle the problems caused to globalization imperatives by socio-technical change. "An instrument now is no longer the end of the process, it's the beginning", an expert at the OECD's legal department explained to me in one of the offices of La Muette. While the official OECD definition framed "Recommendations" as the end-product of international deliberations "representing the political will of Adherents", wherefore "practice accords them great moral force"[914], projects like "Neurotechnology and Society" would serve the purpose of constituting such will and moral force in the first place as my interviewee further detailed:

> We will help you to get there by discussing together, by showing each other good examples of how to do things, by communicating, by peer reviews and peer pressure at some point….and that's also probably part of why we have soft law rather than hard law, you know?[915]

Soft law, viewed this way, was an effective process of harmonizing approaches to governance through dialogue and cross-country learning, rather than the mere codification of a political *rapprochement* among countries in a quasi-legal document. To understand the reasons for the OECD's BNCT working party to set such a process in motion, and the ways its work connected to Gurría's broader call for the organization to "fix globalization" so that it works for all, I first needed to trace the genealogy of reasoning that had characterized the distinctive approach to science, and technology and innovation, as well as the role society had played therein, in the OECD's archives: what had caused a shift in thinking and framing globalization at the organization, and how was it reflected in the DSTI's reasoning about science, technology, and society?

Framing science and technology policy for global markets

From its founding days in the early 1950s, the OECD made science and technology instrumental to the economic recovery of Western states and particularly Europe after WWII[916]. The "Convention on the Organisation for Economic Co-operation and Development" transformed the organization from being tasked by the US with coordinating and overseeing the implementation of the Marshall Plan for the development of a "working economy"[917] in Europe in 1948 into a global knowledge resource for the

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914 OECD, 'OECD Legal Instruments', accessed 26 May 2022.
915 I17, April 2018, OECD Headquarters
916 For a detailed history of the evolution of science, technology and innovation policy, and its initial framing of linear models of innovation, see Benoit Godin, *The Making of Science, Technology and Innovation Policy: Conceptual Frameworks as Narratives, 1945-2005* (Montréal: Centre Urbanisation Culture Société Institut national de la recherche scientifique, 2009).
917 The Marshall Plan, named after its chief designer George Catlett Marshall, sought to stabilize European economies after WWII through the coordination of foreign aid by the US, the reduction of trade barriers among European countries and with the US, and by helping to revive industrial production. Through those measures, the US also aimed to build a "world economy" against Communist threats. As Marshall stated in his famous Harvard lecture in 1947: "It is logical that the United States should do whatever it is able to do to assist in the return of normal economic health in the world, without which there can be no political stability and no assured peace. Our

promotion of policies for the "development of the world economy" and "economic expansion" on a "multilateral, non-discriminatory basis"[918]. Science and technology were a central concern of the OECD's mandate from the start. Article 2 of the Convention ordained members, "both individually and jointly", to:

> (a) promote the efficient use of their economic resources;
> (b) in the scientific and technological field, promote the development of their resources, encourage research and promote vocational training; (and)
> (c) pursue policies designed to achieve economic growth and internal and external financial stability and to avoid developments which might endanger their economies or those of other countries.[919]

The *triumvirate* established in the Convention between economic investment, support of science and technology, and harmonized market-liberal policies, would form the bedrock of OECD's reasoning on the appropriate governance of science, technology and innovation throughout its member-states from the 1960s onwards. The OECD's first "policy doctrine"[920] around science, initiated by the widely cited "Piganiol Report"[921] commissioned by the OECD in 1963, not only coupled investments in science with economic growth through which it came to be regarded as a "social asset"[922] to "be used for the common weal"[923] by enhancing collaboration between scientists and governments (via "policy for science" and "science for policy"[924]). The recognition that science and its contribution to economic growth had become a "public concern"[925] also led to the first OECD heuristics and indicators for measuring and monitoring research and development and its contribution to a country's Gross Domestic Product (GDP)[926] with the help of the OECD's "Frascati Manual", which henceforth formed a common frame

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policy is directed not against any country or doctrine but against hunger, poverty, desperation, and chaos. Its purpose should be the revival of a working economy in the world so as to permit the emergence of political and social conditions in which free institutions exist" Theodore Wilson, *The Marshall Plan 1947-1951,* HEADLINE Series 236 (New York, NY: Foreign Policy Association, Inc, 1977).

918 OECD, 'Convention on the Organisation for Economic Co-Operation and Development - OECD', OECD, 14 December 1960. A helpful overview of the OECD's history and origins is given in Richard Woodward, *The Organisation for Economic Co-Operation and Development (OECD)*, 1st ed. (Routledge, 2009).

919 OECD, 'Convention on the Organisation for Economic Co-Operation and Development - OECD'. Article 2

920 Aant Elzinga and Andrew Jamison, 'Changing Policy Agendas in Science and Technology', *Handbook of Science and Technology Studies* 3 (1995): 572–97; Felt et al., *The Handbook of Science and Technology Studies, Fourth Edition*, 572–96.

921 Directorate for Scientific Affairs and OECD, 'The Measurement of Scientific and Technical Activities Proposed Standard Practice for Surveys of Research and Development', 1963.

922 Directorate for Scientific Affairs and OECD, 16.

923 Directorate for Scientific Affairs and OECD, 18.

924Elzinga and Jamison, 'Changing Policy Agendas in Science and Technology'.

925 Directorate for Scientific Affairs and OECD, 'The Measurement of Scientific and Technical Activities Proposed Standard Practice for Surveys of Research and Development', 13.

926 According to Godin, the OECD's take-up of statistics and indicators for R&D was in great parts informed by the first programs for measuring research funds in the US (particularly by the US Department of Defense and the National Science Foundatioon) and in the UK (and its National Science Foundation) in the 1950s. See Benoit

of reference and “standard practice for surveys of research and development”[927] among OECD member-states and beyond.

The integration of R&D into the OECD’s expertise, built primarily on the discipline of economics and econometrics[928], however, was a demanding task for its bureaucrats, and only one of a series of paradigm changes in the organization’s reasoning as we will see over the course of this chapter. Instead of counting simple elements such as production units or consumed goods, developing the economics of R&D demanded new forms of accounting for the complex relationships between investment in knowledge and its productive output. As long as the OECD could not represent this complexity in numbers, it was unable to speak to the rising trend of spending ever more resources on the R&D system across OECD member-states in the 1960s. To catch up with such a trend, assessment of policies needed to move from counting “chickens” and “eggs” to measuring the number of researchers and engineers, “their output and their cost”. As the first “Frascati Manual” described in 1963:

> Following the rapid increase in the scale of R. and D. activity, but lagging somewhat behind it, has come a significant shift in the emphasis of economic thought. Along with increased attention to the problems of economic growth, there had been a rising interest in the economics of research, development and innovation. This change of emphasis is perhaps long overdue…one of the reasons for this apparent neglect was the almost complete lack of reliable statistics. As long as no statistics were available, applied economic research was hamstrung, and theoretical economics confined to rather limited and abstract generalisations…Most countries still devote far more attention to the measurement of the number of chickens they possess, their rate of lay and the price of eggs, than they do to the measurement of the number of research scientists and technicians, their output and their cost. But the picture is beginning to change.[929]

Over the coming decades, the OECD developed ever more sophisticated and authoritative sets of indicators and statistics on the relationship between R&D and economic growth, which were used

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Godin, *Models of Innovation: The History of an Idea*, Inside Technology (Cambridge MA: MIT Press, 2017), 166–67.

927 The first Frascati Manual, published in 1963, established a direct link between GDP and what it called “Gross Domestic Expenditures on R&D” (GERD), whose ratio measurement also made science, technology, and innovation a competitive instrument among Western economies Directorate for Scientific Affairs and OECD, ‘The Measurement of Scientific and Technical Activities Proposed Standard Practice for Surveys of Research and Development’.

928 See Matthias Schmelzer, *The Hegemony of Growth: The OECD and the Making of the Economic Growth Paradigm* (Cambridge: Cambridge University Press, 2016)., “The Economic and Statistics Department was the largest directorate of the OECD, and also the one that showed the strongest increase both in personnel and funds during the 1960s and early 1970s.” (p. 71) For further details of the rise of economics at the OECD, see Schmelzer’s chapters on Chapter “Paradigm in the making: The emergence of economic growth as the key economic policy norm (148-1959)” and “Setting the stage: a historical introduction to the OECD”.

929 Directorate for Scientific Affairs and OECD, ‘The Measurement of Scientific and Technical Activities Proposed Standard Practice for Surveys of Research and Development’, 5.

primarily to compare and rank countries' innovation performance in so-called "Scoreboards" published every two years, accompanied by commissioned individual country "Reviews" and Science and Technology "Outlooks", which regularly emphasized the need for greater harmonization of scientific and technological "gaps" between member-states, and among the US and Europe in particular[930]. Today, the OECD is arguably the world's most authoritative organization in terms of innovation indicators, which have reverberated far beyond the organization's member states.

By the 1980s static measurements of the relationship between scientific production and economic development were considered insufficient in the generation of policy-knowledge that could support the commercial exploitation of science in form of new technologies. The OECD's report on "Science and Technology Policy for the 1980s" therefore identified the "need for innovation policies"[931] that would support stronger collaboration between public research and industrial policy rather than concentrating on science policy alone. Here, scientific and technological development was believed to be at the core of as well as dependent on contributions from both the public and private sector. The novel focus on concurrent forms of "innovation policy" helped to significantly expand the relevance of science and technology for a wide variety of public policies and industrial sectors. At the same time, an expanded view on the role of public policies and industrial programs in enabling the development of new knowledge and technological products effectively positioned innovation – rather than science – at the heart of achieving economic growth and social welfare. As the 1981 Ministerial Declaration on Future Policies in Science and Technology proclaimed, "it is necessary to integrate policies for science and technology with other aspects of government policy, particularly economic, social, industrial, …education and manpower policies", including steps to "promote innovation as an objective within the framework of economic, social and regulatory policies". [932]

Rather than ideal and linear models, the development of frameworks capable of catching and governing the dynamic character of technoscientific innovation became the OECD's unique expertise, which found new currency among governments through the approach of "National Innovation Systems"[933] (NIS). Lead by prominent economist and former deputy director for science and technology at the OECD Bengt-Ake Lundvall, the NIS approach was vital for the OECD's shift in reasoning and focus on the "complex set of relationships" between actors seen as primarily involved in the production of innovation – businesses, universities, and public research institutions – as well as on the performance of countries in relating actors "to each other as elements of a collective system of knowledge creation and use as well as the technologies they use"[934]. Novel forms of knowledge creation on NIS and on their similarities and differences across countries helped to visualize such interconnectedness and to

[930] A detailed history of the development of R&D indicators at the OECD, see Benoit Godin, 'Rhetorical Numbers: How the OECD Constructs Discourses on S&T', *Project on the History and Sociology of S&T Statistics* Working Paper, no. 19 (2002), http://www.csiic.ca/PDF/Godin_19.pdf.
[931] Manuel Frascati, 'The Measurement of Scientific and Technical Activities', 1980, 186.
[932] OECD, 'Declaration on Future Policies for Science and Technology', 1981.
[933] Lundvall, *National Innovation Systems* (OECD, 1997).
[934] Lundvall, 9.

benchmark innovation performance accordingly. Complementing the Frascati Manual's indicators on R&D, the "Oslo Manual", first published in 1992, gave policymakers the relevant definitions and categories for measuring and surveying the performance of innovation in their countries. The definition of innovation in the Oslo Manual would expand significantly over time, from constituting merely "technologically new or improved *products and processes"*[935] to also consider "*organizational* innovations and *marketing* innovations". What mattered across these types of innovation, as the third edition of the Oslo Manual claimed, was that they had to be implemented by the market:

> An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations…A common feature of innovation is that it must have been *implemented.* A new or improved product is implemented when it is introduced on the market.[936]

In summary of my short journey into the OECD's archive of ideas on innovation, I found that since the mid 20th century, the OECD substantially contributed to defining, institutionalizing and significantly expanding an understanding of technoscientific innovation as inextricably linked to a diversity of public policies and market sectors, and that it had turned an ever-increasing list of public policy instruments into vital elements for ensuring innovation contributes to the "hegemony of growth"[937]. Besides configuring the role of science in and for public policy, technoscientific innovation had been framed as a key domain for governments and budgets of modern democracies as well as of their international coordination. The organization's efforts were crucial for the development of by-now common definitions and measurement tools for the elusive concept of 'innovation' and their mobilization for benchmarking country performance. They also helped build an image of the OECD' as *the* leading authority on innovation, essential for advising on and evaluating national policies. Put differently, over decades the OECD contributed to a large extent to the view that public investment in the institutional conditions for science and innovation is in the public's interest, which, in turn, was primarily seen as driven by globalization and as geared towards economic growth. As such, the organization had been vital for directing a global "innovation crusade" called for by its Secretary-General in 2010 when demanding from member-states that "our innovation policies must have a broader view than simply supporting science and technology. Countries need whole-of-government innovation strategies, capable of aligning the different Ministries, policies and reforms around a nation-wide

[935] OECD and Eurostat, *Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation,* The Measurement of Scientific, Technological and Innovation Activities, 2018, 8. their emphasis
[936] OECD and Eurostat, 46–47.
[937] Schmelzer, *The Hegemony of Growth*.

‘innovation-crusade’“[938].

[938] Angel Gurría, ‘Launch of the OECD’s Innovation Strategy’ (Launch of the OECD’s Innovation Strategy, OECD Conference Center, 27 May 2010).

8.1 Problematizing Society for Global Policies and Markets

The econo-centric approach to science, technology, and innovation that the OECD had advanced throughout most of its history extended well into the 21st century yet was starting to be increasingly re-framed by the time I arrived at the BNCT working party to follow their "Responsible Innovation" work. Only two years before, the DSTI had published "The Innovation Imperative" which detailed the diversity of strategies deemed necessary according to the OECD to make the most of policies in "Contributing to Productivity, Growth and Wellbeing" as the report's subtitle promised, particularly with regard to the ongoing economic crisis that had hit the organization's member-states since 2008. Reiterating much of the common policy language that the OECD had developed over the years, the document was clear in putting governments on the spot in implementing policies supportive of innovation, at the same time as demanding from policies beyond science and technology alone to enable, and not hinder, the performance of innovation, and thus also "economic performance" and "social welfare" of countries more generally:

> Governments play a key role in fostering a sound environment for innovation, in investing in the foundations for innovation, in helping overcome certain barriers to innovation, and in ensuring that innovation contributes to key goals of public policy. Getting the policy mix right can help governments in shaping and strengthening the contribution that innovation makes to economic performance and social welfare. These policies for innovation are much broader than the policies that are often seen as "innovation policies" in a narrow sense – such as policies to support business R&D, financing for risk capital, etc. Such policies for innovation need to be focused on enhancing the performance of the system as a whole, as weak links in the system will hinder its performance. [939]

The right "policy mix", as the report further elaborated, was dependent on the particular and heterogeneous characteristics of a nation's innovation "system", wherefore acknowledgment needed to be paid to the fact that "one size clearly does not fit all"[940]. Instead, the report limited itself to providing advice on the instruments that an innovation-enabling environment of such system featured, "much of which can also be applied in the context of fiscally constrained economies"[941]. These included "knowledge diffusion" throughout society, policies to tackle "a range of barriers to innovation", informing and engaging "skilled consumers", and creating "trust in government action", including via the evaluation of governance within the process and not as an "afterthought"[942].

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[939] OECD, 'The Innovation Imperative: Contributing to Productivity, Growth and Well-Being', 2015, 11.
[940] OECD, 11–12.
[941] OECD, 12.
[942] OECD, 12–13.

Through mobilizing these instruments for the effective governance of innovation systems, the "Innovation Imperative" continued long-held ways of thinking about and approaching the relationship between innovation, its governance, and desirable place within public policy at the OECD. On the other hand, it introduced quite novel strategies of mixing those elements, particularly with regard to how to better link innovation with society via governance, and how to accelerate economic growth and the production of socially desirable innovation with the support of public policy. Such innovation in the OECD's approach first departed from the problem society represented for the implementation of the "Innovation Imperative", which was seen in great parts as deriving from lacking positive attitudes and "knowledge gaps" towards innovation found in Europe in particular – one of the largest contributors to the OECD in terms of numbers both financially and in membership – that demanded urgent resolution. As the "Innovation Imperative" summarized:

> While the importance of innovation for sustaining economic growth and driving improvements in living standards is generally acknowledged, there is also widespread evidence of significant attitudinal and knowledge "gaps". Public perception surveys in a large number of countries indicate that, although most people have a positive view of the impact of S&T on their personal well-being, a significant proportion have mixed or negative opinions about the effects of scientific research. From the perspective of the adoption of new goods and services, a European poll found that nearly half of the EU25 population was significantly hostile to new innovations or very reluctant to try new products or services or pay a premium for them…Public engagement and better risk management…are some of the key responses to this challenge.[943]

As was routine in OECD's construction of relevance around particular policy problems[944], the statistical representation and framing of a deficit within society, such as a lack of openness towards the consumption of new products or services, served to carve out a space for intervention and agenda-setting by the OECD, as well as for gaining authority over detailing responses to the challenge. Yet, by the time the "Innovation Imperative" was published, the process of integrating and operationalizing such deficits and their solutions throughout the DSTI was not completed yet, as the conception of innovation beyond economic factors alone ran against deep-seated modes of thinking and reasoning at the heart of the organizations *raison d'être*, particularly those held by neo-classical economists who form the largest group of staff among OECD experts and advisors. In a way, the Directorate itself needed to acknowledge its own "knowledge gap" in providing the rationale around and solutions for a closer involvement of

[943] OECD, 251.
[944] Godin has summarized the underlying logic of narratives within OECD policy documents in Godin, *The Making of Science, Technology and Innovation Policy: Conceptual Frameworks as Narratives, 1945-2005*, 14–15.

society in innovation policy and processes – until then, it had successfully relied on the politics of hard numbers and their power of persuasiveness rather than on the "soft stuff" that made up society.

The fact that society had been treated mostly as a "residual relegated to the periphery"[945] in OECD work as well as in the policies of member-states could largely be traced back to the difficulty of conceptualizing and interpreting its role vis-à-vis economic growth in measurable terms. Quantitative measures, in turn, were crucial for the legitimacy of OECD's economic expertise as unbiased scientific advice on policymaking, rather than as a particular kind of knowledge on public policy with a politics of its own. A senior policy analyst at the DSTI described the dilemma to me in the following way:

> [A] challenge that OECD has is that…we like to be able to measure things. If you can't measure it, then you can't do anything with it. Part of that I think is the history of economics as well, economics for me, it's not science, but economics became quantitative in order to prove it was a science. And so, the challenge with [society] and these things is what are our measures and indicators? It's soft stuff…It's not really been given a huge amount of thought. The sort of stock response is, 'It's difficult'. So, that's sort of generally where I see STI…I wouldn't say there's a huge resistance to it, there's just a sort of...'Well, how important is it?'... And ultimately in our reports and in the presentations we make what people like is the histograms and the charts and the figures. Which makes it internally also a challenge, how do you do these things?[946]

Upon inspection of the OECD's archives, I found that my interviewee was right in that there was a certain kind of importance attributed to society running through the OECD's genealogy of science, technology and innovation, which could be traced back to a history of repeated concerns for society's relationship to science, innovation and economic growth within OECD publications. Yet, there was no structured approach, set of indicators, or framework that had stabilized to conceptualize or integrate it as a relevant actor in the performance of innovation systems by the time I encountered the OECD's calls for "public engagement" and better "risk management" with regard to society. Neither had the OECD produced guidance on how to better integrate society in innovation and decision-making in policy in the form of soft legal instruments, such as decisions, recommendations and declarations, which form much of OECD's work and products besides the publication of reports, guidelines and working papers on a daily basis. Rather, moments of explicitly mentioning, considering and calling for action with regard to society were discontinuous and, similar to the attention paid towards society in the 2008 crisis aftermath, had mostly been tied to moments of crisis for science, technology, and innovation and their relationship to imperatives of globalization.

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945 Godin, 371.
946 Interview Nr. 5, April 2017

Linking science, growth, and society

The first moment that society gained systematic attention at the DSTI was in the turbulent year of 1971. Facing the civil unrest and the rise of environmental movements of the late 1960s, the severe energy crises and stagflation of the 1970s, and the anticipation of "Limits to Growth" by eminent thinkers[947] – including OECD's former Secretary-General Thorkil Kristensen's and Director of the science department Alexander King's participation in the Club of Rome[948] – the OECD published the report on "Science, Growth and Society: A New Perspective". Also known as the "Brooks report" after its main author, physicist and Dean of the Division of Engineering and Applied Sciences at Harvard University Harvey Brooks, it suggested a turn in perspective from the utilitarian view on science suggested by the OECD's first policy doctrine at the beginning of the 1960s, and argued that "science policies have been considered too much apart from the social and political context in which they operate and which, in fact, they strongly influence"[949]. To remedy such distance between science and society, Brooks proposed that science, technology and economic growth should not be regarded as an end in themselves, but rather "as a means to attain certain social goals"[950]. Identifying such goals early on through new forms of technology assessment, such as forecasting the effects of technoscientific change on society and allowing participation of society in the formulation of policy problems,[951] was here presented as vital for circumventing "errors and disbenefits implicit in certain directions of commitment"[952] towards scientific and technological progress. Science itself had an important role to play within such novel methods of assessment according to Brooks, yet it could not substitute the "art" of anticipating the complex dynamics of the co-evolution of society and technology:

> The forecasting aspect of technology assessment is complex in itself. The difficulties lie not only in forecasting technological development in the narrow sense, but also in

[947] Meadows et al., *The Limits to Growth*.
[948] Schmelzer, *The Hegemony of Growth*, 263.
[949] OECD, *Science Growth and Society: A New Perspective. Report of the Secretary-General's Ad Hoc Group on New Concepts of Science Policy*, vol. 29 (Organisation for Economic Co-operation and Development, 1971), 52. Such co-productionist framing of science and society probably owes to the fact that Yaron Ezrahi, political philosopher and eminent co-productionist thinker, had also been consulted for the compilation of the Brooks report as its acknowledgment section reveals. Critique and discussion of the Brooks report has been presented by Peter Dear and Sheila Jasanoff, 'Dismantling Boundaries in Science and Technology Studies', *Isis* 101, no. 4 (2010): 759–74. as well as Sujatha Raman, review of *Review of Between Politics and Science: Assuring the Integrity and Productivity of Research*, and by David H. Guston, *Science, Technology, & Human Values* 27, no. 2 (2002): 315–19.
[950] OECD, *Science Growth and Society*, 29:45.The language of social orientation also reflected the "appropriate technology" movements of the 1960s-70s, see, for example, Pursell, 'The Rise and Fall of the Appropriate Technology Movement in the United States, 1965-1985'.
[951] Brooks argued that "The identification of new problems, a compulsory function of modern societies trying to recover their equilibrium, is possible only so far as dissatisfactions are perceived, measured, and analysed. Free expression of dissatisfaction as well as satisfaction is a necessary condition for the smooth running of the system; no mechanism for the identification of needs and the determination of objectives can, therefore, function without the participation of those who are personally concerned. Optimum conditions for change are arrived at when individuals can express their choices freely within the normal processes of the socio-economic system" at p. 62 of the Brook's report.
[952] OECD, *Science Growth and Society*, 29:94.

assessing the ways in which social changes will influence the evolution of technology: assumptions about the state of society in 10 or 20 years hence are usually highly questionable. The problem is that neither social change nor technological change are independent variables. They react on each other in surprisingly devious and indirect ways, and one of the consequences of this is that assessment is an art rather than a science - an art to which science has much to contribute·, but for which it cannot substitute.[953]

The OECD's quantitative, economic expertise did not match well with the qualitative, artistic skills needed in technology assessment and forecasting that Brooks was envisioning, yet it gradually began to embed forms of linking social to technoscientific change and development. Paradoxically as it may seem, it was through the Brooks report that a greater consideration of society came to be conceived in similarly instrumental terms – for innovation, the economy and its global orientation – as the ones that had made science and technology be regarded as a central concern for reaching global economic growth and social welfare. As such, the publication of the Brooks report was not an *erreur de parcours*[954] in the OECD's genealogy of science, technology, and innovation; rather, it contributed in important ways to the legitimacy of the organization's global and economic rationales, even if these were considered in need of update by Brooks.

Controlling the social risks to technology-driven economic growth

By the 1980s, the politics of science and technology that had brought society squarely on the agenda of the 1970s had been mostly replaced by a diversity of technocratic methods of risk and safety assessment and management based on quantitative rather than qualitative forms of knowledge[955] and reflected in heterogeneous regulatory regimes incompatible with the OECD's strive for policy and market harmonization. To create "regulatory harmony"[956], the OECD hence began to develop some of the first internationally agreed upon standards for assessing the safety and risks of new knowledge and materials, notably in the area of chemicals regulation, and later in the setting of standards for emissions and their trade[957] or for the safety of consumer products to name but a few[958]. Despite diversity in national legislations, such standards would become important instruments for harmonizing processes of (de)regulation and for introducing market-based governance instruments without having to interfere in

[953] OECD, 29:83.
[954] This is at least what Godin attributes to the Brooks report and its significance for OECD STI policies over time. See Godin, *The Making of Science, Technology and Innovation Policy: Conceptual Frameworks as Narratives, 1945-2005*, 371.
[955] See, for example, Sheila Jasanoff, *Risk Management and Political Culture* (Russell Sage Foundation, 1986).
[956] Colleen Lanier-Christensen, 'Creating Regulatory Harmony: The Participatory Politics of OECD Chemical Testing Standards in the Making', *Science, Technology, & Human Values* 46, no. 5 (1 September 2021): 925–52.
[957] OECD, 'Emission Trading Systems', accessed 26 May 2022.
[958] OECD, 'Recommendation of the Council Concerning the Safety of Consumer Products', OECD Legal Instruments (OECD, 2022).

the political commitments of member-states. As an expert in the OECD's "Chemical Safety and Biosafety" department proudly described:

> All countries have the same goals with regard to safety policies, they have relatively different legislations on it, but have more or less the same technical tools for the implementation of such regulation…because they have been developed at the OECD![959]

The novel forms of technology assessment developed and institutionalized by the OECD and its members over the 1970s and 80s – significantly narrowed down to techniques of risk-benefit calculation – relied to a great extent on the paradigm of 'evidence-based' policy and regulation achieved through the input and assumed political impartiality of science. In fact, such paradigm contributed in important ways to the further differentiation of a dedicated "science for policy" vis-à-vis "policy for science" (a differentiation already proposed by the Piganiol report and Brooks himself in the beginning of the 60s), including the expansion of "the power of science to influence and rationalize policy" and its increasing relevance as a "fifth branch" of governments[960]. The "art" of technology assessment described by Brooks could not stand the test of providing the objective, neutral and fact-based advice attributed to science; it is then no surprise that it would become the subject of much debate about the politicization of regulation across countries, which, in turn, created a "legitimating myth" among practitioners and academics involved in technology assessment to present their work as neutral and free of politics as that of scientists[961]. Technology assessment became a set of "technologies of hubris" focusing on the knowns rather than the unknowns of socio-technical change, their management and control, and designed to "hide the exercise of judgement, so that normative presuppositions are not subjected to general debate"[962].

The OECD's DSTI would form an important resource for such knowledge for policy, as the provision of ideologically neutral and politically nonpartisan advice for governments was a *sine qua non* for the organization's survival in the difficult landscape of international politics within the Cold War era. Even development and experimentation with technologies of 'democracy' within that period could be legitimized along those lines, not as a means to discuss the competitive politics of science and policy, but as a suitable instrument for achieving the evidence-base of "socially robust"[963] science and technology policy. The OECD's "Ministerial Declaration on Future Policies for Science and Technology" agreed upon in 1981 provided a list of such technologies that governments should implement "with regard to the social, economic, cultural and political effects of technological change":

[959] Interview Nr. 8, May 2017
[960] Sheila Jasanoff, *The Fifth Branch* (Harvard University Press, 1998), 6.
[961] Delvenne and Parotte, 'Breaking the Myth of Neutrality', 64–72.
[962] Jasanoff, 'Technologies of Humility', 1 November 2007.
[963] Helga Nowotny, 'Democratising Expertise and Socially Robust Knowledge', *Science & Public Policy - SCI PUBLIC POLICY* 30 (1 June 2003): 151–56.

> 1. Take due account of the social and cultural implications of new technologies, in respect of the employment, mobility and training of the labour force;
> 2. Monitor the introduction and spread of new technologies while attempting to assess their possible future implications for the economy, the environment and society;
> 3. Facilitate public participation in the definition of major technological orientations, particularly through public access to information concerning their foreseeable long-term impacts, and through fostering public understanding of science and technology.[964]

Yet, neither did these ideals evolve into further OECD work on public participation, nor were they translated into standards comparable to those pioneered at the organization for the assessment of technological safety and risk. In the deregulatory fervor that marked the next decade, they would be replaced by a widely different notion of society's role in technological development, globalization, and economic growth.

Adjusting society to the new economy

With the beginning of the 1990s, the political legitimacy of earlier ideas on the right relationship between science, innovation, and society, including respective forms of social regulation and public control of science and technology via legislation, was reaching its limits. The fall of the Iron Curtain and the rise of 'governance' against regulatory intervention by the state also implied that many of the bodies for technology assessment created in the 1970s would see their mandate dwindle (see chapter 2). Ronald Reagan in the US and Margret Thatcher in the UK had successfully lobbied free market ideologies throughout the 1980s that would aim at the gradual decrease of public control vis-à-vis the market's 'invisible hand', increase of deregulation and governance through market mechanisms, and the "all-out liberalization of capital movements and financial markets"[965]. The OECD's former Director-General Emile van Lennep reflected such views when arguing for reform of the organization's and member-states' policy agenda by lamenting that "in responding to rising economic and social aspirations, OECD countries allowed their economies to become over-loaded, over-regulated and insufficiently profitable"[966]. Freeing economies from administrative and regulatory deadlocks was tied to replacing government with 'governance'[967] as more effective forms of decision-making between public institutions, businesses, and civil society[968], encouraging the "proliferation of soft, self-regulatory

964 OECD, 'Declaration on Future Policies for Science and Technology'.
965 Schmelzer, *The Hegemony of Growth*, 325.
966 As quoted in Schmelzer, 326.
967 For a history of the concept of governance as well as an overview of its most important theories, see Anne Mette Kjaer, *Governance* (Wiley), accessed 26 May 2022.
968 The very renaissance of the concept of "civil society" is intimately tied to the developments of the 1990s, including the emphasis on governance as an effective way of bringing social and market needs into greater harmony without intervention by the state. As civil society theorist John Keane described in 1998, "for nearly a century and a half, the language of civil society virtually disappeared from intellectual and political life, and, as

and 'flexible' or 'double' legal standards"[969].

The OECD provided exactly such a setting for and experience with international collaboration and the production of *soft law* as post-political form of decision-making, now framed as being "founded upon the like-mindedness of its membership: each country embracing the principles of democracy, market economy and respect for human rights"[970]. While it had been advocating Keynesian, microenomic principles for the building of social market economies until the late 1970s, it followed the liberalization trend and, in fact, fueled it by providing the necessary knowledge, tools and reasoning for an OECD-wide push towards governance and New Public Management[971] and neoclassical and neoliberal economic thinking and policies that would henceforth constitute the organization's primary epistemology[972]. Technological progress, notably through the development of Information and Communication Technologies (ICT), formed a central pillar of such epistemology, understood as driving the globalization of the 'new economy'[973], as well as accelerating international participation in global social progress. As the OECD's Meeting of the Council at Ministerial Level in May 1996 claimed:

> The globalisation of the economy is the product of the interaction between trade and technological progress. It gives all countries the possibility of participating in world development and all consumers the assurance of benefiting from increasingly vigorous competition between producers. To take advantage of these prospects for improved living conditions and progress, individuals, enterprises and countries must show themselves capable of rapid adjustment and continuous innovation. This is the challenge, particularly for Member countries.[974]

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recently as a decade ago, the language of civil society remained strange sounding, quite unfashionable, even greeted with cynicism or hostility in certain circles. Since then, the term 'civil society' has become so voguish in the human science and uttered so often through the lips politicians, business leaders, and academic, foundation executives, relief agencies and citizens, that even-handed *Times Supplement* has observed, with justification, that the 'very phrase is becoming motherhood-and-applie pie of the 1990s" Keane, *Civil Society*, 4.

969 Gill and Cutler, *New Constitutionalism and World Order*, 7.

970 As summarized by OECD's Secretary-General Donald Johnston in 2001, quoted in Alberto Vega, 'International Governance Through Soft Law: The Case of the OECD Transfer Pricing Guidelines', *SSRN Electronic Journal*, 2012, 122.

971 The PUMA project at the OECD was particularly important for institutionalizing New Public Management thought at the OECD, see Leslie Pal, 'Inversions without End: The OECD and Global Public Management Reform1', *The OECD and Transnational Governance*, 1 January 2008.

972 As so often in OECD's history, its experts were ahead of the curve: the first document codifying the neoclassical turn was the McCracken report published in 1975 as response to the 1973 Oil crisis, see Vincent Gayon, 'The OECD and the "Crisis" of Keynesianism : The McCracken Report, (1975-1977)' (9th European Social Science History Conference, Glasgow, 2012). The detailed archival research by Matthias Schmelzer in "The Hegemony of Growth" gives an in-depth account of the OECD's move from Keynesian to Neo-Classical approaches.

973 Benoit Godin, 'The New Economy: What the Concept Owes to the OECD', *Research Policy* 33, no. 5 (July 2004): 679–90.

974 OECD, 'Meeting of the Council at Ministerial Level Paris, 21-22 May 1996', accessed 26 May 2022.

Rapid adjustment to the new world economy through "continuous innovation" at consumer, firm, and state-level, would become the *leitmotif* of the organization's Directorate for Science, Technology, and Innovation in its transition to the new millennium. Here, society came to be seen as essential for the emergence of an "information"[975] and "knowledge"[976]-based economy, which was envisioned to be the result of "a society where a majority of workers will soon be producing, handling and distributing information or codified knowledge"[977]. The importance of increasing the knowledge-skills and literacy of society for working in the new economy rather than in industrial production was conceived as inextricably linked to the acceleration of technological innovation: "it is the fundamental knowledge base which is generic to technological development[978]" a report on the "Knowledge-Based Economy" argued.

Shaping society's mindset towards innovation

A new form of risk in risk assessment – that of social rejection and lack of acceptance of innovation - figured as a major concern in the OECD's work on science and technology in the 1990s and early 2000s. From the set of technologies for technology assessment developed in the 1970s-80s (see above), it was particularly instruments for foresight of the dynamics of socio-technical change that were taken up again by the OECD during these years. The creation of an "OECD Forum for the Future" evidenced the turn towards a concern with the future of science, technology and innovation vis-à-vis society among OECD members. In the first publication of the Forum, "21st Century Technologies: Promises and Perils of a Dynamic Future"[979], the authors foresaw that "significant progress across a broad spectrum of technologies", and in particular "genetics, brain technology, new materials, energy, transportation and environmental tools and systems", as well as the exploitation of their full potential to "contribute to human wellbeing", was depending "heavily on the capacity to embrace dynamic change" [980]. After enumerating a list of scientific, technological and social promises, the document would speak straight to the various risks of technological innovations' "double edge" in the future[981], including the difficult control of technology's "destructive potential" for human beings and nature and "system-wide breakdowns"[982]. The less material and more political and cultural "shock" that societies could face depending on the choices made towards technological potential was furthermore envisioned as a last

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975 OECD, 'Measuring the Information Economy', 2022.

976 As the first report on the knowledge-based-economy explained, "The OECD economies are increasingly based on knowledge and information. Knowledge is now recognised as the driver of productivity and economic growth, leading to a new focus on the role of information, technology and learning in economic performance. The term "knowledge-based economy" stems from this fuller recognition of the place of knowledge and technology in modern OECD economies." OECD, 'The Knowledge-Based Economy' (OECD, 1996), 3.

977 OECD, 13.

978 OECD, 21.

979 OECD, *21st Century Technologies* (Paris: OECD Publishing, 1998).

980 OECD, 8.

981 OECD, 14.

982 OECD, 14–15.

danger in the list of risks awaiting societies and their leaders in the 21st century:

> Lastly, the third danger relates to ethics, values and mindsets. Even the initial steps in the long-term development and diffusion of radically innovative technologies such as human cloning or computer-based intelligence (or even life-forms) could pose unusually strong challenges to existing ethical and cultural standards, and put greater burdens on people's tolerance of the unknown and foreign. The risk is that the shock induced by certain technological breakthroughs could end up generating serious social unrest. Fortunately, the extent to which technology advances and actually poses such threats is fundamentally shaped by forces other than pure scientific feasibility. The emergence of these risks will depend not only on the extent of the actual and perceived dangers of new technologies but also, and crucially, on social and political choices. Such matters, however, lead to the broader debate on the enabling conditions for realising technology's potential.[983]

The anticipation of the risk of social unrest, here presented as linked to ethical and normative intolerance towards "technological breakthroughs", would form a powerful imaginary at the OECD and throughout its member-states to act with greater commitment upon the role of society in the shaping of global technoscientific futures. Policymakers increasingly recognized that "forces other than pure scientific feasibility", including scientific forms of technology and risk assessment that had penetrated policy rationales in the 1980s-1990s, needed to be mobilized to ensure that new technologies can realize their full potential in serving the human needs of the 21st century. The production of "social and political choices" would come to regarded as paramount for both instrumental ends (achieving innovation's market and social potential and with it, economic growth and social welfare) as well as for improving the human condition in substantive terms (through the production of socially desirable innovation and of technologies to resolve grand social challenges)[984].

Again, such a turn in thinking with regard to society was linked to several crises that framed the turn of the millennium besides its celebration and enthusiastic anticipation through mega-events such as EXPO 2000. In the UK for example, "the great BSE scare of 1996" not only provoked beef-producing businesses to develop novel public communications and monitoring schemes, but also public officials to forcefully demonstrate the safety of continuous beef consumption, even if with little success[985]. A

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983 OECD, 15.
984 Andy Stirling has suggested a useful distinction between "normative", "substantive", and "instrumental" forms of technology appraisal, of which particularly substantive and instrumental approaches help in "closing down, rather than opening up" decision-making on the future of science and technology (policy). See Stirling, '"Opening Up" and "Closing Down": Power, Participation, and Pluralism in the Social Appraisal of Technology'.
985 See Sheila Jasanoff, 'Civilization and Madness: The Great BSE Scare of 1996', *Public Understanding of Science* 6, no. 3 (1997): 221–32.

report by the UK House of Lords Select Committee on Science and Technology entitled "Science and Society", now widely cited as a historical document for a reflexive and participatory turn in science policy[986] (see also chapter 2), identified in 2000 that "society's relationship with science is in a critical phase", and that there was a "mood for dialogue and debate to which existing institutions must respond"[987]. "GM Nation?", a UK-wide debate organized in 2003 on the desirability of genetically modified organisms and crops and their use in agriculture and human consumption would become an internationally acclaimed exemplar of how to include the voices of all stakeholders, including the 'lay public', in deliberations about emerging technoscience. The success of "GM Nation?" could also be attributed to the UK's approval of GM crop in the immediate aftermath of the debate, and hence to the usefulness of public engagement processes as instrumental for informing, and not vetoing, policies for the introduction of biotechnologically engineered entities into societies and their natural environments. Other nations engaged with similar "democratic experiments"[988], notably in Europe, but also in the United States[989], particularly as a response to the rising public unease with novel biotechnologies, and later also due to concerns of a similar loss of trust in the application of nanotechnologies.

Given the variety and heterogeneity of such experiments, their uncertain outcomes, as well as their significance for securing public's support in the introduction of technologies at global scale and through world trade, the OECD's DSTI too entered the 21st century with an unusual openness towards letting society take part in the governance of innovation. An OECD conference held in Edinburgh in 2000 on the "Scientific and Health Aspects of Genetically Modified Foods" represented a first step in shifting OECD reasoning towards public engagement, aimed at reflecting the susceptibility of the organization itself towards widening the circle of its advisors to NGO's and civil society by engaging with critical voices such as Greenpeace in a preparatory consultation to the event[990]. As had been the case with "GM Nation?", "the most significant aspect of the Edinburgh Conference was that it included all sides of the debate surrounding GM foods and nevertheless identified certain areas of agreement", including "separating out issues which are subject to scientific analysis and those which are related to political factors, beliefs and values", the conference's summary argued[991].

Boundary-work of distinguishing between scientific and socio-political issues, and for maintaining the authority of science vis-á-vis society's rising relevance to debates about biotechnology, was central to the conference as well as for its output. Although the 400 participants of the conference

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986 Jasanoff, 'Technologies of Humility', 1 September 2003.
987 Select Committee on Science and Technology, 'Chapter 3: Public Understanding of Science in Science and Technology Third Report'.
988 Brice Laurent, *Democratic Experiments: Problematizing Nanotechnology and Democracy in Europe and the United States*, Inside Technology (Cambridge, MA, USA: MIT Press, 2017).
989 John S. Dryzek and Aviezer Tucker, 'Deliberative Innovation to Different Effect: Consensus Conferences in Denmark, France, and the United States', *Public Administration Review* 68, no. 5 (2008): 864–76.
990 OECD, 'Genetically Modified Foods: Widening the Debate on Health and Safety' (The OECD Edinburgh Conference on the Scientific and Health Aspects of Genetically Modified Foods: OECD Consultation with Non-governmental Organisations on Biotechnology and Other Aspects of Food Safety, 2020).
991 OECD, 10.

could not agree on where those boundaries should be drawn exactly, or how to order scientific and social issues hierarchically, they needed "to be addressed separately if they are to be analytically tractable"[992] and hence operationalizable by OECD's experts and policymakers. The conference's report, "Genetically Modified Foods: Widening the Debate on Health and Safety", thus made a great effort in separating between those benefits and risks based on scientific data, which primarily revolved around the existing "evidence" on the safety of GM food which was given according to scientific experts[993], and the broader "concerns" around GM food voiced by opponents, which "related less to food safety than to the broader question of why GM food is being produced at all"[994]. The latter question was in fact out of the question, as policymakers were facing "longer-term domestic and global agricultural needs" that demanded prioritization according to the report's authors. The challenge for governance rather was to contribute to the evidence-base by including society through an "open process" that relied on "independent scientific advice", as well as on reliance on "best available scientific advice" on part of governments themselves. The role of society, in turn, was reduced to reviewing "the state of scientific knowledge" to "specify areas of uncertainty", and to get convinced that there is "nothing to hide" in GM food:

> Tackling the issues mentioned above demands a major commitment from governments. Focusing research and development priorities on longer-term domestic and global agricultural needs will be particularly challenging. So, too, will organising a more inclusive public debate on the risks and benefits of new GM technologies. The conference was clear that independent scientific advice – even if it is contrary to the generally accepted view – has a role to play in a fully open process. Both governments and scientists should do more to provide the public with clear, understandable and relevant information. That does not necessarily mean that what scientists say must be taken at face value, or that scientific arguments are the only ones that count when the final decisions are made, but decisions – which are the politicians' business – must be informed by the best available scientific advice. It is also important that scientists work both on internal mechanisms in the scientific community and mechanisms that reach out to the wider public, in order to review the state of scientific knowledge at regular intervals with the aim of reducing or specifying areas of uncertainty. More open access to information will be essential to convince concerned consumers that there is nothing to hide in making safety assessments of GM foods.[995]

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[992] OECD, 13.
[993] As the report argued, "Worldwide, many people are eating GM foods (especially in North America and China) with no adverse affects on human health having been reported in the peer-reviewed scientific literature". OECD, 8.
[994] OECD, 10.
[995] OECD, 22.

The OECD's opening towards participation by society in the early 2000s seemed to mark an exceptional moment in its history of ideas on science, technology, and innovation, but in fact, such opening further contributed to framing society as largely deficient of the necessary knowledge and understanding of science, as devoid of its own agency in technoscientific development and governance, and as dependent on scientific expertise – including the OECD's – to appraise the benefits innovation could have for society. No radical turn, or re-configuration, of the role of citizens in the OECD's reasoning had taken place; rather, society was once again fitted into the organization's innovation imperative and its imagination as driver of social progress and wellbeing.

Reflecting on the hardness of the OECD's reasoning on innovation and society

As I finished my archival research at the OECD, I began to understand the pattern through which it had hitherto approached, framed, and ordered society within its broader institutional reasoning and discourse. Over the OECD's more than fifty years of advising governments and policymakers on how to achieve economic growth via investments in and governance of innovation, society first of all only came on the agenda through a concern for economic growth, and as response to the many uncertainties caused by socio-technical change for the achievement of a global economy and, with it, global social prosperity. Second, the presumed difficulty of standardizing a measurement or best practice for policymaking with regard to society's role vis-à-vis innovation also helped to strategically re-frame and re-mold such role in response to the events and diagnoses that raised concerns for the hegemonic stability of the global economic growth imperative. Here, the OECD proved its talent as creative "ideational artist"[996] in drawing on different visions for society's function in relationship to innovation: Society was to orient science towards the public good in the 1970s, to trust in scientific assessment of technological risks in the 1980s, rapidly adjust to the new economy in the 1990s, and participate in the progress of biotechnological innovation in the early 2000s. Such an instrumental view of society supported claims that it had to be engineered, controlled, and managed by public policy so as to fulfill its role properly, and, in turn, to ensure innovation indeed responded to public demand. Society was neither given full agency on par with scientific expertise or the productive role of businesses and governments in the shaping of innovation's socially desirable boundaries, nor was it conceived as necessarily welcoming of technoscientific rationales. Society was mostly understood at the OECD as deficient of the necessary knowledge, ethics or skills on where to draw such boundaries for the global public good, and hence as a risk in itself for the coming into being of socially desirable innovations and their spread through global markets.

Third, and as a result to the latter inclinations, as long as the OECD could not 'see' society through numbers[997], it could not become integrated into the sets of knowledge deemed as the unique

[996] Vega, 'International Governance Through Soft Law', 103–28, 117.
[997] Porter, *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life*.

competitive advantage of the OECD within the landscape of international organizations. It was statistics and assessments of productivity rates that provided the OECD its primary legitimacy to advice nation-states on the right strategies to achieve economic growth, rather than a (neo)liberal socio-political agenda to guide countries' integration in the free world economy with the support of innovation imperatives produced by the OECD. Lastly, and notwithstanding these dimensions that structured the OECD's reasoning around society and innovation throughout its history, the OECD's work was understood as in and of itself contributing to "better policies for better lives", a commitment reinforced by Angel Gurría at the organization's 50th anniversary when asking what the OECD is "if not a place to blend experience and knowledge to promote global social progress?"[998]

In sum, whereas the OECD had produced much authoritative advice for governments on how to achieve technological progress and concurrent economic growth through the soft power of its econo-centric reasoning, its rationale on society had remained surprisingly stable, and had even hardened, over decades. This was not necessarily a welcoming space for the development of a new OECD rationale on society in science and technology governance through the settlement of *soft law*, which was the envisioned outcome of the BNCT's project on "Responsible Innovation in Neurotechnology". Yet, as I started to get immersed in the project's backstage meetings and deliberations, as well as into their frontstage production of reports and texts on the ethical and social dimensions of innovation in neurotechnology, I could observe that something was starting to change. One of my first interlocutors at DSTI, a senior policy advisor at the department, confirmed my observation when explaining

> To start with, you must have noticed that OECD comes with an 'E' for economy. And that's where our central mission is, that's where our comparative advantage is when we look at all sorts of matters that the OECD covers, essentially all of government activity, except for security. All the rest we cover. But we cover it mainly from an economic perspective. So, the societal aspects and so on, are not our comparative advantage. And we don't usually focus on them. There are other organizations on the planet. The UN, WHO, and so on that might be better equipped than we are, and which have as a mission to do that. So it's also part of a good world order that we don't infringe of other territory and keep to our role in the division of labor between international organizations. That said, we can't obviously ignore a number of issues that interfere closely with economics. And the truth is, I believe that we've been doing it increasingly, over the recent years. It has been one direction of our Secretary General, that we take more into account the societal aspect in our work. We don't keep to the purely economic aspect for a number of reasons… Things have been changing recently, probably partly because reality has

[998] Opening remarks by Angel Gurría, OECD Secretary-General delivered at the OECD 50th Anniversary Forum OECD, 'Better Policies for Better Lives', OECD, 24 May 2011.

been changing as well. And new issues have come in front of us.[999]

Over the coming months, I would learn how the ‘E’ in the OECD’s name was beginning to take a new shape in the DSTI’s attempt to integrate the “new issues” perceived as part of a changing reality in policymaking, of which a turn in the framing, reasoning, and imagining of society in innovation governance formed a central element. This turn also shifted thinking of the OECD’s place in a “good world order”, which was enabled by several acts of re-ordering the ways DSTI had hitherto produced knowledge on innovation and its relationship to society, giving way to a new imaginary of desirable global order and the OECD’s role in its achievement.

[999] Interview Nr. 2, April 2017

8.2 Converging Reason on Responsible Innovation

Processes for embedding new visions and reasoning on the role of society in science and technology at DSTI were characterized by convergence at several levels, ranging from the organizational and epistemological ways of knowledge production at the BNCT working party, to the very constitution of its "Recommendation on Responsible Innovation in Neurotechnology" through the BNCT's "Neurotechnology and Society Project". One was the convergence between two working-parties at the Directorate, the Working Party for Nanotechnology (WPN) and the Working Party for Biotechnology (WPB), which were merged into a new party for Bio, Nano, and Converging Technologies – the BNCT – in 2015. The mandate of BNCT, as decided by the Committee for Scientific and Technological Policy (CSTP), the Directorate's highest-level decision-making committee, was to "address policy issues related to biotechnology, nanotechnology, and their convergence with other technologies", such as "research and technological development; innovation and commercialization; standards and regulations; best practice policy formulation and implementation; ethical, legal and social issues; public engagement; education, skills and training, organization of research, and measurement and evaluation methods and tools, and other relevant topics"[1000]. Such a dense agenda necessarily relied on preparatory work at the WPN and WPB, particularly with regard to the challenging item of "ethical, legal and social issues" as well as "public engagement", which formed but one, yet an important element of BNCT's agenda.

The WPN, created in 2007 to advance the "responsible development of nanotechnologies", for example, had already been taking up larger trends in emerging governance approaches and discourses around society with regard to emerging materials manufactured at nano-scale. In the mid-2000s, the terminology of "responsible development in nanotechnologies" started to appear in US policy-documents by the US National Nanotechnology Initiative as an attempt to settle concerns "about the possible impacts of the new and still uncertain nanotechnology, and concerns from promoters that nanotechnology would face lack of acceptance and active resistance as had happened with biotechnology – so this time, they should do it right from the beginning"[1001]. Nanotechnology quickly became a leading area in which policy makers prototyped "democratic experiments" with policy instruments[1002], such as the development of a "Code of Conduct for Responsible Nanosciences and Nanotechnologies Research"[1003] developed by the European Commission. As such codes and respective practices gained increasing traction in the policy-departments of OECD member-states with varying regulatory outcomes, the WPN also started to work on the "key points for consideration when planning public engagement activities in nanotechnology", and, after several expert consultations and mapping exercises, published the "Planning Guide for Public Engagement and Outreach in Nanotechnology" in

[1000] OECD, 'Draft Summary Record of the 105th Session', 2014.
[1001] Arie Rip, 'The Past and Future of RRI', *Life Sciences, Society and Policy* 10, no. 1 (6 November 2014): 7.
[1002] These experiments are documented and analyzed at length by Brice Laurent in his book Laurent, *Democratic Experiments*.
[1003] European Commission, *Commission Recommendation on a Code of Conduct for Responsible Nanosciences and Nanotechnologies Research & Council Conclusions on Responsible Nanosciences and Nanotechnologies Research*.

2012. The Guide assigned a key role to "society at large" for ensuring desirable innovation in nanotechnology, and while societal critique of nanotechnologies was not considered as the WPN's business, it regarded the engagement of society as "critical to the acceptance of the technology in marketable products", providing good reasons to clarify best practices across countries on how to fix such acceptance through "outreach and public engagement":

> The public and society at large have become key actors in the development of the field of nanotechnology and this engagement is critical to the acceptance of the technology in marketable products. In recognition of this, strategies for outreach and public engagement in nanotechnology have been identified as crucial elements of government policies regarding nanotechnology. The need to clarify how to communicate, with whom and how to engage a wide audience in the debate on nanotechnology, and in the development of policies related to it, has been a major point of discussion amongst policy makers.[1004]

The WPB, in turn, prepared DSTI's shift towards a greater inclusion of society in innovation through the construction of frames around (bio)technology as instrumental response to social challenges and needs. Diverging framings of the exact relationship between biotechnology and society in the US and the EU had provided a moment for intervention by the WPB to discuss ideas around what it was that was exactly driving the development of bioengineered products towards the social good: were such products in themselves solving social challenges such as health or food shortages, as had been widely advocated in the US, or was the input of society required first so as to know where to steer the process of biotechnological innovation and to ensure it contributed to socially desirable ends, as was increasing belief in the EU's policy circles?[1005] Different to commitments to the EU's approach in the Directorate's broader work on GM food in the early 2000s (see above), the WPB proposed biotechnologies as a solution to "sustainable growth and development", which included framing them as "delivering on better outcomes for health, the environment, and for industrial, agricultural and energy production" in 2004[1006]. Rather than input from society to tame the uncertainties of biotechnological progress, such a vision departed from the "remarkable advances in the biosciences" in contributing "fully to improving the health of society and to sustainable growth", wherefore there was a "particular need for progress in enabling the continued flow of innovation"[1007] which could be accelerated by the right kind of policies. The WPB's contribution to the OECD "Innovation Strategy" once more reinforced such framing around

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[1004] OECD, 'Planning Guide for Public Engagement and Outreach in Nanotechnology', 2012, 3.
[1005] This is admittedly quite a brute way to put the differences between US and EU approaches to biotechnology; a subtler analysis of those differences is provided in Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*.
[1006] OECD, 'Biotechnology for Sustainable Growth', 2004, sec. Executive Summary.
[1007] OECD, 10.

technoscientific innovation as a globally shared social good. In the synthesis report “Biomedicine and Health Innovation”, for example, the party described support of biotechnological innovation as adequate fix for the provision of social welfare within broader efforts to “bring about sustainable recovery” in the post-crisis years:

> The recent economic crisis and ongoing efforts to bring about a sustainable recovery bring many of the points made into this document into even sharper relief. The crisis has caused civil society and the governments that serve them to place renewed focus on the social welfare benefits of investment in innovation. Nowhere is innovation more relevant than in the context of human health. Thus, the recent economic worries have done much to bring the issues set out in this document even further up the political agenda and have placed health provision solidly in the cross-hairs of public scrutiny and expectation. Governments must more than ever ensure they harness innovation in health technology in an efficient and effective manner.[1008]

Both rationales – innovation ‘as’ and public engagement ‘for’ the social good – from both Working Parties would become relevant discursive anchors for BNCT’s work more generally, and for the framing of the “Neurotechnology and Society” project in particular.

Introducing novel expertise on society and innovation

The new-found BNCT working-party not only merged previous discourses of member-state delegates, representatives and experts that had constituted the WPB and WPN, but also converged the OECD’s economic expertise with new forms of knowledge on how to set up socially inclusive innovation-policies. The Secretariat of the newly appointed BNCT would represent just such convergence, and hence also the opening of the Directorate for science and technology towards epistemologies and ontologies of innovation beyond economics alone, an opening that had indeed been rejected during much of the OECD’s work in the past as we have learned above. While the Secretariats of International Organizations typically are assumed to perform only administrative functions, such as coordinating delegates to meet, providing relevant documents, and putting the outcomes of deliberations in glossy formats, they could also be regarded as political “actors in their own right”[1009] with subtle, yet significant power to shape the knowledge-production of working parties, both in terms of what becomes an item on delegates’ agenda, as well as who is authorized to provide advice on such items as we will

[1008] OECD, ‘Biomedicine and Health Innovation Synthesis Report’, November 2010, 3.
[1009] Jinnah’s empirical study of secretariat work within IOs reveals that “secretariats change power relations by defining governance architectures/institutions, redistributing capabilities, and shaping shared norms and ideas” (p. 8) behind the veil of political neutrality: “Behind this veil, secretariats perform key regime functions. For example, they draft decisions, filter information and frame policy ideas. These activities can be critical to regime operation, yet are often informal, unacknowledged, undocumented and /or obscured” Sikina Jinnah, *Post-Treaty Politics* (The MIT Press, 2014.

find out further below. Such power becomes particularly visible "when regimes overlap and require management"[1010], as was indeed the case in the BNCT's Secretariat set-up as hybrid actor composed of what could be called the OECD's 'economics of innovation knowledge regime' (and its expertise on the market and productivity aspects of innovation) and the new turn towards emerging regimes of understanding innovation as a social and political practice, with a key role for expertise on the relationship between science, technology, and society. As one expert from the Directorate described the difficulty of converging those radically different approaches to innovation, "the more senior people here think that the market will work [social controversies] out. We have to get the market right but we must not inhibit innovation"; yet growing concerns "that society can block some of these technologies" also required that "somehow, we have to take into account these soft social concerns."[1011]

The appointment of a BNCT director with a strong track record in theorizing the relationship between science, technology, and society in governance reflected a certain hope to mediate between the 'hard' and 'soft' knowledge regimes at DSTI and in the work on innovation and society at the BNCT party in particular. The new director's networks would indeed be vital for bringing in new sets of knowledge on society and innovation into the process of developing shared principles for the governance of neurotechnology, such as Bioethics, the emerging field of Neuroethics, and STS scholars like me with different understandings of innovation and the role of society in policymaking than those of the usual suspects to be found at OECD conferences and workshops. Their inclusion in deliberations was crucial for ordering knowledge in the BNCT and, in fact, "knowing governance"[1012] with regard to socially inclusive and desirable innovation policies. As another interlocutor at the Directorate phrased the different reasons – and difficulties – for an inclusion of new regimes of knowledge for governance in OECD work,

> There's been a shift towards grant challenges and all that sort of stuff... People were talking about these things for a long time, of course, going back to the 90s, before we even go back longer and look at mission-orientated science [in] the 60s…So none of this is very new, but it has a different flavor, it's a different scope and there's been that shift that's happened, in particular in the last decade, which has meant that the OECD has had to move into that space as well. [And an important] factor is the individuals that you have. So you bring someone like [the new BNCT director] into the secretariat. This is really a different type of a person you'd not normally associate with being in the OECD and so he's able to bring all of that societal, legal, ethical perspective to play in a very difficult setting, I should say, because the BNCT, which is a new working party, has traditionally been very technology driven and they kind of sneer at all the societal

1010 Jinnah, 5.
1011 Interview 5, April 2017.
1012 Richard Freeman and Jan-Peter Voß, 'Introduction: Knowing Governance', *Knowing Governance. The Epistemic Construction of Political Order*, 2016, 1–33.

stuff, they don't really understand it, they're not really that interested in it. So, he's had to fight some battles, I think, to get this stuff onto the agenda.[1013]

Converging econo-centric with society-centric rationales

My interviewee was right that getting the "Neurotechnology and Society" project to work caused some friction within the DSTI, as the convergence with new perspectives on innovation challenged a highly stabilized and causal narrative of the relationship between innovation, economic growth and societal benefits. For a great part of science, technology and innovation expertise at the OECD, the new focus on societal inclusion was legitimate only as part of the organization's larger "Innovation Imperative"[1014], in which "soft" social issues had been pre-configured as risks to innovation's hard economic benefits. Such thinking penetrated the post-crisis years, despite calls by the organization's leader to produce new narratives on globalization and economic growth, and to take society better on board in the design and formulation of policy. Even where society was mobilized not as a risk to but as an important resource for innovation imperatives, DSTI continued to frame its role primarily as instrumental for the achievement of economic growth. For example, parallel to the BNCT's kick-off, a project on "Inclusive Innovation" aimed at "Making Innovation Benefit All"[1015] though the development of "Innovation Policies for Inclusive Growth" that emphasized compatibility between concerns of societal inclusion and the organization's dominant economic growth paradigm: "inclusive growth means that people…should have fair opportunities to contribute to growth, and that their contribution should yield equitable benefits"[1016]. While the terminology of "Inclusive Innovation" conveyed a sense of commitment to greater public engagement in innovation processes, it did not lose sight of the organization's larger "growth-enhancing goal" as one expert on the project described to me:

> People understand inclusive innovation as, maybe, including the general public in the elaboration of public policy; maybe promoting innovation that has some social goals; or innovation that aims at tackling social inequalities and so on and so forth. But our approach was more to say well, actually there is already a lot of policy areas that are actually devoted to addressing income gaps and all of this, and innovation policy should always keep as a main objective this growth-enhancing goal, right?[1017]

In order to build institutional and member-state support for the "Neurotechnology and Society Project", new forms of reasoning and framing the societal inclusion in innovation processes and governance thus first had to be made discursively compatible with the "growth-enhancing goal" with

[1013] Interview Nr. 17, May 2017.
[1014] OECD, 'The Innovation Imperative'.
[1015] OECD, 'Making Innovation Benefit All: Policies for Inclusive Growth', n.d.
[1016] OECD, 81.
[1017] Interview Nr. 13, May 2018

which the organization had hitherto approached the steering and monitoring of innovation. In the project's first policy paper, for example, traditional approaches to governance, such as market mechanisms and product regulation, would become diagnosed as deficient for taming public concerns with innovation: "Leaving policy engagement on the social challenges to *post hoc* regulation can be restrictive, controversial, and burdensome"[1018]. Adherence to traditional top-down regulation was made plausible as a threat to the marketability of new products, and failure to take societal concerns into account in innovation governance re-framed as a potential risk to the diffusion of promising technologies such as neurotechnologies on a global scale. Spelling out how a deficit in integrating public values in innovation governance may impede emerging global markets also included arguing that

> Inattentiveness to ethical, legal, social, and safety aspects of new technology could […] lead to bad social outcomes, and breed resistance and distrust in society. Furthermore, and as a consequence, neglect of these issues may impede the uptake and diffusion of innovation.[1019]

Such reasoning helped to present greater public inclusion as a suitable instrument for fixing "demand uncertainties" produced by the 2008 crisis. Rather than relying on "traditional infrastructure and financial support instruments," new "policy tools, notably in sectors where potential demand is high (e.g., health, ageing, etc.), would help improve innovation and growth prospects,"[1020] the OECD had proposed in its 2012 Outlook on the role of innovation in the crisis and beyond. A case in point, the "Neurotechnology and Society" paper dedicated a lengthy preamble to a meticulous enumeration of unmet but increasing needs in the market for mental health solutions. The paper noted, for example, "it has been estimated that the global costs of mental health conditions in 2010 were USD 2.5 trillion. This number is expected to rise to USD 6.0 trillion by 2030"[1021]. While societal inclusion could still not be measured in terms of its contribution to economic performance *per se*, at least the costs of not providing innovation in areas with great social needs could, which aided the project in enrolling DSTI and member-state delegates and in aligning with the wider regime of understanding innovation primarily as contribution to the development of new markets, here presented as adequate response to pressing demands from society.

Assembling emerging policy regimes on societal inclusion in innovation

As the BNCT began to convene its delegates, experts from DSTI, and the carder of academics and practitioners on science, innovation and society invited to inform the "Neurotechnology and Society" project, it not only had to take care not to lose sight of the OECD's economic growth regime, but also

[1018] OECD, 'Neurotechnology and Society', no. 46 (2017): 11.
[1019] OECD, 11.
[1020] OECD, *OECD Science, Technology and Industry Outlook 2012,* 2012, 23.
[1021] OECD, 'Neurotechnology and Society', 9.

needed to balance the different knowledge regimes of member-states and their experts' understanding of what inclusivity, society, and, in fact responsible or ethical innovation actually signified beyond economic instrumentalism alone. The narrow focus on "neurotechnology", instead of an approach to innovation and society more generally, was a helpful starter and not coincidental, as this emerging technoscientific field had not been taken up by the DSTI's working parties, and thus had not yet been absorbed by the economic growth imperative. Previous work in other OECD Directorates too had only indirectly touched upon the significance of innovation in the area of mental health[1022], specifically in "addressing dementia"[1023], and in the increasing integration of neuroscience in education and the learning sciences[1024]. Moreover, understandings of neurotechnology's social dimensions, both in terms of the problems and solutions, believed to be provoked by innovation in neurotechnology and with respect to its inclusive governance, had not settled among member-states and academic communities. Eventually, unlike in biotechnology, nanotechnology, and, more recently, artificial intelligence, neurotechnology had so far not caused much controversy in popular media and policy-circles with regard to its ethical and social implications. Such a scenario was on the horizon, however, particularly because neurotechnology had the potential of convergence across all of these contentious technoscientific domains. Yet, it had not trickled down into the popular imagination, partly because there were still no scalable or radical breakthroughs emanating from neuroscientific labs that could have provoked equally radical public views or discussion.

Neurotechnology governance was thus an area where policymakers could still show they had been anticipating and learning how to prepare public controversies early on, and an area with innovation potential for the DSTI's innovation rationale. Policymakers in countries that had invested in big neuroscience projects to fuel innovation in the field had indeed taken care that such potential implications were scrutinized by ethicists, social scientists, and even society itself from the start so as to preempt public debates around and possible rejection of innovative neurotechnology. As we have seen in preceding chapters, particularly in the US and the EU, "Neuroethics" and "RRI" approaches formed important, if quite diverging, exemplars on how to govern the BRAIN initiative and the Human Brain Project towards socially desirable outcomes. Other OECD-members, such as Australia and Japan were also starting to experiment with governance frameworks in neurotechnology, yet no standard model had emerged across countries on best practices for operationalizing the inclusion of society in neurotechnology and concurrent frameworks in innovation policy.

The divergence in approaches and lack of internationally comprehensive standards put BNCT in the position to argue for greater dialogue and harmonization of policy approaches for the governance of neurotechnology innovation across member-states. A survey conducted among BNCT members on the implementation of socially inclusive innovation policies underscored a need for international

[1022] For example, see OECD, 'Making Mental Health Count', 2014.
[1023] OECD, *Addressing Dementia*, 2015.
[1024] OECD, *Understanding the Brain: The Birth of a Learning Science* (OECD, 2007).

deliberation and standardization, as respondents showed incongruent understandings and practices of socially inclusive innovation policies. My own consultancy work for the BNCT, which coincided with this phase of policy planning, provided ample grounds for reasoning that large differences remained in how countries addressed questions of responsibility, inclusivity, and openness in the governance of neurotechnology innovation. My analysis, which became part of a "background report" for a planned BNCT meeting, argued that "mainstreaming responsibility practices on a global scale might be ineffective due to distinct socio-cultural understandings of the meaning of new technology that underwrite distinct assessment, decision, and governance principles"[1025]. Such assessments were vital for allowing the BNCT to carve out a space for socially inclusive governance frameworks – and for the legitimacy of its own work: since there was "limited coherence on the process, or processes involved, for compliance with frameworks such as anticipatory governance, Responsible Research and Innovation, or open science"[1026], the "Neurotechnology and Society" policy paper argued, "Guidelines might be needed that bring together brain science, technology innovation, and society in an international and cross-cultural perspective"[1027].

A patchwork of local responses and governance styles thus provided a key rationale to help construct a deficit in international harmonization arising from incongruent governance concerns and instruments across member-states, justifying the creation of shared standards as solution to the risks and quibbles of national particularities. This rationale, in turn, helped to further stabilize the project as contribution to the organization's unique expertise to assess and compare national innovation performances and benchmark countries accordingly, even if such comparison could not be reasoned on the grounds of quantitative measures. In particular, and in contrast to previous OECD harmonization efforts that targeted policies 'for' innovation in diverse policy settings, BNCT's efforts now could specifically target divergent modes of reasoning and governing the relationship between (neuro-) innovation 'and' society.

At the same time, these differences in nationally and regionally situated approaches to the socially inclusive governance of neurotechnology innovation presented the BNCT with a challenge. Among the two frameworks at the forefront of policy innovation with regard to social inclusion in neurotechnology R&D – "Neuroethics" in the US and "RRI" in the EU – were significantly different understandings of what neurotechnology is, which social and ethical issues needed to be considered, and how it ought to be governed in socially desirable ways. Bound to OECD's "soft law" approach, the BNCT could not prescribe one or the other rationale as the best model for other countries to follow, which would have presented its work as inherently biased towards particular regions and their forms of reasoning on and practicing the inclusion of society in science and technology governance. This was

[1025] Frahm, N. and Pfotenhauer, S. M. (2017) Responsible and Open Innovation in Neuroscience and Neurotechnology: Mapping Frameworks, Mechanisms and Directions. Background report presented to the OECD Working Party on Bio-, Nano-, and Converging Technologies (BNCT). Internal document / not published.
[1026] OECD, 'Neurotechnology and Society', 46.
[1027] OECD, 8.

even more the case as there were no 'objective' numbers or statistics available on which model worked better in reaching socially desirable and acceptable innovation, or through whose approach to society innovation performance and demand could actually be strengthened. Instead, a common recommendation needed to reflect the OECD's impartial "view from nowhere"[1028] without relying on the politics of numbers that the organization so often had mobilized in the harmonization of science, technology and innovation policies.

How could the organization frame the process as well as its expected outcome as politically neutral if the matter at hand was a contentious array of 'ethical, legal, and social issues' provoked by new forms of understanding, intervening, and manipulating the human brain? How could it not go for either the US' or the EU's frameworks and their rationales, if these were largely the only, and seemingly also the most "innovative" ways, of approaching such issues in the context of public policy on neurotechnological innovation? I asked this question to one of the more experienced policy-analysts at DSTI, who luckily went beyond providing me with the answer that "it's difficult" when explaining that:

> It's quite difficult. I mean, we have 35 countries. It's very, very difficult to have a recommendation…It's hard to come up with recommendations that speak to all countries. Part of that is because they're at different levels of point of development, so it's hard to speak to the most advanced and speak to the, I don't want to say least advanced, … but the countries who have introduced the fewest innovations, or have the least capacity, you know. We often end up speaking to the middle, so in the countries where it's policy priority and they're trying to be innovative and often we're taking their innovations and trying to share them, and we hope that our recommendations make sense in their context, and they can be used to lobby for continuing the work that they've been doing, but it is difficult.[1029]

The mid-way that the BNCT chose between the two more "advanced" approaches to the governance of neurotechnological innovation was "Responsible Innovation", which neither represented a full commitment to the increasingly codified "RRI" framework and its aims of collective and democratic steering of technological progress, nor to the emerging "Neuroethics" approach that, with its emphasis on scientific self-regulation through ethics education, departed from the other extreme of novel forms public reasoning on and steering of innovative neurotechnology. What an OECD approach to "Responsible Innovation" would entail more specifically, particularly with regard to the different perspectives on the innovation system and its appropriate relationship to society, was a constitutive point on the agenda of BNCT workshops and meetings held throughout the process of drafting a joint recommendation, which turned out to be quite an innovative mix of the two approaches, as we will

[1028] Thomas Nagel, *The View From Nowhere* (Oxford, New York: Oxford University Press, 1989).
[1029] Interview Nr. 29, 2018

discuss in a moment. For now, it is more relevant to understand how the BNCT's process towards a joint recommendation could not be framed as a completely independent, radically novel, or better approach to the relationship between innovation and society and its adequate forms of governance vis-à-vis member-state practice and discourses. Rather, the recommendation had to stick to a certain degree to the discourses and practices already in use in national and regional policy-making, and, at the same time, provide sufficient ground for the development of global principles that could guide policymakers where novel approaches had not emerged yet, while supporting those that had with further "continuing the work they've been doing". In music, one would label this as a good "remix"; in the language of innovation policy, it could be seen as an incremental form of innovation constituted by the novel assemblage or use of already existing elements. In the words of a policy-analyst from another Directorate,

> There's nothing at all new in any of these pieces, but the fact that you bring it together in one place, put an OECD badge on it, you take a particular angle to it as well, which is not very novel either, but the fact that you've assembled these components, that's really the novelty…In fact, its novelty has to be in what it can pull together and combine or juxtapose things that perhaps others are not combining or juxtaposing. That's where its novelty lies.[1030]

(Re)ordering rationales and approaches to responsible innovation

The re-assembly of different governance approaches and rationales for socially inclusive innovation in neurotechnology took place primarily through a series of meetings and their documentation through the BNCT Secretariat, member-state delegates, and participating experts. Deliberations during the meetings served to re-present the heterogenous landscape of frameworks and instruments on the one hand, as well as to perform a certain kind of openness among member states towards their possible convergence through international dialogue on the other. In the second meeting organized by the "Neurotechnology and Society" project in Washington, DC, in September 2017, for example, discussion between policymakers, representatives from regulatory agencies and funding bodies, neuroscientists, and academic experts, major differences could be observed in terms of how participants reasoned on and framed "public engagement"[1031].

One group of participants would regard public engagement primarily as a process for educating society and citizens about neuroscience and evolving neurotechnologies, as well as about potential ethical issues, while another would conceive it as a process of de-facto political participation of citizens in decision-making about science and innovation pathways. Both groups mobilized these diverging understandings within the discussion to show they were already committed to public engagement, but

[1030] Interview Nr. 19, May 2017

[1031] Fieldnotes, Washington Meeting "Neurotechnology and Society" D1, September 2017 they would also openly acknowledge deficits in each approach. Informing the public on the state of the art in neuroscience and ethics was described as a potential tool for getting ethical "issues off the table" as one participant claimed. Yet another would argue that the provision of information in itself was insufficient, and that more needed to be done to make consumers and citizens understand and apply such information in every-day decision-making. Adherents of the participation camp, in turn, would mobilize their experiences with involving citizens in neuroscientific research early on, but would also question the actual impact of such involvements "upstream" in decision-making on innovation in neurotechnology. While the first approach was presented as an approach to ethics as "having no teeth", the second was questionably having any greater impact on governance either, which helped finding consensus among the two groups on a "two-way approach". Here, publics were envisioned to be informed by science, and scientists by publics and their values. As the meeting's report, "Issues in Neurotechnology Governance"[1032] summarized:

> Historically, 'public engagement' has often meant science communication intended to inform the public about science to increase public support and reduce public fear of concern. What is also now recognized is that the "deficit model" of assuming the public is largely ignorant of science and its methodologies is counterproductive, dismissive, and inaccurate. Increasingly, calls for publicly engaged science are more substantive and more focused on two-way, rather than one-way, communication with the public, or at least an acknowledgment that there are deficits to be addressed on both sides. The public, including policy makers, needs to better understand what is going on in laboratories and the researchers need to better understand the hopes, interests and concerns of the public (and even reflect more on their own values as scientists) with respect to science and value.[1033]

The "Neurotechnology and Society" project hence had significant room to maneuver the flexibility and closure of different interpretations and forms of reasoning with regard to best practices and instruments for a closer alignment of neurotechnological innovation with society, which was repeatedly achieved through engaging the logic of constructing deficits in the social inclusion and orientation of innovation and the production of respective fixes.

Next to agreement on public engagement for neurotechnological innovation to become more responsive to "hopes, interests, and concerns" of the public, and the public more literate in neuroscientific R&D processes, consensus also emerged with regard to how innovation in the field itself could be reasoned as a solution to the contemporary challenges faced by societies across countries. Here, ontological and normative surgery with regard to what social problems innovation in neurotechnology

[1032] Hermann Garden and David Winickoff, 'Issues in Neurotechnology Governance', 2018.
[1033] Garden and Winickoff, 14.

should solve in the first place, and how such problems can be tackled responsibly, was conducted through narrowing down a cacophony of nationally situated R&D agendas in neurotechnology. For instance, and as discussed earlier, the American BRAIN initiative aimed at "revolutionizing our understanding of the human brain" to "treat, cure, and even prevent brain disorders"[1034] while the EU's goal with the HBP is to "put in place a cutting-edge research infrastructure"[1035] with contributions to health only figuring in the second order of goals. Consensus among countries was reached primarily through boundary work around medical neurotechnological applications that address "human health and well-being"[1036] as the orientation towards health was a framing that national brain research and technology policies shared and hence could subscribe to, despite diverging R&D agendas and governance frameworks.

In the project, Responsible Innovation was primarily deliberated with regard to neurotechnology for health, which made innovation a constitutive part of "responsible" public policies in the field as well as of providing a solution to 'global' social challenges. In that sense, the framing of neurotechnologies for health was a 'win-win' situation for delegates as well as for the global mandate of the OECD: it not only stabilized the individual efforts of member-states in the area as substantive investments in the public good, but also granted the OECD a legitimate role in assisting governments not to deviate from centering health in their consideration of neurotechnology R&D. This was also reflected in the frontstage work of the eventual Recommendation settled through the series of workshops and meetings performed by the BNCT and its constituents. The Recommendation's very first principle, for example, urges stakeholders to "first and foremost, promote beneficial applications of neurotechnology for health" and prescribes that member-states should "foster alignment of public support and economic incentives for neurotechnology innovation with the greatest health needs"[1037]. Thereby, Responsible Innovation governance was constructed as a useful solution for better matching emerging neurotechnology markets with public demand for health (i.e., controlling "uncertain demand" as described above) which laid the groundwork for future deficit monitoring where national policies and innovation trajectories diverge from the Recommendation's understanding of social orientation.

Within the reduced scope of neurotechnology's orientation towards health, in turn, public consultation was seen as safe and, in fact, key to the success of neurotechnology innovation. Without public engagement, neurotechnology was constructed as running the risk of not being accepted by societies if these are not consulted in advance. By not engaging "public values which warrant representation or at least consideration" the paper on Issues in Neurotechnology Governance argued, member-states could risk "a disconnect or conflict between public values and research, allowing science

1034 NIH, 'Brain Initiative', accessed 14 June 2022.
1035 Human Brain Project, 'Human Brain Project Home', accessed 14 June 2022.
1036 Garden and Winickoff, 'Issues in Neurotechnology Governance', 17.
1037 OECD, 'Recommendation of the Council on Responsible Innovation in Neurotechnology, OECD/LEGAL/0457'. Principle 1.

to evolve in ways that may run counter to the goal of improving human health and wellbeing"[1038].

Delineating responsible from irresponsible innovation

While the drawing of boundaries around neurotechnology's potential in contributing to public health was instrumental for finding consensus within the BNCT's process to develop a joint recommendation, the identification of "irresponsible" innovation as the counterpart to "responsible innovation," and hence the exclusion of certain (national) innovation activities, proved to be more difficult. The like-mindedness of the working party's constituents reached its limits when deliberations touched upon more sensitive and publicly contested applications arising in domains beyond health, such as military use and enhancement of individuals through novel neurotechnologies. While different governance instruments and best practices formed a vast area for finding consensus, reaching collective agreement on the exact "issues" that innovation in these domains might provoke in society today and in the future was a contentious process, and hence required vast front- and backstage management by the involved participants.

Particularly "dual use" of neurotechnologies for civilian as well as military purposes was a domain with large discrepancies among member-states, and between the US and EU in particular. While in the US, DARPA was at the forefront of funding and accelerating neurotechnological applications for veterans as well as for potential use on the battlefield, in the EU, public funding of dual-use research was officially prohibited, even if such commitments were beginning to blur (see chapter on EU and the politics of "responsible dual use" in the HBP). Such differences became evident during the Washington meeting's attempts to discuss and produce a joint list of potential issues to be addressed by policymakers across countries in the governance of emerging neurotechnologies, which was important to establish legitimacy for responsible innovation guidelines in the field. After one of the expert contributions to the meeting had touched upon on the "ugly side of neurotechnology", which included the largely unregulated space of what the presenter labelled "neuroweapons", significant controversy erupted in the peaceful atmosphere that had thus far existed between participants. Stressing the heterogeneity of approaches to "dual use" in the room, one of the experts insisted that "we are from different nations from all around the world" and that "we have to confront our views and our systems", which included different perspectives on the "ethics of war"[1039]. The commentator then insisted on discussing and developing a shared and universal ethics for the dual use of neurotechnologies around which countries should "unite" in order to prevent irresponsible application in war settings, for which he designated the OECD as appropriate forum.

As he continued to offer reasons for a joint ethics on dual use by reference to Jonathan Moreno's "Mind Wars"[1040] – a book with explosive potential not least due to its cover that depicts a brain in form

[1038] Garden and Winickoff, 'Issues in Neurotechnology Governance', 14.
[1039] Fieldnotes, Washington Meeting "Neurotechnology and Society" D1, September 2017
[1040] Jonathan D. Moreno, *Mind Wars: Brain Science and the Military in the 21st Century* (Bellevue Literary Press, 2012).

of a hand grenade, but also due to its fine-grained research on the ties between brain science and military research in the 21st century – the tension in the room culminated. Some respondents fiercely argued for acknowledging the cultural relativism of ethics, which included the impossibility of defining a universal set of principles on the ethics of war and, by extension, the ethics of neurotechnology. Others would point to the absence of representatives and experts of military and security R&D in the room, wherefore a deeper consideration of dual use questions would not be feasible for the group. Substantive consensus continued to elude the participants and could only be partly restored at a meta-level, e.g., on the importance of bringing relevant stakeholders together in the future and to "develop common definitions of concepts like…"dual use"... to facilitate mutual understanding and cross-sectoral discussions"[1041], as the meetings' report summarized.

Reflecting the 'information control' needed to present the BNCT's "Neurotechnology & Society" work as credible, "dual use" was not mentioned once within the Recommendation's nine principles and their detailed set of subprinciples. Instead, the Recommendation mobilized more cautious language that bypassed politically sensitive issues in neurotechnology innovation, for example when differentiating "responsible" neurotechnologies for health from the "unintended and/or misuse of neurotechnology." The very last principle of the Recommendation described the latter as "activities that seek to influence decision processes of individuals or groups by purposely affecting freedom and self-determination" against which "active steps" should be taken "where possible"[1042]. As a result, "responsible" neurotechnology innovation could be credibly constructed as an area for public good rather than as an enabler of myriad other uses, such as new forms of warfare and surveillance.

This framing of consensus by omission was in part achieved through the politics of who was invited and who was excluded to participate in OECD expert and delegate meetings, as a stand-in for who was considered legitimate to define what responsible innovation in the field entails. Agreement on joint principles would rest on the politics of cultural relativism that were not only mobilized during the Washington meeting, but would also find acknowledgment in the Recommendation when claiming that "given the different cultural understandings of the brain and mind, there may be diverse ways of putting responsible innovation into practice"[1043]. Abstinence from politically contentious issues as well as from ethical universalism, in turn, was vital for further cementing the OECD's soft regulatory power "from nowhere"[1044], which would only be regarded as credible and authoritative when refusing interference with politics or values believed to be a sovereign area of decision-making at member-state level. Such a view also supported the international positioning of national agendas in contentious areas of neurotechnological R&D as primarily directed towards the public good of health, and to derail attention

[1041] Garden and Winickoff, 'Issues in Neurotechnology Governance', 5.
[1042] OECD, 'Recommendation of the Council on Responsible Innovation in Neurotechnology, OECD/LEGAL/0457'. Principle 9
[1043] OECD.
[1044] Douglas Kysar, *Regulating from Nowhere: Environmental Law and the Search for Objectivity* (Yale University Press, 2010).

from their large discrepancies with regard to the politics and ethics of neurotechnological use beyond the domain of medical or clinical applications.

Puzzled about the OECD's reluctance to settle the social, legal, and ethical "issues", and with it the uncertainty of norms, values and politics which had provoked the coming together of BNCT delegates around the theme of "Responsible Innovation" in the first place, I asked an experienced policy-analyst at the OECD Directorate for help and explanation. Her answer would frame the OECD's processes of consensus-making and advice-giving in the following way:

> So yeah, it's true, because OECD is a club of like-minded countries, that's the sort of rationale. And there's good and bad to that, it does mean you can get things done, you can build consensus you can establish norms to some extent. But it means that certain issues are off the table. Or can only... they can be approached only in certain ways. It's all about informing policy, so in the end it has to have some recommendation about policy implications. So we're not doing philosophical basic ethics stuff at all.[1045]

Bridging responsible sectors and future markets

The OECD's restriction to "policy implications" only, as my interlocutor so eloquently illustrated, had a politics of its own, as certain issues were indeed "off the table", yet others could be effectively addressed within the "Neurotechnology and Society" project and its process of concluding deliberations with a joint Recommendation on Responsible Innovation for the governance of neurotechnology. What seemed puzzling to me was in fact a delicate act of boundary-work between the elevation of certain issues to the global arena, including the generation of a legitimate and authoritative view from "nowhere" on best policy practices, and the delegation of other points of discussion to the national, cultural, or normative level, including the granting of sovereignty to particular forms of reasoning around the ethical and social implications of emerging technoscientific innovation. While within the process, "ethics stuff" had been located at national levels of decision-making, issues provoked by the translation and commercialization of neurotechnologies, for example, had a rightful place in OECD's mandate, as it would be here that innovation policy could be bridged with markets and hence with wider imperatives of economic growth.

One such issue was the role of the emerging innovation superpower China in the development of global markets for neurotechnology; the other was the arguable role played by the private sector and businesses themselves in bringing about "responsible" neurotechnological products and services. Both were elevated to the global arena through a BNCT workshop organized in Shanghai, China, in the summer of 2018. The two-day agenda of "Minding Neurotechnology: Delivering Responsible Innovation for Health and Well Being" sought to:

[1045] Interview Nr. 23, May 2017

Promote a deeper dialogue among business leaders, investors, policy-makers, social scientists, and practitioner communities to enable desirable social outcomes and benefits of neurotechnology; enrich current discussions of the social implications of neurotechnology on both short and long-term time horizons by hearing from those engaged in bringing products to market; (and) better understand how considerations of responsible innovation can improve the sustainability of business models in novel neurotechnology.[1046]

As an international organization that gathers primarily “Western” economies with democratic political systems, efforts of promoting “a deeper dialogue” at the OECD have traditionally also been a way of projecting soft power beyond its circle of membership – and particularly towards emerging economies such as the BRICS nations, to whom it offers formal roads to accession as well as more informal forms of mutual policy “learning”[1047]. Shanghai was a strategically relevant place for “enriching” global discussions on neurotechnology policies and markets, as it represented “a new force in brain research”[1048] and concurrent efforts towards market translation, reflecting China’s broader moves towards challenging US and EU efforts in neuroscience R&D[1049]. Yet, little was known about how Chinese policymakers viewed trends such as “Responsible Innovation” or “Neuroethics” that aimed at improving the relationship between innovation, society and governance. If anything, the suspicion was that China would follow the road it had previously taken for internet governance and economic protectionism in technology industries, which caused concerns for both a potentially global “responsibility” agenda and the development of global neurotechnology markets in the future. At the same time, China was without doubt both a major market and research player, and hence the Shanghai meeting an opportunity of high strategic importance for BNCT, the OECD, and its club of “like-minded countries”.

On the surface, some of these fears were quickly confirmed at the meeting. A kick-off keynote delivered by neuroscientist Mu-ming Poo, well-known for his controversial efforts to clone gene-edited monkeys for drug testing and neuroscientific research on issues such as aggression suppression[1050], raised eyebrows among workshop participants and put into question the vision of a global alliance in Responsible Innovation governance on commensurable terms[1051]. The keynote fit within a larger

[1046] OECD, ‘Recommendation of the Council on Responsible Innovation in Neurotechnology, OECD/LEGAL/0457’, 45.
[1047] Rianne Mahon and Stephen McBride, ‘Standardizing and Disseminating Knowledge: The Role of the OECD in Global Governance’, *European Political Science Review* 1 (March 2009).
[1048] Nature Research custom media and ShanghaiTech University, ‘Exploring Connections: A New Force in Brain Research’, accessed 26 May 2022.
[1049] Dennis Normile, ‘Here’s How China Is Challenging the U.S. and European Brain Initiatives’, *Science,* May 2018.
[1050] David Cyranoski, ‘The CRISPR-Baby Scandal: What’s next for Human Gene-Editing’, *Nature* 566, no. 7745 (February 2019): 440–42.
[1051] Fieldnotes Shanghai Meeting D1, September 2018

research trajectory in which China's had positioned itself as a hub for Non-Human-Primates (NHP's) research on genetics of neurodegenerative disorders which raised international attention with regard to potential social and ethical issues vis-à-vis treatments and products derived from NHP research. Particularly in the EU, experimentation with NHP's had caused great social protests, and was heavily restricted in 2013, including a ban on use of NHP's in cosmetic research[1052]. As my French table neighbor whispered after Mu-ming Poo's talk: "*c'est l'horreur*!"

Yet, shortly after the workshop, a Chinese contribution to the flagship journal Neuron[1053] by some of the meeting participants framed national brain science and technology development in China as being governed responsibly and emphasized the need for international exchange – language that directly picked up themes from the meeting in Shanghai and indeed proved the OECD's effectiveness in streamlining policy concepts through its soft power. Yet, the paper also insisted on a "Culture-Oriented Perspective" respectful of Chinese Confucianism, well in line with the BNCT's "hands off" approach with regard to attempts to harmonize ethical or social values through an international recommendation:

> In China, there is broad agreement that every important decision and action ought to be based on the common goal to improve the well-being of people and society. There is a saying from The Analects of Confucius that concisely summarizes what were considered ''responsible actions'': do not impose on others what you yourself do not desire (己所不欲,勿 施于人). We have the responsibility to make every effort to avoid any potential harm that might be imposed upon people in society. Potential harms include but are not limited to threats to safety, privacy, and autonomy. Responsible research with goals oriented toward human well-being sets up the basis for the sustainability of brain science and technology.[1054]

Closely connected to the Shanghai meeting's goals to promote deeper dialogue with China on "Responsible Innovation" was the workshop's vital role in having businesses commit to the "goal to improve the well-being of people and society" via the embrace of responsible innovation frameworks, and hence in converging a pro-health, pro-market narrative in the "Neurotechnology and Society" project. Since a settlement of ethical issues, such as the controversial NHP research conducted by Mu-ming Poo, were not on the meeting's agenda, representatives from neurotechnology businesses and start-ups in particular had quite an easy role to play within the deliberations, as most enterprises participating in the meeting shared a declared goal to advance neurotechnologies for health, a mission they would

[1052] European Union, 'Directive of the European Parliament and of the Council on the Protection of Animals Used for Scientific Purposes', *Official Journal of the European Union,* 22 September 2010, 47.
[1053] Yi Wang et al., 'Responsibility and Sustainability in Brain Science, Technology, and Neuroethics in China—a Culture-Oriented Perspective', *Neuron* 101, no. 3 (2019): 375–79.
[1054] Wang et al., 375.

perform with great enthusiasm throughout the meeting, for example, by drawing on personal and emotionally touchy stories of patients that had been cured through their innovations. Their presentations framed the efforts of emerging neurotechnology companies as efforts to contribute to the resolution of pressing social challenges such as mental health, at the same time as they were key for representing technological progress for greater access, and indeed the "democratization" of neurotechnologies as one of the speakers proudly described company efforts[1055], particularly through innovations in mobile and inexpensive neurotechnological health applications. Here, the imperative to "bend the curve" of neurodegenerative diseases and mental health problems, in themselves considered to be global in spread, was presented as a global "ethical mandate"[1056] of private sector R&D and translation of neurotechnologies into society.

The private sector hence already embraced the framing of neurotechnologies as and for the social good, and the Shanghai meeting presented a formidable space to showcase such commitments to policy makers and the academic community. Representatives from government bodies and experts on ethical and social innovation policy, in turn, also reinforced their efforts to steer neurotechnological innovation towards greatest health needs during several presentations and comments. What was left as an "issue" to be discussed among the policymakers and business entrepreneurs, then, was how to formalize an international and cross-sector alliance that protects neurotechnology development from deviating from publicly desirable goals such as health.

Collective departure from the frame of "neurotechnologies for health" helped in leaving discussions around other potential uses and applications of neurotechnology largely aside, and in focusing deliberations on the means, rather than the myriad potential ends, of neurotechnological innovation and their respective ethical or social "issues". A turn to frameworks for the generation of "responsible" neurotechnology innovation presented an effective way to bridge public and private sector quests in the field. While companies were keen on performing their pioneering role in bringing about technologies serving global health needs, they were less acquainted with the particular instruments that were rising in the public sector with regard to social inclusion neurotechnology governance: "we're looking for guidance, but we haven't found much in terms of actual frameworks", one of the participants lamented particularly with regard to how to responsibly tackle the increasing accumulation and reliance on data by neurotechnologies, which could turn into an "issue" with regard to privacy of "brain data"[1057]. Governance frameworks were often too abstract and principles located at much too high normative level for companies to operationalize concrete questions such as data protection in day-to-day business.

Such assessments of a dearth of private sector frameworks for ensuring responsible neuro-innovation provided ample ground to call for a greater inclusion of the private sector in the development and implementation of Responsible Innovation governance. Here, deficits were not identified within

[1055] Fieldnotes, Shanghai Meeting, D1, September 2018
[1056] Fieldnotes, Shanghai Meeting, D1, September 2018
[1057] Fieldnotes, Shanghai Meeting, D1, September 2018

public policy and its lack of attention to social inclusion, but were shifted to the private sector, including in the provision of solutions through OECD work, including the framing of effective incentives to ensure "business sustainability"[1058] and to demonstrate private sector "responsibility and integrity" towards society. As the meeting's report, in which I was involved as a consultant, argued:

> The private sector has an important role in the development of responsible innovation practices in global markets. Companies – and especially start-ups – are at the forefront of neurotechnology innovation. Responsible technology development and effective governance must involve the private sector as a central actor early on, especially in global contexts. At the same time, the private sector has a key interest in demonstrating responsibility and integrity.[1059]

The Shanghai meeting was thus vital both for shoring up support and legitimacy for the OECD's development of shared principles among its member-states and as an attempt to project its reach towards constituents reaching far beyond the organization's original purview. Opening up deliberations to new actors, such as China and neurotechnology enterprises, reflected a turn in the process to grant those actors significant agency in the development of 'responsible' innovation frameworks that could ensure harmonized global policies and markets in the field; such agency, in turn, was crucial for catering to both market and social welfare imperatives that penetrated much of OECD's discourse around innovation in the post-crisis years. The need for international "soft law"[1060] which could also bring about a closer partnership between the public and private sector could once again be reasoned on the grounds of deficits in existing practices and approaches, and Responsible Innovation frameworks and instruments, including public engagement, framed as an effective fix for the stabilization of novel neurotechnologies (and markets) as and for the public good. As the meeting's report put to the point: "Far from being a barrier to innovation and development, engagement with such governance processes, alongside public engagement at all stages, can help secure public acceptability and clearer and more predictable routes through the innovation pathways"[1061]. The self-governance of neurotechnology businesses through Responsible Innovation frameworks developed jointly with the public sector became envisioned as a solution that enables technologies both to easily spread through societies and to shore up the imperative of innovation because it was framed as productive of good social outcomes, trust, and acceptance. According to the OECD report documenting the meeting,

> Recognizing that the social and ethical issues raised by the diversity of novel technologies fall squarely in-between public and private sector responsibilities as part

[1058] Fieldnotes, Shanghai Meeting D2, September 2018
[1059] Hermann Garden et al., 'Responsible Innovation in Neurotechnology Enterprises', 2019, 6.
[1060] Garden et al., 29.
[1061] Garden et al., 29.

> of the innovation process can help ensure socially desirable outcomes and contribute to the robustness and sustainability of products and services in this promising field.[1062]

The localization of solutions to ethical and social issues raised by neurotechnologies "in between" the public and private sector, in turn, allowed to construct global responsibility frameworks as effective "soft" instruments for the mutual stabilization of business and public R&D as geared towards desirable social outcomes as well as market development and growth.

Innovating the OECD's innovation imperative

Viewed within the larger genealogy of OECD ideas on innovation and its relationship to society, the outcome of the three-year negotiation process around a joint "Recommendation for Responsible Innovation in Neurotechnology" presented a considerable innovation – and deviation – from previous reasoning at the DSTI. This innovation consisted not only of a novel understanding of society and its role for innovation processes in OECD thinking, but also in the re-imagination of innovation and its significance for society, both of which would be co-produced by the Recommendation, the "first international standard in this domain"[1063]. On the one hand, these re-configurations were the result of accommodating an increasing concern towards the uptake of innovation by society within the OECD's deep-seated forms of reasoning about innovation in purely economic terms; on the other hand, they reflected a deep-seated commitment to settling such concerns through new policy-instruments in member-states, such as "RRI" in the EU or "Neuroethics" in the US. If we were to interpret the Recommendation in innovation policy language, it does not (and arguably could not) represent a 'radical' or 'revolutionary' innovation – that is, as a completely new approach disrupting existing modes of thought and reasoning about innovation and society[1064]. Rather, the Recommendation could only innovate the OECD's innovation agenda through incremental steps of remixing existing commitments to the relationship between innovation and society, including those of the DSTI itself, as well as those of member-states and the US and EU in particular. The very first page of the Recommendation, which gives readers "Background information", exemplifies such an eclectic mix of reasoning for the "Need for an International Standard for Responsible Innovation in Neurotechnology":

> Novel neurotechnology offers significant potential for the promotion of health, wellbeing, and economic growth…Neurotechnology is redefining what is possible in terms of monitoring and intervention in clinical and non-clinical settings, with great promise for improving mental health, well-being, and productivity…At the same time,

[1062] Garden et al., 33.
[1063] OECD, 'Recommendation of the Council on Responsible Innovation in Neurotechnology, OECD/LEGAL/0457'.
[1064] For a typology of different kinds of innovation, see Benoît Godin, 'The Vocabulary of Innovation: A Lexicon', n.d., 64.

> neurotechnology raises a range of unique ethical, legal, and societal questions that potential business models will have to address…Governance issues surrounding neurotechnology affect the entire innovation pipeline, from fundamental brain research, cognitive neuroscience, and other brain-inspired sciences to questions of commercialization and marketing.[1065]

Here, the "need" and legitimacy for a Recommendation on Responsible Innovation was grounded in two imperatives for action. One is the traditional "innovation imperative," i.e., an imperative to foster innovation as the driver of economic growth and productivity in knowledge economies, resting firmly within the OECD's traditional econo-centric approach to innovation. The other is an imperative of innovation as a provider of the common good, and in particular "health and wellbeing", for which "inclusion of ethical, legal, and societal questions" needs to be addressed. Those imperatives are not independent of one another, but are linked in interesting ways which makes it nearly impossible to distinguish their distinctive claims on innovation and its proper relationship to society: the "good" (here labelled as "potential" and "promise") envisioned to be achievable by neurotechnological innovation is at the same time good for the market as it is for the public good of health; similarly, the inclusion of "societal questions" is at the same time presented as relevant for "potential business models" as it is for the "entire innovation pipeline", including fundamental brain research pertaining rather to the public than to the market side of the innovation process.

Such a double bind in terms of what innovation actually stands for – and who is responsible for putting it "responsibly" to work for societies and markets – permeates the entire Recommendation and its nine principles. The Recommendation's preamble, for example, begins the document with the recognition that "neurotechnology holds great promise for human health *and* innovation", that the "fast moving and uncertain pathways of certain neurotechnologies…might require agile forms of governance*",* and that "realizing responsible innovation in neurotechnology will require concerted action across governmental levels and across the public and private sectors*"* which also means that "the principles set out in this Recommendation may accordingly be relevant to actors in all of these settings.*"*[1066] These statements significantly expand the boundaries of what innovation *is* (a market and a social good), as well as how it *ought* to be governed (responsibly, and by all actors, businesses, policymakers, and citizens alike) towards socially desirable ends.

Yet, beneath vague language, a shift of ideas on the roles and responsibilities with regard to the governance of the innovation-society nexus shines through. Markets now are responsibilized to control technological development with regard to social issues, a role usually assigned to publics and the policies initiated on their behalf by governments; and governments, in turn, are held accountable to bring

[1065] OECD, 'Recommendation of the Council on Responsible Innovation in Neurotechnology, OECD/LEGAL/0457', sec. Background Information.
[1066] OECD, sec. Background Information. My emphasis.

about innovation where public demand is high, a function usually provided by businesses and so-called "market pull" mechanisms. Such a shift, again, is not necessarily "new", as the OECD had pioneered work on international "Corporate Social Responsibility"[1067] (CSR) standards from the early 2000s onwards. Rather, the novelty of such an ordering of the responsibilities of states and markets lies in the explicit attention to responsible innovation as productive of good public policies, and on "agile" forms of governance as legitimate tools for policing corporate and political power[1068]. In conjunction, these shifts make the joint public-private production of "responsible" innovation in the field of neurotechnology imperative for achieving socio-economic progress.

Next to the responsibilization of public and private sectors in governance, who together are encouraged to "promote cultures of stewardship and trust in neurotechnology"[1069], also the public is re-configured as an actor in the Recommendation, sharing significant agency in steering innovation towards socially desirable ends. Different to the framing of society in OECD documents in the past as an elusive 'risk' to innovation that has to be managed, controlled, and engineered, the Recommendation assigns a critical role to society in enabling responsible neurotechnological innovation. Not only do definitions of "actors" and "stakeholders" provided at the beginning of the Recommendation allude to society's role in neurotechnology innovation, particularly in its "uptake and use", and as being "directly or indirectly" involved in, or affected by, advancements in the field. The opportunities and challenges provided by innovation also "warrant a broad public discussion about the best future of neurotechnology in society", require the "alignment of public support and economic incentives", and "open communication across expert communities and with the public to promote neurotechnology literacy and the exchange of information and knowledge."[1070] Discussion, support, and literacy of neurotechnologies by societies are here regarded as paramount for delineating a desirable future of neurotechnology, a capacity that was largely missing from previous assessments of society's role in innovation at the OECD. Desirability of innovation here does not only figure as an end-product of public deliberation, but, importantly, also as a process dimension and as the starting-point for society to be granted agency in the engagement of the decision-making on science and technology.

But while society is constructed as having a vital role in informing innovation policy and processes, such agency is also limited to inform and contribute to (rather than question or change) the course of technoscientific innovation already set by governments and the market as being in the public's interest. Such framing stabilizes innovation as a socially, and indeed globally, desirable course of action towards the future, to which citizens – next to governments and businesses - now have a responsibility to contribute. Society is allowed to have agency primarily with regard to its benevolence towards innovation, which dismisses its role in envisioning alternative futures that do not rest on, or even oppose,

[1067] OECD, 'Guidelines for Multinational Enterprises', accessed 26 May 2022.
[1068] Barkan, *Corporate Sovereignty*.
[1069] OECD, 'Recommendation of the Council on Responsible Innovation in Neurotechnology, OECD/LEGAL/0457'. Principle 8.
[1070] OECD.

neurotechnological innovation. The Recommendation also pre-empts other avenues for contributing than invited deliberation or the acquisition of scientific literacy on neuroscience and technologies. Such ordering work becomes particularly visible in principles set forth by the Recommendation that call on policymakers and private enterprises to take societal "values" better into account in the design and governance of innovation pathways[1071]. While we have learned that the harmonization of ethical norms was a sort of "no-go" for the BNCT during the process of developing the Recommendation, certain "high-level values"[1072] did make it into the final text, which mobilizes a set of norms "such as stewardship, trust, safety, and privacy"[1073] from the first page onwards.

The elevation of particular values to the high level of an OECD Recommendation implies that such norms are shared across member countries and their societies, including more specific values such as "cognitive liberty and autonomy of individuals"[1074], "freedom and self-determination"[1075], "safety"[1076], "inclusivity"[1077], "confidentiality"[1078], and "accountability, transparency, integrity, trustworthiness, (and) responsiveness"[1079]. It is not surprising that these norms are raised in the Recommendation, as they broadly represent normative commitments perceived to be shared by many of OECD's liberal-democratic member-states with regard to individual and collective rights and freedoms vis-à-vis the state's biopolitics[1080]. Nor is it particularly dazzling that many of these values are geared towards making innovation more "trustworthy" and " safe", which can be read as instrumental for countering the high uncertainty associated with innovation processes (as described, for example, in the case of EU's commitment to high-risk innovation). More important in the context of global governance is the declaration of these norms as common point of departure for "responsible" innovation policy across OECD countries, which implies a harmonized liberal understanding of rights, norms, and liberties, as well as a certain degree of susceptibility by publics towards imaginations of responsible socio-technical progress that such values cement. The Recommendation departs from a firm belief that public engagement with innovation rests on clear and well-articulated values that ought to inform technoscientific futures, which can be enabled by governments' and markets' embrace of more responsible innovation governance. In foregrounding these values as constitutive for socially desirable innovation on a global scale, the OECD shows significant flexibility with regard to its rather hard, econo-centric imaginary of innovation, at the same time as it further caters to an imperative of innovation as global good with the power to bring about desirable futures – for citizens, businesses, and the OECD

[1071] OECD. Principle 1.
[1072] OECD.
[1073] OECD.Background Information.
[1074] OECD. Principle 1.
[1075]OECD. Principle 1.
[1076] OECD. Principle 2
[1077] OECD. Principle 3.
[1078]OECD. Principle 3.
[1079] OECD. Principle 8.
[1080] Michel Foucault, *The History of Sexuality: The Will to Knowledge* (Harmondsworth: Penguin Books, Limited, 2006).

itself.

9. Ordering Public Reason on Innovation and Society: The Constitutional Role of Soft Law

My three case studies, located in different jurisdictions and displaying diverging ways of settling normative principles, guidelines, and recommendations on innovation in neurotechnology, illustrate the powerful work of *soft law* bodies and texts in contemporary policymaking on science and technology. Well beyond a purely normative function, they show how *soft law* is productive of knowledge that orders, frames, and imagines innovation as a public good, and is central to the constitution of publics, their ideals of social order, and sense of regulatory agency vis-á-vis innovation. Instead of seeing *soft law* as "instruments that are not legally binding, or whose binding force is somewhat 'weaker' than that of traditional law"[1081], a co-productionist STS analysis reveals that such instruments do indeed shape the relationship between innovation and society with quasi-constitutional force – that is, that they have consequential effects[1082] for the making of socio-technical order by and within jurisdictions at the national, regional, or global level. From this perspective, the production, performance, and settlement of *soft law* in science and technology governance has binding effects on the ways publics reason about the desirability of innovation in modern democracies: it effectively defines what publicly desirable innovation is, which governance arrangements are appropriate to achieve it, and whose right and responsibility it is to put it into practice. These forms of regulating innovation toward the public benefit recall the construction of bioconstitutional order that has been the target of late 20th century attempts at "reframing rights" of individuals and their bodies with regard to modern science's biopolitics[1083]. Yet, they inflect these bioconstitutional regimes by the growing imperative of technoscientific innovation of the early 21st century, which is legitimized through an increasing turn to *soft law* as regulator of innovation toward the public benefit.

In this chapter, I propose that the rise of what I call *soft technoscientific constitutions* represents a powerful modality for disciplining political collectives concerning their relationship to innovation – they create, much like a Constitution, the checks and balances deemed legitimate within a political culture to shape the course of knowledge and technology development towards socially desirable ends, and hence grant authority to certain actors and knowledge claims over others to define and execute the allocation of power within the governance of innovation and society. As we will explore through comparison of my case studies further below, wide differences can be observed with regard to how *soft constitutions* are put to work across different jurisdictions, how they are shaped by situated forms of public reasoning, and to which forms of ontological, epistemic and normative order they give rise. Most importantly, however, we will discuss the elementary role of *soft constitutions* in the development of authoritative visions of future order among innovation and democracy, which I argue is a distinctive

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[1081] OECD, 'Soft Law', accessed 28 May 2022.
[1082] Hurlbut, Jasanoff, and Saha, 'Constitutionalism at the Nexus of Life and Law'.
[1083] Jasanoff, *Reframing Rights*; Nikolas Rose, 'The Politics of Life Itself', *Theory, Culture & Society* 18, no. 6 (1 December 2001): 1–30.

component of evolving regimes of *technoscientific constitutionalism.* These visions can be described as the *constitutional imagination* that marks contemporary public reason on and governance of emerging science and technology, in that they project powerful ideals of a democratic regulation of innovation into the future, with concomitant consequences for the governance of innovation and society in the present.

Different imaginations of how societies will constitute themselves vis-à-vis innovation are related to different ways of imagining legitimate forms of democratic regulation, including what needs to be regulated, why, through which types of government, and by which forms of distribution of power across society. They are embedded in historically grown ideals of democratic rule – i.e., of the legitimate relationships of authority between government and citizens – in political cultures, and yet are also subject to change in processes of re-ordering relationships between science, technology, and society. Throughout my case studies, we can observe the powerful futuring-work that *soft constitutions* exert: in the EU, a republican constitutional imagination foresees that democratic rule is *collectivized* through responsibilizing citizens in innovation governance; in the US, a liberal imagination *individualizes* innovation governance through scientists, experts, and citizens; and at the OECD, a liberal-republican imagination conjures a *harmonized* form of innovation governance across democratic jurisdictions. That these constitutional imaginations are mobilized in particular since the onset of a crisis, *ressentiment*, or fatigue of liberal democracy and its ideals of reaching social progress through scientific reason and technological means[1084] is no coincidence – rather, we might conceive the emergence of *soft constitutions* as answer and solution to the crisis of democracy and of innovation that haunts today's public imagination.

The following pages will guide us through the series of different arguments on the nature, function, and effects of *soft constitutions* that I derive from analyzing and comparing the interaction between *soft law* and innovation imperatives in science and technology policy across the three case studies of this thesis. I will first discuss the idiosyncratic ways through which the US, EU, and OECD have produced public reason on emerging neuroscience and -technology, including the different *soft law* bodies and texts constructed in each case, and the ordering work between innovation and society conducted by them. Then, I will carve out some of the threads that are shared across the case studies, particularly with regard to shifting public commitments from science to innovation proclaimed by science and technology policy since the beginning of the 21st century. From here, I move on to argue that these shifts are legitimized through a new, *constitutional imagination* of democratic sovereignty vis-á-vis technoscientific innovation, which rests on historical ideals of democratic order and rule that have first been described by Enlightenment thinkers, and which have developed further during the 20th century. Eventually, I analyze in depth the different imaginations of democratic innovation governance that mark my three case studies through asking what objects and forms of reasoning, subjects and types

[1084] A collection of such arguments can be found in Heinrich Geiselberger, *The Great Regression* (John Wiley & Sons, 2017).

of government, and checks and balances are envisioned as constitutive elements of future socio-technical order in each case.

9.1 Co-producing Reason on Neuro-Innovation and Society in the US, EU, and OECD

Within the short and crisis-riddled history of the 21st century, innovation in neuroscience and -technology ascended to a constitutive place in the public imagination of modern democracies in the Northern hemisphere. Particularly in the EU and the US, but also through their transatlantic policy forum, the OECD, research and development targeting the human brain, its functioning, and its diseases came to be framed as an indispensable means to respond to the social and economic challenges of the new millennium, and specifically those believed to be caused by the 2008 economic and financial crisis. The US once again underlined its claim to remain the world's technological superpower through providing yet the largest resources, both financially and in human resources, to the acceleration of neurotechnological innovation via the BRAIN initiative. Meanwhile, the EU was struggling to expand its own technoscientific powers through awarding the HBP the largest research award of its history in science and technology funding. As an organization set up to enhance the economic cooperation among the US and the EU, the OECD took up policies in its member-states so as to produce a global framework for the governance of innovation in neurotechnology. Across all of these contexts, a shift from public investments in science to innovation was envisioned as a powerful remedy for the resolution of social and economic problems.

Yet, the crisis years in which imperatives to innovate neurotechnology were proclaimed by public institutions proved to be both an opportunity and a challenge, as promises of great returns for economies and societies from investments in high-risk, long-term research on the brain were causing their own crises of legitimacy in public policy. In the US, investments in a public-private partnership for the advancement of the BRAIN initiative, framed as key for providing a healthy society and economy, caused significant outrage by neuroscientists. The young field of neuroscience, which had risen on the federal agenda as a moral good for the nation in itself, was deeply suspicious of the centralization of federal investments in the BRAIN initiative and their public legitimation strategies. Controversy evolved in particular around the bold promises of policymakers on the BRAIN initiative's innovative potential, which pitted the public value of pure scientific knowledge against the perceived instrumental goals pursued by the turn to innovation in public policy. And while the announcement of the HBP in Europe in the same year was a powerful trope for member states' achievement of unity in scientific and technological progress, the revolt of neuroscientists against the HBP's design as a top-down, ICT-driven project with the potential to drive economic growth and social prosperity had consequential effects on the integrity of the project and the legitimacy of its funders. Similar to the US, scientists would question the public benefits of HBP's bold aims, which were primarily seen as geared towards economic instead of social ends. At the OECD, in turn, a crisis in imperatives of globalization achievable through technological progress was in full swing when its DSTI staff began to embrace work on the role of societies in science and technology policy, with wide-ranging challenges for the econo-centric approach with which the organization had hitherto approached the public governance of innovation.

The three case studies at the heart of this thesis show how public legitimacy in these moments of crisis was achieved through the work of bodies and texts that produced public reasoning on what publicly desirable neurotechnology innovation is and which principles, or rules should guide innovation in neurotechnology toward socially beneficial ends. While across all of the cases, public reasoning took place through 'soft' bodies and processes with no de-facto democratic legitimacy and power to regulate neuro-innovation in the name of society, their work was constitutive for legitimizing the proclamation of innovation in the field as a shared, public good. Large differences can be observed with regard to how *soft law* was mobilized in each case so as to be perceived as a credible voice of the public and its interest since in each context, culturally specific ways of public reasoning configured the ways through which normative principles and rules were crafted and gained authority. In other words, differences in styles of knowledge production on, ontological and normative ordering around, and framing of socially desirable neuro-innovation in these different cases show how the production of *soft law* in innovation governance is contingent, situated in specific political cultures, and a product of its time.

Constituting the public good of neuro-innovation in the US

In the years following President Obama's grand announcement of the BRAIN initiative and its subsequent controversies, two ethics bodies and the *soft law* they produced through "Gray Matters Volume 1 & 2" and the "Neuroethics Roadmap" were constitutive for ordering the rise of neuroscience and -technologies and their meaning for American society. The promissory claims of the initiative advanced by policy, administration, and research with regard to its variegated potential – from curing mental illnesses to curing the economy – deviated substantially from the ways that the government's role in scientific and technological development had been conceived in the 20th century. Rather than linear ideals of public investments in science that would lead to innovations produced and governed by markets, the public's support of the BRAIN initiative was framed as resting on a public-private partnership, including a novel role for the American government to invest in the development of technoscientific innovation. The new imperative was sustained by forms of 'ethical' reasoning that would embed the new brain sciences, the project, as well as its expected outcomes within the public's interest and imagination. The PCSBI's Gray Matters Volumes and the NEWG's Neuroethics Roadmap performed this function by presenting their work as guarding long-held notions of a well-ordered society enabled by science, as well as through introducing novel elements of public reasoning on innovation to American publics. Whereas the relationship between ethics and science had been tied through revolutions in understanding life through genetics in the second half of the 20th century, for which Bioethics became the underlying "cultural repertoire of [American] public reason"[1085], neuroscience's ambitious re-framing of human nature sitting in the brain and neurotechnology's promise to enhance society's wellbeing beyond health, was be accompanied by the differentiation of public reasoning into a particular branch of Neuroethics expertise.

[1085] Hurlbut, Jasanoff, and Saha, 'Constitutionalism at the Nexus of Life and Law', 11.

While Gray Matters Volume 1 & 2 were crucial for stabilizing the BRAIN initiative's goals as continuation of an established, legitimized mode of governing science and technology through Bioethics, the Neuroethics Roadmap would open up a new chapter in coming to terms with emerging, uncertain understandings of life and concurrent shifts in imagination of how it ought to be protected by the state. Both texts, as well as the backstage work mobilized to produce them, strongly relied on drawing the boundaries around the authority of ethics and science to regulate public reason towards a beneficial uptake of neuroscience and -technology, and for re-enacting a strict separation of ethics and science from politics held dearly by the modern American state. Knowledge and norms, conceived as objective and neutral representations of the body and its politic, were standing above the interestedness and bias some commentators saw in the BRAIN initiative's embrace at federal level. This allowed to present "scientific-technological norms" as "socially trusted guarantors of the integrity of public action"[1086], and disciplined (Neuro)ethics to stand in for regulatory and legal absence vis-á-vis the introduction of neuroscientific innovation into society writ large.

In the early years of the BRAIN initiative, the PCSBI was key for ordering the "Gray Matters" of neuroscience and -technologies' bold claims as driving forces of the public good. Its performance of bioethical reasoning served a constitutive function for the stabilization of neuroscience's rightful place in public policy, as meriting significant federal funding which would return to the public by way of health, happiness, and jobs, and supporting the nation in fulfilling its moral obligation in advancing knowledge's endless frontiers for enhanced human flourishing. The frames and imaginaries evoked to produce such order were not only tied to long-held American commitments towards the means and meaning of the pursuit of the public good through science and technology; they also introduced new elements to the list of ingredients, in particular the role of innovation as imperative for the attainment of a just, free, and democratic society. Innovation not only enabled a marriage of governments and markets in such a vision, it also legitimized uncertain, high-risk neuroscience research as a high-reward project to be addressed at the level of government and to be embraced by American citizens. The state's normative agency represented by Bioethics expertise, however, was not to be confounded with its authority to rule through law, but disciplined into becoming a facilitator for science and technology's self-regulatory powers.

While the integration of Bioethics into the rising neurosciences was a key principle for Gray Matters 1 & 2, the PCSBI's reasoning enacted particular forms of boundary-work between ethical and unethical neuroscience. Illustrated by the group's deliberations on cognitive enhancement, the ethics of neural modification were primarily framed through science, whose naturalization of enhancement techniques helped to settle them as "not inherently ethical or unethical". Rather than discussing the ethics of neuroscientific knowledge and interventions in the human brain, the PCBSI located the ethics of brain enhancement in the individual uptake and use of neural modifiers. This framing also allowed to present cognitive enhancement across the whole of society as morally, politically, and economically

[1086] Ezrahi, 'Science and the Making of Representative Actions and Accountable Actors', 44.

desirable area of innovation. Central to the Gray Matters 1 & 2 imagination of ethical neuroscience was hence the education of citizens in judging and using newfound knowledge of the brain and techniques for its enhancement – an imagination which effectively located the responsibility for human health and wellbeing in the individual. Yet, whereas the individual formed the locus of the PSBSI's reasoning, authority over defining what the ethics of neuroscience and -technology entail for individuals and society still rested in the scientists' and ethics experts' purview and authority.

The Neuroethics Roadmap, in turn, faced the nitty-gritty work of purifying the project's politics of neuroscience and -technology as significant interventions into the public good promised to have great, yet uncertain material and moral outcomes. Through ordering neurotechnologies into uncontroversial ones and those provoking the "but-what-if factor" and potential public rejection, the imperative to innovate advanced by the BRAIN initiative was shaped as an undisputable good in itself, which could only benefit from a Neuroethics discourse that could control the public's fantasies going awry. Ontological and normative surgery also extended to conceptualizations of person- and selfhood by means of reification of liberal-individualistic interpretations of human nature that were updated to the new neuro era: the seat of rationality and autonomy being in the brain became a reason for spotlighting its moral significance as well as a legitimization for the further institutionalization of Neuroethics expertise and concurrent forms of disciplining public discourse around the brain.

The performance of a co-regulatory relationship between (highly specialized) science and norms – where neuroscience's re-formulation of fundamental ontological categories was authorized to set the limits of the normative imagination and vice-versa, where Neuroethics was allowed to frame normative questions and problems within the bonds provided by science – here came to pass as a soft mode of governance that could prevent future legal and regulatory reaction. Upon closer analysis, however, the coalition of neuroscience and Neuroethics formed a powerful bond for the making of a new bio- as well as technoscientific constitutional order. The reasoning provided by the NEWG constituted neuroscientific subjects and objects at the same time as it performed a system of checks and balances between knowledge and norms regulating innovation to prevent 'arbitrary' political rule[1087].

While this political economy around the relationship of ethics, science, innovation and the state arises from the idiosyncratic ways of reasoning in American culture[1088] as well as from the particular economic and political challenges of the moment, it could also be interpreted as characteristic of current attempts in liberal democracies of the 21st century more generally to re-formulate the basic components of the public good and legitimate styles of governance in the name of innovation, as we will find out in comparison to the EU's normative reasoning around emerging neuroscience and -technology

[1087] This co-productionist move was famously described by Shapin and Shaffer in their examination of Hobbe's and Boyle's approaches and controversy over natural philosophy and experimentalism: "The form of life in which we make our scientific knowledge will stand and fall with the way we order our affairs in the state." See chapter 3, Shapin and Schaffer, *Leviathan and the Air-Pump*, 344.
[1088] Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*.

Constituting the public good of neuro-innovation in the EU

Different to its transatlantic counterpart, the EU's efforts to produce "responsible" innovation in neuroscience and technology through the HBP were not sustained by a ready-made state with a common political culture in reasoning around emerging science and technology, but were marked by struggles of European policymakers to unite its member-states and institutions beyond a common market in a joint political identity. The history of the HBP – from its announcement as "flagship" to sail the Union to brighter horizons, to the ensuing controversy about the EU's support of the project's promissory techno-economic politics – is inextricably linked, and, in fact, co-produced by the difficult trajectory of shifting authority over the governance of science to the supranational level of the EU, as well as by the post-crisis narrative of providing and protecting European common good(s) through the creation of an "Innovation Union". While the integration of European countries via the Lisbon Agenda had been diagnosed of a lacking "political will" among member-states to delegate sovereignty over research governance to the EU, the embrace of an "innovation principle" worked as a surrogate integration tool that convinced countries to invest in an unprecedentedly high budget for R&D allocated in the framework program Horizon 2020, including in the HBP. Albeit its high-risk and highly questionable benefit for public health, the HBP made a persuasive case for supporting *in silico* neuroscience as effective means to reach economic and social prosperity across the continent, promising not only a complete understanding of the human brain and its diseases, but the development of new and highly competitive ICT industries and markets inspired by the brain sciences.

Yet, the EU's strategy to "innovate Europe out of the crisis" through big science projects such as the HBP provoked much fury within the neuroscience community, as it pitted highly stabilized national understandings of basic science as public good against the politics of technoscience proclaimed by Brussel's policy elite. Here, the shift to innovation was regarded with suspicion particularly because it was ordained by the EU and its perceived undemocratic decision-making culture – the social function of science, instead, required that it ought to be governed by democracy as one of the HBP's commentators put to the point earlier. In the European context, the public good of science was not expected to be protected by scientists and neuroethics experts as was we have observed in the US BRAIN initiative, but entrusted to be governed by European bodies and their public so as to ensure it caters to the European society's benefit. A collective view from "everywhere"[1089] on the benefits and risks of neuroscientific innovation was seen as instrumental for ensuring science was not instrumentalized by the interests of politics and of markets, a criterion which should also guide neuroscience and its translation into applications and products according to the HBP's critics. As long as the EU could not prove it was representative and inclusive of the diversity of European perspectives in the production of reason around emerging neuroscience and -technology, it lacked the legitimacy to proclaim innovation in the neurosciences as a European common good. For such legitimacy to be

[1089] Sheila Jasanoff, 'Virtual, Visible, and Actionable: Data Assemblages and the Sightlines of Justice', *Big Data & Society* 4, no. 2 (2017): 2053951717724477.

achieved, the EU still had to develop a shared culture of making sense and making rules on science and technology, which included the production of a European public to be engaged in the democratic governance of knowledge and innovation. Rather than an "experiment in democracy"[1090], the processes instigated by the EU to sustain the HBP with public legitimacy were constitutive for the stabilization of European public reason on neuroscientific innovation.

Nearly a decade before the HBP kicked off, first steps towards the production of European public reason around emerging neuroscience and -technology were initiated within the ERA framework and its aims to reach a more harmonious relationship between science and society. A prototype in performing democracy at EU-scale, the "Meeting of Minds" (MoM) showcased that European citizens indeed were willing and able to find agreement on the desirable place of neuroscience in society, and that they thus could be effectively enrolled in the governance of science via participatory processes. The invitation to citizens to draw the boundaries around desirable European knowledge creation on the brain made neuroscience a constitutive area of public deliberation at the same time as it made citizens subject to the broader frames for science envisioned by the EU's institutions as adequate for guiding participatory processes. Whereas the beginning of the 21st century had witnessed citizens across the continent vetoing the federalization of the Union through conferral of authority to a joint Constitution, as well as protesting the introduction of uncertain technoscientific entities such as GMOs through European institutions, the MoM produced the harmonious relationship between citizens, science, and the Union called for by Commisioner Busquin when proposing the "Science and Society Action Plan".

Instead of the top-down introduction of a Constitution to form the European polity, deliberations in MoM became a tool through which the polity would constitute itself from the bottom up[1091]. Such process relied on the formation of a European public willing to produce joint European reason bound by shared values. MoM's participants would not only perform a passionate European citizenry immersed in the experience of parliamentary co-legislation, but would also form a European public receptive of science, engaged in the drawing of its normative boundaries, and willing to authorize its "soft" governance at the supranational level. This subjectivity differed significantly from the understanding of "ignorant, distrustful, risk-averse" European citizens that had characterized the science-society relationship around EU's biotechnology policy in the late 1990s[1092]. Citizens in the MoM would neither reject neuroscience nor its governance through EU bodies but welcomed both as adequate and legitimate means of expressing and safeguarding the public interest; moreover, they would readily accept their collective duty to set the boundaries of science and of EU's authority when acting against the common will. In the citizen's recommendations, science would provide the EU the objective knowledge needed to take decisions in the public interest, which, in turn, could only be expressed and achieved through participation in, and hence collective responsibility of, the governance of science. These settlements

[1090] See e.g., Hurlbut, *Experiments in Democracy*.
[1091] Richard Bellamy and Dario Castiglione, 'Legitimizing the Euro-`polity' and Its `Regime': The Normative Turn in EU Studies', *European Journal of Political Theory* 2, no. 1 (2003): 7–34.
[1092] Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*, 87.

constituted neuroscience as an object of shared European interest, and positioned shared EU governance as the adequate venue for settling the boundaries around science, politics, and markets in the public interest. In other words, they co-produced a particular order for "good" science, "good" citizens, and "good" EU governance.

The HBP's "RRI" approach continued the process of better aligning the EU's science policy with citizens, yet the pervasive innovation imperative declared by Horizon 2020 and the HBP itself formed the larger frame of reference for deliberating on the desirability of innovation in neuroscience for society in the project. From the MoM's recommendations to the full-fledged and scaled-up operationalization of RRI 'keys' to open the HBP to society, significant shifts occurred in reasoning around what exactly would constitute the benefit, and the risk, of publicly supporting neuroscientific innovation. While participants in the MoM were strictly against the uptake of neuroscience beyond social ends, in the HBP's RRI work not the sector or the specific actor, but the use of neuroscience for or against society's interest was key. This marked an important shift in how desirable and undesirable, or responsible and irresponsible, innovation in neuroscience would be conceived – as a predominantly knowledge-driven endeavor for the advancement of medicine and welfare (which ought not to be left to market forces alone), or as an inherently technology- powered enterprise directed at developing society in a beneficial way (to paraphrase from the HBP's citizen deliberations). Through a full-fledged subproject tasked with integrating "Ethics & Society" upstream in the project, the HBP envisioned ensuring its promised innovative outcomes would be beneficial for and, in fact, accepted by European society.

The performance of an ongoing "feedback loop" between innovation processes in the HBP with society and its values produced a powerful way of reasoning what RRI means and how it ought to be put into practice in the service of society. From the co-production of European defense policy with citizens' opinions on the governance of "dual use research", to the ontological and normative surgery around the brain's circuits and its socio-cultural nature conducted in teamwork by HBP's scientists and philosophers, the re-ordering of boundaries between categories as constitutional as the distinction between the civil and military mission of public institutions, and scientific and philosophical conceptualizations of the brain, the mind, and their relationship to human nature, helped to imagine and enact a collective agency responsible for guarding neuroscientific innovation for the benefit of society – whether in the form of defending responsible dual-use research conducted by public and private bodies alike, or by allowing neuroscience to become a legitimate reference in the provision and protection of the moral good ensiled in the brain. In both processes of constituting innovation as a desirable public good, we could find great and in-built- optimism of society's capacity to steer science and technology towards socially desirable ends, which on the one hand was reasoned as a "contamination" of technoscientific rationales and policies through social norms, but, on the other hand, also served to purify "responsible" vs. "irresponsible" innovation as inherently embedded in, and hence the product of, society and its normative apparatus.

Such positioning of responsible innovation legitimized the emergence and embrace of new objects to provide and protect through the EU – responsible security and defense research and applications in the case of deliberations about the permissibility of dual use research, and educational programs for epigenetic brains to proactively develop a morally and neurologically enhanced society in the work of "Neuroethics & Philosophy". Not only were the EU's bodies imagined to act as a focal point to provide neuroscience applications for the public's welfare and to protect its citizens from possibly "irresponsible" outcomes – along the way, a European public with a joint voice and will in setting the normative boundaries of innovation's risks and benefits was also produced as a necessary component of legitimizing the EU's efforts to achieve an "Innovation Union" in the crisis aftermath. As such, the HBP's performance of RRI reflected larger republican efforts mobilized in Europe for decades, from calls for a "cosmopolitinization of Europe from below" to the making of a "European identity born in the daylight of the public sphere". Whereas this political economy around the right relationship between the EU, science, innovation, and citizens reflects the particular challenges of the European project which gained renewed attention in the post-crisis years, it also evidences the EU's capacity to re-invent and re-constitute itself via RRI, including through fashioning itself as a democratic project capable of providing Europeans with innovative goods as shared public good.

Constituting the global good of neuro-innovation at the OECD

The OECD too re-invented itself through a novel form of reasoning on its identity as a policy organization geared towards supporting global economic growth through the liberalization of markets, to an enabler of globalization processes that "bridges divides" between citizens, governments, and markets caused by the 2008 crisis. Proclaimed at the highest OECD-levels, the new agenda spoke squarely to the effects of technological progress on societies' discontent with globalization, which was taken up by the OECD's DSTI through the formation of the BNCT working party with a dedicated emphasis on public engagement and inclusion in the governance of innovation. Located within the traditionally econo-centric approaches to innovation that had been a key asset for DSTI in advising member-states in policy-making, and in which citizens and societies had figured mostly as a risk to the fulfillment of economic growth through science and technology, the BNCT had to align new approaches to governance with the DSTI's long-held forms of reasoning and ordering innovation and its place in globalization processes. This included a re-ordering of expertise at the DSTI itself, including the approximation of economic and social knowledge regimes concerned with innovation, finding a "mid-way" between diverging, nationally embedded forms of reasoning on the normative aspects of innovation, and bridging geographic discrepancies as well as instruments employed by the public and the private sector with soft instruments to ensure economically "sustainable" and socially "responsible" innovation.

The process of developing a joint OECD "Recommendation on Responsible Innovation in Neurotechnology" was hence marked by several processes of convergence put in motion by the BNCT

Working Party, its delegates, experts, and broadened set of stakeholders such as non-members and business representatives. Reaching a joint "political will" and "moral force" on questions as difficult as whose knowledge counts in the governance of innovation, what globally desirable innovation actually means, and which instruments and tools are deemed legitimate to govern innovation towards socially desirable ends, was achieved through complex strategies of adjusting innovation imperatives in crisis to rising imperatives of social welfare provision through innovation within the context of global governance. While in all of these processes, significant competition and political tensions among constituents could have brought the whole project to a halt, they successfully managed to carve out their "overlap" and to identify common ground that made the declaration of joint principles for Responsible Innovation in neurotechnology governance possible. In fact, it was the mutual stabilization of these different re-alignments which made the Recommendation on Responsible Innovation a success within the difficult environment of the BNCT as well as within the highly competitive international landscape of innovation policy.

As we observed during several meetings and workshops, and through a close reading of the texts documenting the BNCT's deliberations throughout the process, the harmonization of socially inclusive innovation policies rested primarily on the identification of deficits perceived to endanger the project of making innovation and globalization "work for all". The construction of deficits in OECD expertise to respond to a crisis of globalization and multilateralism, missing elements in national governance frameworks to ensure innovation was addressing perceived social needs, and a lack of instruments for businesses to team up with public policy in bringing about "responsible" innovation, provided an abundance of reasons to act decisively and internationally on the delivery of global governance solutions. Such political will towards joint solutions was not given, particularly with regard to the difficulties of upholding multilateral decision-making and attempts at global governance within the post-crisis years, and needed careful negotiation and management of the boundaries of global and local sovereignty over the definition of socially desirable innovation and the means for its attainment. Not only the perceived deficits but also their envisioned resolution, could only be produced "in a certain way" as one of my interlocutors at the OECD described above.

The co-construction of deficits and solutions within the OECD's innovation environment was only legitimate if seen from an unbiased "view from nowhere", which included non-interference with normative commitments and controversies located at the national or cultural level, and a concentration of deliberation efforts on the instrumental role of governance instruments and frameworks pertaining to policymaking rather than to politics. As reasoning by the BNCT could not rest on the OECD's politics of numbers and quantitative representation, such view was particularly important to gain credibility within the organization as well as across its member-states, and to make the Recommendation legitimate within the OECD's set of *soft law* instruments. Which issues could be elevated to the global, and which delegated to the national level depended on the framing and delineation of particular aspects of innovation and its relationship with society, or, to stay with the "view from nowhere", on particular ways of seeing different levels of this relationship across global and local settings.

"Frameworks" for the inclusion of societal demand in innovation policy indeed worked for the BNCT to frame innovation as an important instrument to solve social and particularly health challenges, which could also be depicted as a solution to economic demand uncertainties, as well as to frame public engagement for the orientation of innovation processes and governance towards social needs, which could also be made credible as a suitable instrument for reaching the acceptance of innovation by society. That frameworks such as "Responsible Innovation" could be constructed as rational policy guidance rather than normative or political intervention by the OECD was enabled through boundary work around values, ethics, or culture vis-à-vis innovation placed beyond OECD's policy mandate and located within national particularities not to be touched by harmonization efforts. Such a way of ordering "policy implications" at the global level, and "values" or "norms" at the national or cultural level, helped to purify the process and eventual agreement on a Recommendation from the politics and interests that the boundary work around global/local, and values/policy achieved to settle.

Yet, the emphasis on soft governance instruments and "best practices" found in the "Recommendation for Responsible Innovation in Neurotechnology" should not distract attention from the political dimensions of "new governance" strategies proclaimed by the OECD as a response to a crisis of globalization. The production of international *soft law* for Responsible Innovation stabilized the organization's place in the global order through delineating boundaries between the OECD's technocratic "assistance" [1093] function in international relations and its member states' political and normative agendas, including what counts as Responsible Innovation. The Recommendation not only reified deficits diagnosed in the innovation governance of member states in foreseeing and tackling controversies around emerging neurotechnology; it also positioned the organization as the conductor for a "concerted action across governmental levels and across the public and private sectors"[1094], and hence as an important provider of solutions to such deficits in the form of shared yet politically neutral instruments. It legitimized the OECD in moving epistemic authority over Responsible Innovation policy and practice firmly into the international arena, elevating questions of comparability, compatibility, and harmonization over more localized forms of public reasoning and governance of emerging technologies. Such legitimacy rested on processes of purifying society, norms, and values from politics, which allowed to present the inclusion of society as key for socially desirable innovation and inclusive global economic growth.

The harmonization of Responsible Innovation on a global scale hence implied a significant re-ordering of innovation-society relationships – including what (good) innovation and a (good) democratic society look like, with the latter receiving innovation benevolently and allowing itself to be enrolled as an active contributor to it through processes of participation. Responsible Innovation not only permitted

[1093] OECD, 'Recommendation of the Council on Responsible Innovation in Neurotechnology, OECD/LEGAL/0457'.
[1094] OECD.

re-constituting innovation as a global social desire, but also legitimated the shift of national public policy towards innovation as source and goal of achieving the public good, as well as the framing of innovative businesses and markets as vital actors in catering to social values and needs through the provision of innovation. The claiming of epistemic authority over responsibility with regard to innovation by the OECD thus has considerable political implications. By intervening in policy discourses over socially desirable innovation in global governance, the BNCT located both the power to correctly diagnose problems and enact solutions within the OECD, whereby its mandate was significantly expanded. As constructivist scholars of international relations have argued, such an expansion of areas of expertise for global governance always also entails "creating particular kinds of states with particular kinds of interests"[1095] – in this case, democratic states with an interest in liberalized global markets and social welfare attainable through Responsible Innovation. We might want to add to their argument that the *soft constitution* represented by the "Recommendation on Responsible Innovation in Neurotechnology" also created particular kinds of citizens with particular kinds of interests (innovation) and agency (of shaping it towards globally desirable ends), as well as particular kinds of markets with a distinctive interest in the social demand and acceptability of innovative products. The OECD's efforts in bringing about harmonized principles and instruments across member-states and beyond are hence not only constitutive for calling states, citizens, and markets into being vis-à-vis innovation imperatives that emphasize the collective good attainable through technoscientific change, but also for constituting what the right relationship among those constituents ought to look like in a globalized world. In the same process, the OECD, becomes an arbitrator of right modes of social deliberation and appraisal of techno-scientific change, adding to its power of "epistemic jurisdiction"[1096] through calculations of the global economy the authority of "normative jurisdiction" through knowledge on and instruments for "Responsible Innovation".

The co-production socially desirable innovation through soft law

These three case studies showcase the often challenging, yet constitutive role of *soft law* bodies and texts in science and technology governance, as well as the various elements that are co-produced by their performances and modes of reasoning. While processes of ordering the relationship between (neuro)innovation and society settle desirable forms and objects of reasoning for society, such as ethical or participatory deliberation around 'cognitive enhancement' or 'dual use' technologies, they also produce the very subjects and types of governance to rule on new knowledge and technologies, their propositions of socio-technical order, and visions of desirable social progress. In modern states such as the US, supranational administrations like the EU, or global think-tanks as the OECD, the legitimacy of

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[1095] Barnett and Finnemore, *Rules for the World*, 164.

[1096] Winickoff and Mondou suggest that "epistemic jurisdiction" represents the "formal power to produce or warrant technical knowledge for a given political community, topical arena, or geographical territory" David E Winickoff and Matthieu Mondou, 'The Problem of Epistemic Jurisdiction in Global Governance: The Case of Sustainability Standards for Biofuels', *Social Studies of Science* 47, no. 1 (2017): 25.

these orders is and, indeed, necessarily needs to be, sustained by the performance of liberal democratic fictions of inclusive self-government by the people in whose name the reform of knowledge and norms through *soft law* is executed[1097]. As one of the first formal Constitutions famously begins in the voice of "We the People", so do the three *soft constitutions* reviewed here mobilize and speak, even if in quite disparate ways, for the general will of citizens to protect and provide innovation as a common good. Mediated by representatives with expertise on "Neuroethics" in the US, performed by citizens themselves in acts of direct participation in the EU, and negotiated among the delegates and bureaucrats of global market economies at the OECD, citizens and their willingness to enact shared normative frameworks for the governance of innovation figure as constitutive elements for generating legitimacy in the construction of public sovereignty over neurotechnological innovation. In other words, by calling into being different forms of reasoning, participation, and representation in innovation governance, *soft constitutions* frame and define the contracts on socio-technical change to which citizens and their representatives submit themselves in performative acts of self-rule.

The social contracts crafted in the three cases hence also call into being the very identities of the State, Union, and International Organizations authorized to reason and rule on innovation in the name of various publics. When President Obama announced the US BRAIN initiative in 2013, for instance, he framed the joints of America's pluralistic political culture as one of relentless technoscientific discovery: "that's what the American story is about. That's who we are"[1098]. But while in the US, the politics of producing collective identity around innovation rely on a pluralist, yet relatively steady State codified through a written Constitution, the performance and enactment of "who we are" is less straightforward in the supranational and global entities such as Europe or the OECD and its member states. It is in part because of these weaker identities that the latter institutions in particular must rely on *soft law* to co-produce their imagined publics. As I will discuss in a moment, the relatively weak democratic constructs represented by the EU and the OECD both mobilize frameworks for a better alignment of innovation and society in times of severe crisis of their *raison d'être*, allowing them to significantly consolidate and expand domains of jurisdiction, and to re-envision their identity and role as inclusive, participatory, and public institutions catering to social welfare and economic prosperity. Grounded first and foremost in projects of market harmonization believed to eventually solidify unions of shared political interest, the EU's and OECD's *soft constitutions* are shaped by the opposite imaginary, in which the production of collective reasoning and norms is framed as indispensable ingredient of economic growth achievable through public investments in innovation. The drafting of *soft constitutions* in these examples serves to present policies and politics for neuro-innovation as effectively catering to the public good beyond market goods alone; commitments to the provision and protection of innovation in neurotechnology as common good, in turn, establish "the very sense of a 'we' living together, and also, however embryonically, of *political* community, of doing a range of

[1097] Ezrahi, *Imagined Democracies: Necessary Political Fictions*.
[1098] The White House, *President Obama Speaks on the BRAIN Initiative and American Innovation*.

things together in common cause and concern".[1099]

Whereas across all three settings, the role of science and technology policy was framed in the past as one of facilitating technology-based economic growth produced between public investments in science on the one hand, and rational markets on the other[1100], the 'soft turn' in policymaking supports the re-configuration of the state, the Union, and the global community as direct investors and enablers, and thus also *soft* regulators, of innovation for the public benefit. Throughout the second half of the 20th century, a social contract with science had imagined a "simple bargain" between governments and science, in which public investments in basic research "would produce a steady flow of technically trained personnel and discoveries to advance (…) health, prosperity, and welfare"[1101]. The crisis years of the early 21st century turned such logic upside down, presenting health, social prosperity, and welfare as the central driver of technoscientific discovery, and the public and its desires as major source and goal of innovation policy, and with it, of economic development *and* social progress[1102]. Declarations of an imperative to enable innovation through public actors and institutions rather than private sectors and markets could not rely on narratives of the infamous 'invisible hand' of the economy for the governance of innovation, or on the 'regulatory State' as external control of the market and its failures[1103], since the governance of the public-private partnership envisioned by such imperatives draws on a collaborative relationship between the state and the market for the co-creation of socially desirable innovation. As an explanation of the reasons why *soft law* became such a constitutive instrument in the co-production of order around emerging technoscience, then, we can note how its reconciliation of the market with the public interest opens open up novel imaginations of social regulation simultaneously responsive to the norms and values of the economy and of society.

The new function of public institutions in the production of innovation reverberates in recent calls for a new approach to the role of the State in innovation policy, which have particularly proliferated since the 2008 economic and financial crisis. As the meltdown of global capital markets brought the Keynesian interventionist State back to assume responsibility for the failures of *laissez-faire* free market ideology, innovation became "a framing device – a diagnostic lens – through which [public policy] frame[d] policy problems as problems of innovation"[1104]. Even so, the emergence of a public innovation imperative did not result in a tough(er) regulation of market activity, but instead in the re-positioning of the state as positive facilitator guiding such activity strategically towards the public benefit. For instance, economist of innovation Mariana Mazzucato argued in 2011 that "[the State] is a leading agent in

1099 Neil Walker, 'The European Public Good and European Public Goods', SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, 15 October 2020).
1100 See Pfotenhauer and Juhl, 'Innovation and the Political State: Beyond the Facilitation of Technologies and Markets'.
1101 Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States,* 225.
1102 Frahm, Doezema, and Pfotenhauer, 'Fixing Technology with Society'.
1103 See Majone's seminal article Giandomenico Majone, 'From the Positive to the Regulatory State: Causes and Consequences of Changes in the Mode of Governance', *Journal of Public Policy* 17, no. 2 (1997): 139–67."
1104 Pfotenhauer, Juhl, and Aarden, 'Challenging the "Deficit Model" of Innovation: Framing Policy Issues under the Innovation Imperative', 896.

achieving the type of innovative breakthroughs that allow companies, and economies, to grow, not just by creating the 'conditions' of innovation. Rather the state can proactively create strategy around a new high growth area before the potential is understood by the business community…in this sense, it plays an important entrepreneurial role"[1105].

The role of *soft law* is a key element within this turn, as in the course of settling public entrepreneurial agency in innovation, soft forms of technoscientific regulation also constitute innovation in itself as a value for and of individuals and collectives. As Roberto Viola, Director General of Communications, Content, and Technology described the EU's efforts in the HBP "there is a right demand that Europe and European institutions deliver value to citizens. And clearly, citizens recognize when something delivers value to them…[Through the HBP], we have the possibility to deliver something which is not only an important scientific exercise, but we do a very concrete exercise to improve the quality of life of our citizens."[1106] His statement reminds us that innovation has no intrinsic *a priori* value for society that can be recognized, managed and delivered at actor's will. Rather, as recent scholarship on the sociology of (e)valuation has argued, recogni*zing* innovation as socially valuable is a process that is "by no means trivial"[1107]. Drawing on the pragmatist writings of John Dewey, these scholars examine moments that qualify the "new" as valuable, and show how the making of innovation as a shared good for society is a performative, spatially and temporally embedded undertaking[1108]. This situated performance of valuation becomes visible through an interactional co-productionist reading of *soft law:* tasked with deliberating and delineating the social values that ought to guide future research, development and governance of innovation, bodies for the production of *soft law* simultaneously define what the value of innovation for society and individuals is. Such a process is indeed not trivial, as techno-scientific innovation, much like anything else claiming novelty beyond the present state of affairs, first raises significant dissonance[1109].

In the vocabulary of SCOT, *soft law* opens and closes the interpretive flexibility around novel artifacts and knowledge[1110] with regard to the meaning they constitute for society and with respect to the values that render society meaningful to innovation. These processes of opening up and closing down[1111] variegated interpretations of innovation depend on the knowledge and frames deemed reasonable and legitimate by different political cultures. The reasoning advanced by the HBP's "Ethics and Society" subproject serves as a case in point: while the over-promising of *in silico* neuroscience's value for European industry by the HBP's leader Henry Markram caused massive protest from scientists

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[1105] Mazzucato, 'The Entrepreneurial State', 18.
[1106] European Parliament Multimedia Centre, *Science and Technology Options Assessment*.
[1107] David Stark and Michael Hutter, 'Pragmatist Perspectives on Valuation', in *Introduction to Moments of Valuation* (Oxford University Press, 2015), 1.
[1108] Stark and Hutter, 5–7.
[1109] Stark and Hutter, 10.
[1110]Wiebe E. Bijker, *Of Bicycles, Bakelites, and Bulbs: Toward a Theory of Sociotechnical Change* (MIT Press, 1997).
[1111] Stirling, '"Opening Up" and "Closing Down": Power, Participation, and Pluralism in the Social Appraisal of Technology'.

that saw no value of such approach for the advancement of knowledge on the brain and for providing cures for its diseases, the "Opinions" drafted by the subproject in collaboration with citizens settled the controversy of what "responsible research and innovation" for the HBP means and what the value of *in silico* neuroscience for society constitutes. In the words of the subproject's work package leader Nikolas Rose: "to take responsibility implies having an understanding of how you can maximize those benefits, what kinds of decisions can you make in the present that might produce benefits in the future?" Closure on these questions in the HBP's "Opinions" was achieved both through powerful rhetorical strategies of boundary work between responsible and irresponsible innovation, as well as by re-definition of the very problem innovation in *in silico* research presents for the HBP's governance (e.g., re-defining politically controversial "dual use research of concern" as "responsible dual use research" of high value to society)[1112]. In this context, the norms and principles suggested by the project's "Opinions" not only closed moments of dissonance in the settlement of value for *in silico* neuro-innovation, but also foreclosed potential controversy around such value in the future (e.g., in the coming into being of a European "Defense Union"). In a single move, these *soft constitutions* resolve what the issues and problems with innovation in society will be, how adequate solutions to such future problems should look, and what the desirable benefits generated by such solutions mean to society today. Such moves are hence deeply oriented toward the future (economic and social) benefits that investments in science and technology in the present might enable.

[1112] Pinch and Bijker's classic text for the STS toolkit describes two forms of closure and stabilization in moments of technological controversy: rhetorical closure and closure by re-definition of the problem. Relevant to understand in this regard is not if the problems underlying the controversy at hand have actually been solved, but "whether the relevant social groups *see* the problem as being solved." In: Pinch and Bijker, 'The Social Construction of Facts and Artefacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other'.

9.2 Fueling the Constitutional Imagination through Soft Law

While the drafting of *soft constitutions* in innovation governance has consequential effects on contemporary political practice, particularly with respect to how the "softness" of their nature is made credible vis-á-vis the "hardness" of the law, a key element of their legitimacy is the crafting of imaginations of desirable socio-technical futures. Throughout my case studies, we can see significant shifts in the logics that underwrite the reasoning of public institutions with regard to science and technology and their role in achieving future benefits for societies and individuals. As the framing of innovation as all-embracing panacea to social or economic problems caused major challenges to the legitimacy of public institutions in all of the contexts analyzed here, we can observe how a new logic emerged through the imaginative work of *soft constitutions*, in which rationales for the solution of socio-economic problems were re-configured in substantial ways. Rather than relying on "deficit models of innovation" in science and technology governance as "powerful justification and organizing principle for major institutional and policy interventions"[1113], public reasoning through *soft law* enables quite a different way of intervening in the governance of innovation and society. Whereas models geared toward the future problems caused by a lack of attention and investments to innovation are working through a deterministic imaginary of "technological fixes"[1114] – i.e., a framing of technology as driver of social progress –, the futures constructed in my case studies mobilize a logic of "social fixes" for the potential problems and risks caused by innovation to societies in the future – i.e. a framing of society as driver of technological progress[1115]. Here, deficits in attention towards and inclusion of societal norms, values, and needs in contemporary science and technology policy are portrayed as risking futures where innovation can deliver its envisioned benefits to society. In this sense, *soft constitutions* oscillate between the hubris of technoscience[1116] and the hubris of democratic power.

To construct such logic, bodies for the production of soft rules go well beyond the framing of positive opportunities and capabilities that innovation can deliver to society, and delineate, next to desirable utopias attainable through techno-scientific innovation, also the undesirable dystopias[1117] ahead of societies if norms and ethical principles for innovation are not set "upstream" in the governance of innovation. Boundaries between the utopias and dystopias of futures shaped by neurotechnologies are carefully ordered in the work of the Presidential Commission for Bioethics, HBP's public engagement exercises, and the OECD's deliberations around shared norms for the advancement of responsible innovation, as the projection of such orders has significant ramifications for political action on neurotechnological innovation in the present: an overt focus on dystopian scenarios could bring the

[1113] Pfotenhauer, Juhl, and Aarden, 'Challenging the "Deficit Model" of Innovation: Framing Policy Issues under the Innovation Imperative', 903.
[1114] Rudi Volti, *Cars and Culture: The Life Story of a Technology* (JHU Press, 2006); Sally Wyatt, 'Technological Determinism Is Dead; Long Live Technological Determinism', in *Handbook of Science and Technology Studies*, 2008, 165–80.
[1115] Frahm, Doezema, and Pfotenhauer, 'Fixing Technology with Society'.
[1116] Scott, *Seeing like a State*; Jasanoff, 'Technologies of Humility', 1 September 2003.
[1117]Jasanoff, 'Future Imperfect: Science, Technology, and the Imaginations of Modernity'.

public enthusiasm built around neuro-innovation to a halt and stifle investments in research and the development of new neurotech-markets; the construction of all-too optimistic visions of neurotechnologies' impact on society, in turn, could de-legitimize the settlement of *soft law* for the attainment of desirable socio-technical futures. The Presidential Commission's discussion of potential "dolly moments" arising with new technologies for brain enhancement in the future, for instance, manifests these delicate politics when co-chair James Wagner warns the group not to engage in too pessimistic appraisals of large-scale application of neural modifiers in society by arguing that such speculations could result in a "precautionary approach" to neuroscientific research in the present. His suggestion to instead concentrate deliberations on the "rich conversation" of "ethically informed future uses" of brain enhancement technologies is manifested throughout the Commission's recommendations which encourage further research and innovation in the area as well as society-wide access to neural enhancement as a means to "close gaps in opportunity…such as educational attainment or employment". The group's reasoning on desirable neuro-enhancement notably shifted attention on the looming prospects of a technologically stratified neuro-society to a vision of reaching a more just, fair, and equal society through the present-day "ethical" advancement of neuroscience- and technology. In this context, soft principles for innovation in neurotechnology gain the power to propose desirable socio-technical futures – such as the desirability of a society with cognitively augmented individuals – *because* ethical principles of justice and fairness have been incorporated into contemporary governance in advance.

In the course of balancing the fine line between an imperative to innovate and an imperative to socially regulate the possible risks caused by innovation in the future, bodies for the production of soft norms both challenge and stabilize existing imaginaries that "encode not only visions of what is attainable through science and technology but also how life ought, or ought not, to be lived"[1118]. The notion of "socio-technical vanguards" proposed by Hilgartner (see chapter 3) helps us to better understand their productive role for the (de)stabilization of shared imaginations of desirable futures. Whereas Hilgartner's vanguards try to embed their revolutionary technoscientific visions within wider imaginations of collective identity and shared good (such as "America the innovator"), the "Neureothics" or "RRI" vanguards in my case studies aim to achieve credibility for their visions of desirable innovation through embedding their reasoning within larger frames of legitimate democracy. Constituted by similarly small groups of experts and publics at the frontline of knowledge generation on the normative dimensions of emerging science and technology, they too envision a sort of revolution – not of scientific or technological kind, but of social and normative nature (e.g., an "ethicalization" of innovation). These vanguards do not necessarily form coalitions with imaginations of the future attainable through science and technology but with shared visions of "good" democracy of the political cultures in which new norms, values and processes for the governance of innovation in society are proposed (such as "America the liberal democracy").

The *soft constitutions* crafted in my case studies might hence be thought of as productive device

[1118] Jasanoff, 4.

for stabilizing visions of legitimate governmental order and social contract that aim to "become constitutive of political reality."[1119] Described by public law scholar Martin Loughlin as "the manner in which constitutions can harness the power of narrative, symbol, ritual and myth to project an account of political existence in ways that shape – and re-shape – political reality[1120]", the notion of *constitutional imagination* draws attention to the performative and fictitious character of 'capital c' Constitutions that modern democracies have settled to regulate their relations, and particularly those between citizens and their governments. Loughlin suggests that the "idea of collective self-representation is at the core of the constitutional imagination"[1121], in that it conveys a sense of governance of, by, and for the people that is key for modern democracies and their sense of legitimate social order. As Yaron Ezrahi explained in his work on "imagined democracies", the figure of self-government and -representation, is one of the most powerful forms for regulating the contemporary performance of democratic government[1122]. In both Ezrahi's and Loughlin's accounts, our practice of democracy is inherently shaped by the political fiction of popular sovereignty we have inherited from social-contract thinkers since the Enlightenment, such as Kant, Rousseau, or Locke (to which we might add more recent proposals such as those of a Habermas or Rawls), including their conception of agency (e.g., citizenship) and legitimacy (e.g., democratic procedures and institutions) in the formation of the Leviathan[1123]. The *soft constitutions* I have described here are critical instruments for the re-imagination of this political fiction vis-à-vis the fictions proclaimed by innovation imperatives. This form of imagination is directed at the future utopias and dystopias that innovation could bring about but its function is to contain a sense of social sovereignty in the present over the regulation of innovation's uncertain pathways in the future.

In conclusion and re-capitulation of the points raised so far in this chapter, I would like to put forth the following proposition: The primary role, function, and effect of *soft law* in the contemporary governance of innovation is to fuel such *constitutional imagination* of collectives, and hence their sense of democratic sovereignty, with respect to techno-scientific change. My turn to the imaginative nature of *soft constitutions* pays tribute to the socially constructed nature of *soft constitutions* that I have attempted to show in the review of my case studies, both with respect to their normative claims about innovation's future value for society, as well as with regard to the co-production of order around society's values for the governance of innovation in the present. A reading of *soft law* as performative, political, and powerful form of social imagination eventually aides me in underlining the constitutional dimensions sorted out by *soft constitutions* in innovation governance. They revolve around the basic questions settled by constitutional texts for the production of legitimate social regulation in liberal democracies:

[1119] Martin Loughlin, 'The Constitutional Imagination', *The Modern Law Review* 78, no. 1 (2015): 12.
[1120] Loughlin, 3.
[1121]Loughlin, 11.
[1122] Ezrahi, *Imagined Democracies: Necessary Political Fictions*., Introduction
[1123] Ezrahi, 1.

(1) Objects and forms of reasoning:
What should be regulated? Through which forms of reasoning is such regulation legitimized?

(2) Subjects and types of government:
Who gives authority to regulate? Who has authority to regulate?

(3) Checks and balances:
How is power distributed across society and how is it controlled?

And, in summary of the foregoing questions,

(4) Constitutional imaginary:
Which vision of democracy is being proposed?

These categories allow us to capture part of the "grammar" of the dialectic of *soft constitutions*[1124], which can be traced back to foundational strands of social theory and imagination that have historically fueled constitutional debates. These include ideas of liberalism, republicanism, and social contract theory advanced by philosophers, sociologists, and policymakers over time. They compromise the political philosophies proposed before and since the great revolutions of the 18th century, as well as more recent propositions for an "ethicalization" and "democratization" of science and technology in the 20st century. Rooted in the North-Western hemisphere, our cases share a broad commitment to liberal democracy, even if such commitments are interpreted quite differently across each imaginary. In short, we have to trace the constitutional imagination on neuro-innovation back to those moments, ideas, and texts that have been constitutive for imagining how and why liberal societies ought to organize themselves in democratic ways, as well as how science and technology should be governed in conjunction with such liberal democratic orders.

To be sure, 'capital C' Constitutions may extend way beyond answering these questions alone, and by no means do I aim to give a reductive account of them through my arguments. What I can and will show in the following pages, however, is how the 'small c' constitutions proposed by *soft law* for innovation governance can be read through taking these questions as analytic and interpretive heuristic point of departure. Although they too are reductive in scope and can be criticized of generating only ideal-type descriptions of the complex nature of *soft constitutionalism* in innovation governance, I find them helpful for reading *soft law* as a powerful remedy for the resurrection of the constitutional imagination in liberal societies more generally, and in particular for comparing how political cultures differ in the construction of such remedy for the present governance of innovation and society (see Fig. 3). The next part of this chapter illustrates their heuristic potential for carving out the diverging constitutional imaginations of the US, EU, and OECD with regard to innovation in neuroscience-and technology and its relationship to democratic order.

[1124] Kenneth Burke, *A Grammar of Motives* (University of California Press, 1969), pt. 3.

Elements of soft constitutionalism	US	EU	OECD
Objects of reasoning	Individual good	Collective good	Global good
Forms of reasoning and legitimation	Bio- and Neuroethics;	Public Engagement, Responsible Research and Innovation;	Inclusive, Responsible Innovation
Subjects	(Neurochemical) rational selves	(Epigenetic) humanist society	(Nation-states and their citizens in) the world economy
Types of government	Representative democracy	Deliberative democracy	Free market democracy
Checks & Balances	Purification of scientific / normative expertise	Cross-contamination of lay knowledge / scientific expertise	Orchestration of socio-economic expertise
Constitutional Imaginary	Liberal; *Individualization* of governance	Republican; *Collectivization* of governance	Liberal-republican; *Harmonization* of governance

Figure 3: Regimes of soft constitutionalism on neuro-innovation in the US, EU, and OECD

The Constitutional Imagination of Neuroethics in the US: A Constitution of Liberty[1125]

It may be no surprise that I locate the origins of the constitutional imagination on neuro-innovation in the US in the tradition of political liberalism first formulated in the "Two Treatises of Government" by British philosopher John Locke. His ideas on the natural rights of human beings to life, liberty, and private property have not only shaped the minds of the founding fathers of the American republic when beginning the Declaration of Independence with the well-known assertion that men possess the unalienable rights to "life, liberty and the pursuit of happiness". Locke's political philosophy also lives on in much less visible moments of American politics, such as recent accounts of human nature and natural laws crafted by neuroscience and Neuroethics as part of the BRAIN initiative. On the one hand, the *soft constitutions* drafted by the PCSBI and the NEWG rely on the ideas of this 17th century thinker regarding the nature of human beings, where it can be found, and how it can be best regulated; on the other hand, they are also invested, even if in slightly attenuated form, in Locke's ideas on the legitimacy of civil government. Let me start with the former and then continue on to the latter.

[1125] This heading is, of course, copied from one of the texts most forcefully defending liberalism, F. A. Hayek, *The Constitution of Liberty: The Definitive Edition* (Routledge, 2020).

As we have learned in the US case study, the proliferation of Neuroethics as specialized branch of Bioethics in the US has been justified on the grounds of "the moral significance of the human brain" as that organ giving rise to humans' sense of "personhood, rational agency, personal identity, and personal interactions – all of which are crucial for grounding our everyday moral judgements of ourselves and others."[1126] Neuroethicists, we have seen, were quite explicit in their faithfulness to the ideas of Locke that men are rational creatures, and that it is the possession of reason(ability) that makes them be born naturally free: "the freedom of man, and liberty of acting according to his own will, is grounded on his having reason", Locke argues in the second Essay of his Treatise, a reason "which is able to instruct him in that law he is to govern himself by, and make him know how far he is left to the freedom of his own will." Reason, or rationality, in the account of Locke and that of Neuroethics, is hence what turns human beings into subjects of their own laws, i.e., it is the possession of reason that gives individuals the ability to govern themselves. The liberal conception of neurochemical, rational selves that neuroscience advanced as counter-proposition to the genetic selves and that had been the subjects of genetics and Bioethics (i.e., bioconstitutional) regimes, was taken as plain fact in the deliberations and recommendations of the NEWG on how to govern innovation in neuroscience in ethical ways. Through this adherence to human rationality found by science in the brain, in the neuroethical imagination, the virtue of individuals to take decisions independently and with the use of reason worked as an ontological entry point for the justification of the normative regulation of neuroscience and -technology in the future. Rational subjects hereby became a key figure to imagine legitimate forms of governance over the potential problems caused by innovation in neuroscience and -technology, both scientists and engineers themselves as well as the imagined beneficiaries of neuroscientific knowledge and technologies.

If we owe to Locke and other early philosophers of liberal government the idea that people are born naturally reasonable, Locke has exerted corollary influence in establishing within the American political imagination that men are born free and that any form of law must respect this natural liberty and intervene in it as little as possible. The struggle for American independence worked like an amplifier for those ideals, declared by revolutionaries as the new common sense that ought to guide America into its freedom: "Government even in its best state is but a necessary evil", Thomas Paine famously proposed in his "Common Sense" pamphlet of 1776 – "we may be as effectually enslaved by the want of laws in America, as by submitting to laws made for us in England"[1127]. And indeed, throughout the evolution of Neuroethics as specialized form of normative expertise, a limited form of government was imagined as legitimate expression of individuals' right to freedom. Neuroscientists ought to follow the moral imperative of generating knowledge on the brain, which should neither be impeded by government intervention through the law nor by a transgression of the boundaries between the authority

[1126] 'The BRAIN Initiative and Neuroethics: Enabling and Enhancing Neuroscience Advances for Society', 22.
[1127] Thomas Paine, *Common Sense. Addressed to the Inhabitants of America* (Newburyport, MA: John Mycall, 1776).

of knowledge and norms by Neuroethics. Neuro-subjects, capable of objective, rational judgement and use of new knowledge and technologies on the brain, can themselves assume responsibility as individual citizens of an ethical application of neurotechnologies in their lives. Self-governance, in this liberal imagination of ethical governance, figures as a legitimate form of government for scientists as well as for those individuals benefiting from the fruits of science. It locates responsibility over ethical judgement and practice firmly in the individual and denies other forms of executing ethical authority at collective levels. In the words of the most liberal of all liberals Friedrich A. Hayek, "responsibility, to be effective, must be individual responsibility", to which he added that "a joint or divided responsibility may create for the individual the necessity of agreeing with others and thereby limit the powers of each…As everybody's property affects nobody's property, so everybody's responsibility is nobody's responsibility."[1128]

Given science and individuals are imagined as capable and free in deciding ethically on innovation by themselves, why is it, one might wonder, that the neuroethical imagination projects an important function for *soft law* in the future governance of neuro-innovation? One possible answer to this question is that *soft law* can be seen as an enactment of self-governance (i.e., as a law not ordained by higher authorities such as the federal government or court judges), which represents one of the interpretations of "ethics" that we can find prominently in the US case study and that is shared by many advocates of *soft law* in innovation policy (see chapter 2). Another answer to this question can be found in the liberal imaginary of a state of nature into which free and rational individuals are born in (a pre-political) state, which, according to Locke, was "full of fears and continual dangers" that threatened the enjoyment of natural rights, rights which would be "constantly exposed to the intervention of others". People, in this imaginary, unite in a society and give themselves laws "for the mutual preservation of their lives, liberties and property", and hence for ensuring justice and equity in the exertion of their natural rights to freedom and rational will. To remain free and self-governing, that is, people need to agree that these universal rights are enjoyed by everyone in a society, and then need to consent to a government to exercise authority in the protection of those rights through a constitution. Justice and equity in the free enjoyment of one's natural rights become the public value that individuals agree to protect through civil government in their move out of the state of nature. Or, as Charles Taylor has put it, "the theory starts with individuals, whom political society must serve…this service is defined in terms of the defense of individual's rights."[1129] The same can be said of the reasoning proposed by Neuroethics: it starts with individuals and a concern for their rational agency (sitting in the brain), whom *soft law* must serve; it must, moreover, protect every individual in the right to freedom of his faculties.

Such right is natural to individuals and should be enjoyed with the greatest possible freedom as Locke would argue, yet he also asserted that the virtue of liberty needs to be nurtured and formed from the onset so that individual liberties do not conflict with each other. Rather than intervention in

[1128] Hayek, *The Constitution of Liberty*, 83.
[1129] Taylor, *Modern Social Imaginaries*, 20–21.

individual freedom through government, Locke imagined that individuals needed to be educated early on in cultivating respect for their reasonability and liberty, i.e. being born free and rational in his account does not mean "that we have actually the exercise of either: age, that brings one, bring with it the other too"[1130]. The Presidential Commission's and Neuroethics Working Group's overt focus on ethics education reiterates such views – here, individuals are not imagined to be educated by their parents until reaching a certain age, but through ethical and scientific expertise particular to knowledge and technologies on the brain. Only when individuals have received the knowledge and education necessary for making ethically informed choices on innovation are they perceived as legitimate self-governors in its application.

In this sense, the role of ethics experts in the governance of neuro-innovation is framed similarly to liberal conceptions of parenthood when granting them a certain degree of authority over defining what morally reasonable use of innovation is and educating individuals accordingly. Yet, it grants the state, rather than the parent, a significant function to cultivate ingenuity and ethics vis-á-vis innovation in the individual via Bio- or Neuroethics. One of the first books by Amy Guttman, the Presidential Commission's chair and viral proponent of deliberative forms of liberal democracy delineated such an imagination of shared authority in educating individuals decades before the drafting of the "Gray Matters" volumes by the Commission: "a state makes choice possible by teaching its future citizens respect for opposing points of view and ways of life.", she argued in 1999, "it makes choice meaningful by equipping children with the intellectual skills necessary to evaluate ways of life different from that of their parents"[1131]. The uptake of these views in the Commission's work on neuro-innovation is reminiscent of governance models that understand public deficient of knowledge deemed necessary to assess and evaluate science and technology, which has been often criticized as imagining a one-way, top-down form of governance that neglects the agency of individuals to meaningfully engage with innovation and policy[1132]. Interestingly, however, the imagination of rightful innovation governance advanced in the US case only departs from such public deficit models to then grant individuals full epistemic and normative agency in the course of governing neuro-innovation for the public benefit. Once educated in scientifically and ethically rightful forms of reasoning, individuals form the central agent of the neuroethical imagination in preventing and fixing potential problems that may arise once innovations in neurotechnology are widely in use and accessible to individuals throughout society.

Locke's ideas on the legitimacy of civil government furthermore explain why justice forms such a key element of Neuroethics' constitutional imagination. As the recommendations on enhancement by the PCSBI exemplify, commitments to distributive justice in access to the right to neural modification and augmentation were recommended without difficulty to the BRAIN initiative and the advancement of innovation in neuroscience and -technology in the US more generally (easily because they were

[1130] John Locke, ed., *Second Treatise of Government*, EBook #7370 (Project Gutenber, 2010), 125. §61
[1131] Amy Gutmann, *Democratic Education: Revised Edition* (Princeton University Press, 1999), 31.
[1132] See e.g., Wynne, 'Public Engagement as a Means of Restoring Public Trust in Science – Hitting the Notes, but Missing the Music?'

already part of the wider constitutional imaginary I am trying to delineate here). I have argued, in this example, that the norm of justice proposed by the Commission recall what liberal political philosopher John Rawls has imagined as a "well-ordered society" in 1971 – a society advancing the good of its members through adherence to "a public conception of justice" with an ideal of equality rooted in individual liberty and opportunity[1133]. The framing of innovation in neural enhancement as desirable avenue to individual freedom, paired with Neuroethics' norm of justice in access to new technologies, formed a formidable liberal imagination of the desirability of individual cognitive enhancement for the whole of society. It is, as Rawls would agree, not necessarily a utilitarian form of imagining – rather, principles of justice are envisioned by Neuroethics as "the principles that free and rational persons concerned to further their own interests would accept in an initial position of equality as defining the fundamental terms of their association"[1134]. Deliberations around cognitive enhancement in the US were characterized by an adherence to the imaginary of an "initial position of equality", which Rawls has labelled as an "original position" from which groups of individuals should depart when agreeing on the principles of justice to guide their association and cooperation. The original position – an imagined, "purely hypothetical situation"[1135] of absolute equality similar to that of Locke's state of nature – is enabled by individuals reasoning around principles of justice behind a "veil of ignorance", i.e. without any knowledge on their own place, status, property, and conception of the good, and hence with complete objectivity and rationality. Importantly, Rawls did not envision citizens themselves to engage in such a difficult act of ignorance but representatives of citizens to reason from an original position on their behalf[1136].

As we have seen in the US case study, discussions on cognitive enhancement by the Presidential Commission performed this objective gaze in convincing ways, for instance through naturalizing technologies for the modification of brain functioning or through the strategic focus on the ethical use of technologies instead of the ethics of enhancement technologies themselves. Members of the PCSBI as well as the NEWG mobilized the "veil of ignorance" to strengthen their ethical claims vis-á-vis the objectivity of science and the undisputed good of neuro-innovation, as becomes visible, for instance, in PCSBI's co-chair James Wagner's insistence on the role of Bioethics to refrain from judgements about the (im)morality of pursuing neuroscience research. Such construction of a-political reasoning, in turn, made the articulation of soft normative principles such as justice possible and hence granted ethics significant authority in defining what ethically sound neuro-innovation is and how it ought be governed in ethically reasonable ways. Put differently, ethics assumed the role of representing the interest of individuals through the performance of neutrality with respect to the pluralism of ethical standpoints on

[1133] Rawls, *A Theory of Justice*, 4.; Hurlbut has made an inspiring observation for these arguments in '*Experiments in Democracy'*.
[1134] Rawls, 10.
[1135] Rawls, 11.
[1136] Neither did he see philosophical experts as those best situated to represent the interest of citizens ("heaven forbid!") but as citizens among others in generating principles of justice (Rawls, 174.)

matters as contentious as the desirability of cognitive enhancement. This also helped to fashion Neuroethics recommendations and principles not as a hard instrument for regulating individual freedom and behavior but as a soft form of governance able to accommodate plural individual preferences and interests.

Beyond granting Neuroethics the authority to reason on behalf, educate, and softly govern individuals in their moral reasoning on neuro-innovation, the neuroethical imagination assigns a critical role to the self-regulatory capacities of science to produce knowledge and technologies in the interest of society. In light of the liberal imaginations of legitimate social regulation we have just discussed, both in terms of why such regulation is necessary and how such authority should be executed, we can begin to understand why the Neuroethics Group as well as the Bioethics Commission in the US gave so much power to scientists themselves in controlling the normative pathways of neuro-innovation. What seems to be a rather abstract imaginary of a more than 200-year old philosophy proposing liberalism as form of regulating freedom finds great reverb in the modern American commitment to ideals of a "republic of science", in which rational scientists are believed to produce reason most effectively in the interest of society when left free in the pursuit of knowledge, a freedom which needs, however, to be regulated by the mutual adjustment of scientific opinion.

Proposed by the scientific polyglot Michael Polanyi in 1962, the "republic of science" is one where "the authority of scientific opinion remains essentially mutual; it is established *between* scientists, not above them. Scientists exercise their authority over each other."[1137] This idea of scientific self-governance not only continued squarely liberal traditions of social-contract thinking, it also linked to the imagination of science as governed by its own, invisible hand towards the public good. Neuroethicists indeed had a difficult time in framing an appropriate relationship with the American imagination of a republic of science and its legitimacy in democratic culture, as neuroscientists and BRAIN initiative leaders were keen on safeguarding the freedom of science and presenting it as capable of effective self-regulation in the interest of society.

I have characterized the vision that settled the disputes among scientists and ethicists earlier as one of co-regulation between science and ethics, in which science produces reasonable facts, and ethics the moral vocabulary to make public sense of emerging neurotechnologies. The tedious work of separating or "purifying" these two domains of social regulation has been documented in the US chapter and should not distract us here. Relevant for the present purposes is to understand how epistemic and normative power is imagined to be distributed among science and ethics in similar ways as a Constitution imagines the separation of powers between branches of liberal government: the drawing of boundaries between science and ethics simultaneously enacts a vision of checks and balances in which ethics is allowed to enter the republic of science as neutral advisor and in which science is authorized to set the epistemic boundaries of ethical reason. As argued by the Neuroethics Working Group's chair

[1137] Michael Polanyi, John Ziman, and Steve Fuller, 'The Republic of Science: Its Political and Economic Theory', *Minerva* 38, no. 1 (2000): 60. Their emphasis.

Hank Greely, neuroethics should be thought about as “friends, not foes” and as “helpers, not drags” in advancing knowledge on and technologies for the brain rather than as a transgressor of science’s undisputed boundaries.

What do all of these elements of the constitutional imagination of neuroethics tell us about how the public good of neuro-innovation is constructed in the US through the development of *soft law*? Commitments to liberal conceptions of individual responsibility and governance such as those advanced by neuroethics with regard to the ethical development and application of neurotechnologies are co-produced by an inherently value-neutral understanding and framing of innovation. Innovation, as the PCSBI underlined with regard to neural enhancement, is not “inherently ethical or unethical”, but the individual development, use and application of innovation can be assessed on normative grounds. Put differently, the *individualization* of governance proposed by neuroethics rests on and further supports “America’s historical record of seeing technology as an instrument of progress and nature as ripe for appropriation through human ingenuity”[1138] in which science, technology and norms are strictly separated within the production of public reason. It situates processes of an ethical valorization of neuro-innovation squarely in the individual’s capacity of rational technology appraisal (i.e. in the ethics expert, educated lay person, or inventive genius or scientist), through which the values stipulated by neuroscience and -technology itself (e.g., the moral imperative of advancing knowledge on the brain as well as brain functionality through technologies) are effectively framed as a-political, shared common sense from which individual ethical deliberations are imagined to depart.

This form of disciplining the production and governance of (individual) ethical reason constructs future neuro-innovation as public good meriting significant support in the present by drawing on the soft constitutional imagination of liberalism: rational and free subjects, limited representative government, self-governance through reason and education, justice and equality in the exertion of rights, and a system of checks and balances between the different regulatory powers of ethics and knowledge. Through proposing this liberal vision of democratic order around innovation, the neuroethical imagination pairs American ideals of individual rights and popular sovereignty with the imperative of generating innovation in the public interest. Such order rests on an understanding and framing of America as “the innovator” held dearly by the modern American state, yet it is complemented by the equally powerful and historically grown imagination of American identity as “liberal democracy”. One might even go a step further and argue that the rising attention to the preservation of liberal values through neuroethics vis-á-vis neuro-innovation in the US case aspires to legitimize emerging innovation imperatives through the conjuration of its liberal heritage, or to put it less dramatically, aims to anchor such imperatives within the overall liberal *constitutional imagination* of the US.

[1138] Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*, 278.

A European Republic of Innovation[1139]: The Constitutional Imagination of RRI in the EU

The *soft law* produced for neuro-innovation on the other side of the Atlantic is shaped by a markedly different, if not to say opposite, *constitutional imagination* – one inextricably tied to the difficult and ongoing project of European unification. Rather than envisioning a process of individual self-governance of innovation, the EU's *constitutional imagination* conjures the European collective and its will to jointly regulate innovation towards the benefit of an imaged pan-European public. What Benjamin Constant has famously distinguished as two forms of liberalism available to post-revolutionary France – the "liberties of the moderns" versus the "liberties of the ancients"[1140] – is a useful starting point for understanding how and why European and American reasoning on desirable innovation and its governance diverges in nearly all respects. Constant's comparison of liberal, modern freedoms enjoyed by citizens with that of republican, ancient freedoms served the purpose to advocate a Lockean conception of liberty to the distinguished audience of the Royal Athenum in Paris in 1819: "individual liberty", Constant claimed, "is the true modern liberty"[1141]. It is the true form of freedom because it protects private rights such as freedom of belief or the right to property against arbitrary power by a self-declared sovereign. Republican forms of freedom such as those found in ancient Greece, in turn, focused on the "sharing of social power among the citizens of the same fatherland", a "collective freedom" compatible with "the complete subjection of the individual to the authority of the community", and on sovereignty in public affairs at the expense of the individual, who is made a "slave in all his private relations"[1142].

While Constant found the republican model of democracy oppressive and enslaving, prompting him to draft an exceptionally liberal constitution for Napoleon I in 1815, the EU's turn to "Responsible Research and Innovation" roughly 200 years later echoes republican ideals of government and the "liberty of the ancients" and, with them, the dream of a united European republic. Key components of this ideal were prominently described by French enlightenment thinker Jean-Jacques Rousseau in his "Discourse on the Political Economy" and "The Social Contract", and in newer proposals for deliberative forms of democracy in the late 20th century such as those advanced by the eminent German philosopher Jürgen Habermas. As we have seen in the EU case study, they gained new currency in Brussels particularly due to failed agreement among European member-states on a joint, "capital c" Constitution at the beginning of the 2000s, as well as in response to the looming disintegration of the Union in the years following the 2008 financial crisis. Through fueling the constitutional imagination on "responsible" innovation, the EU re-imagined itself as a democratically legitimate 'superstate' in

[1139] This title, in turn, is inspired by Jasanoff's chapter on "Republics of Science" in Designs on Nature, and aims to catch the turn to innovation occurring since her observations on biotechnology governance in the US, Britain, and Germany at the turn of the century.
[1140] Benjamin Constant, 'The Liberty of Ancients Compared with That of Moderns', Online Library of Liberty, 1819.
[1141] Constant.
[1142] Constant.

which political integration no longer lags behind its successful economic unification[1143], eventually forming the "ever closer union among the peoples of Europe" that the EU's founding fathers envisioned with the Treaty Establishing the European Community in 1957[1144].

The EU's emphasis on collective innovation governance departs, similarly to its American counterpart, from a distinct, socio-historically embedded understanding of the subject affected by and giving rise to desirable neuro-innovation. We have seen how such understanding is closely linked to the EU's RRI agenda in which a European *demos* – a collective rather than individual body – is imagined to emerge from participatory deliberation exercises that supersedes individual national identities and attachments. We can trace this subject back to the first articulations of the RRI framework by STS scholars, such as Stilgoe et al's often-cited proposition that "Responsible innovation means taking care of the future through *collective stewardship* of science and innovation in the present"[1145] that substantially informed the EU's turn to public engagement in research and innovation policy throughout the post-crisis years. But it was already in the "Meeting of Minds" held a decade before the HBP's "Ethics and Society" subproject's commitment to RRI that we could observe how a group of nationally diverse citizens performed a European polity and effectively created a sense of shared identity under the auspices of the EC: "this is the first time Europe has asked my opinion. Today, I feel truly European" one of the participants expressed the meeting's success in building a European public around neuroscience and -technology. The participatory processes mobilized to draft the HBP's "Opinions" too rested on the formation of a shared European will in delineating, for instance, the desirability of dual use neuroscience research and applications.

As the HBP's reasoning on "epigenetic brains" and "proactive epigenesis" reflects, such imagination extended well beyond envisioning a European public directly participating in the governance of innovation. They also include the "culture-bound brain" susceptible to social environments, changing norms and thus collective moral values. What the HBP's philosopher Kathinka Evers proposed in teamwork with neuroscientist Jean-Pierre Changeux as "proactive epigenesis" stands in stark contrast to the rational, individual brain forming the common-sense locus of subjectivity in the American neuroethical imagination. Here, normative individual agency is framed as shaped by neural circuits as well as by its interaction with society, inviting the argument that it can be proactively enhanced through novel educational programs and an "ethical innovation" of society-wide norms.

Consciously or not, the overt focus on public opinion and engagement that permeates the EU's governance of neuro-innovation through *soft law* in particular and the RRI approach more generally has learned a great deal from Rousseau's republican thinking. In his "*Discours sur l'oeconomie politique*" first published in 1755, Rousseau made the famous observation that "if you can create citizens you have

[1143] Arguments of EU's political project lagging behind the economic integration of member state economies can be found, amongst others, in Stefan Collignon's often cited *The European Republic: Reflections on the Political Economy of a Future Constitution* (Federal Trust for Education and Research, 2003).
[1144] 'Treaty Establishing the European Community (Consolidated Version 2002)', 325 OJ C § (2002), http://data.europa.eu/eli/treaty/tec_2002/oj/eng.
[1145] Stilgoe, Owen, and Macnaghten, 'Developing a Framework for Responsible Innovation'. My emphasis.

gained everything, but otherwise all you will have is wretched slaves, beginning with the leaders of the state"[1146]. His account on why the creation of citizens is so crucial for safeguarding freedom arises from the view that private self-interest will sooner or later lead to corruption and misery, impeding individuals to fully exercise their freedoms. Unlike Locke, Rousseau did not believe that people are born only rational, but that they have feelings too, feelings which can be as much a vice as a virtue for others, and they will be virtuous citizens only if individual interests concur with the interests of others. Put bluntly, individual's reason and feelings need to be harmonized to safeguard everyone's freedom. This is the baseline of a legitimate social contract for Rousseau, in which "each of us puts his person and all his power in common under the supreme direction of the general will; and we as a body receive each member as indivisible part of the whole"[1147].

In this social contract, it is individuals who follow only their own interests, while citizens have learned on how to fuse love for oneself (*amour de soi* and *amour propre*) with love for the whole, common good (*pitié)*. This sympathy, or compassion, for the good of the people (that, in Rousseau's times, equaled love for your country) is the central virtue that makes republican order possible. Yet we are neither born naturally with such virtue nor is it "enough to say to citizens: Be good"[1148] in their pursuit and preservation of collective freedom. In a similar move to that of Locke, Rousseau thought that the process of making virtuous citizens "is not the work of a single day" but involves training individuals "early enough to consider their individual selves only in relation to the body of the state, and to see their own existence, so to speak, only as part of its existence"[1149]. It is difficult to oversee the links between such ideas on citizen formation that Rousseau formulated in the midst of the turmoil leading up to the French revolution, and the civic-republican imagination that we have found in the EU's struggles to form a united European people at the height of its potential disintegration. The participatory deliberations around neuro-innovation, at least, could be read as a sort of "machinery for making publics"[1150], disciplining *European citizens* to become *citizens of Europe* through engaging them in the production of a *volonté generale* on innovation in the interest of society as a whole. It is through the formation of such citizens in the present that innovation governance in the future is imagined as socially "robust" in similar ways as Rousseau imagined the robustness of laws to arise from the solid foundation of virtuous citizens: "In the same way as an architect, before constructing a great building, studies and probes the soil to see if it can bear the weight", he contents in "*Du Contrat Social", "*the wise creator of institutions will not begin by drafting laws good in themselves, but will first consider whether the people for whom they are intended is capable of receiving them."[1151]

While Rousseau's thoughts on the citizen and its vital role in the formation of a sovereign will

[1146] Jean-Jaques Rousseau, *Discourse on Political Economy and The Social Contract*, trans. Christopher Betts (Oxford World's Classics, 2009), 22.
[1147] Rousseau, 55.
[1148] Rousseau, 17.
[1149] Rousseau, 22.
[1150] Felt and Fochler, 'Machineries for Making Publics'.
[1151] Rousseau, *Discourse on Political Economy and The Social Contract*, 80.

arguably inspired the French revolutionaries to overthrow the *Ancien Régime*, no revolution would be needed to bring the citizen of Europe into being through the EU's public engagement imperative. An orderly performance of democracy resting on the ability of citizens to overcome their national particularities and culturally entrenched perspectives on innovation, as well as on their willingness to embrace a shared European civic identity and joint *soft law* on neuro-innovation, sufficed to perform self-government of and for the people over the revolutions proposed by the new neurosciences and -technologies.

It is important to note that whereas the constitution of citizens in the EU case resembles early republican ideas of the making of citizens in many ways, the deliberative process performed by the "Meeting of Minds" or the HBP's "Ethics and Society" subproject also diverges from what Rousseau envisioned would be appropriate ways to reach the general will. To be sure, the *performance* of a common European stance on innovation is well in line with Rousseau's imagination of general will formation as a kind of theater, open and accessible to the sight of the people, who are at the same time its performers and its spectators[1152]. Yet, such theater is not where the common interest is debated and deliberated in Rousseau's view, as citizens already know what the general will is and share a desire to make it the rightful ruler over their lives. In Rousseau's thought, citizens have deliberated what the common good is in silence - not in the loud and rhetorically manipulative arena of public deliberation - by listening to their *sentiment intérieur* which will inevitably make them see what the good for everyone in a society is:

> So long as a number of men gathered together consider themselves a single body, they have single will also, which is directed to their common conservation and to the general welfare. All the mechanisms of the state are strong and simple, and its maxims clear and luminous; there is no tangle of contradictory interests; the common good is obvious everywhere, and all that is required to perceive it is good sense.[1153]

Citizens, in other words, do not need to deliberate with each other because they all share the same sense of good, i.e., there are no opposing interests to debate and resolve. Rousseau insisted that the sovereignty of the general will cannot be divided: "a will is either general, or it is not, it is the will of the body of the people, or of a part only"[1154]. We need not go into detail how and why Rousseau conceptualized the procedural aspects of republicanism in such way - for instance because he himself was a citizen of the culturally highly homogenous city-state of Geneva that served as his model republic - but only understand that his general will is imagined as something akin to a "civil religion"[1155], which includes the sanctity of the social contract authored and known by everyone in the republic.

[1152] Taylor, *Modern Social Imaginaries*, 121–22.
[1153] Rousseau, *Discourse on Political Economy and The Social Contract*, 134.
[1154] Rousseau, 64.
[1155] Rousseau, viii; Rousseau, 158. ff

The EU arguably (still) lacks such "civil religion" and shared sense of common good, which is subject to a diversity of forms of reasoning and governing the public interest under the authority of member-states. This deficit of a European *demos* was lamented often enough, and with ever greater voice in the run-up to the referendum on a shared European constitution of the early 2000s believed to transform the EU into a republic: "a *transformative* politics, which would demand that member states not just overcome obstacles for competitiveness but form a common will", two of Europe's arguably greatest contemporary philosophers argued in 2003, "must take recourse to the motives and the attitudes of the *citizens themselves*…The population must so to speak 'build up' their national identities, and add to them a European dimension. What is already a fairly abstract form of civic solidarity, still largely confined to members of nation-states, must be extended to include the European citizens of other nations as well"[1156].

One key aspect of this continued struggle to establish a general European sovereign are the heterogeneous "civic epistemologies" which give rise to European nations' diverging ways of establishing facts and norms around emerging science and technology that Sheila Jasanoff has so eloquently described[1157]. It is no coincidence, then, that the 'capital c' European constitutional referendum ran in parallel to the "Meeting of Minds", showcasing how a harmonization of diverse perspectives on neuro-innovation can effectively be produced. By invoking the spirit of Europe's shared humanist values, the meeting's participants grounded their vision of desirable neuro-innovation in the failed Constitution's imagination of humanism as the secular, civil religion binding European citizens together. And also the EC's later turn to RRI aimed at nothing less than to bring member-states different ways of reasoning on desirable innovation in line. As one of my interlocutors at the EC described the deficit to which such efforts sought remedy, what RRI is "is not a commonly agreed; in the policy discourse people often say that they are doing things for citizens, but it is not necessarily with citizens that they are doing research"[1158]. Such diversity might well serve as explanation for why the *process* of European will-formation on neuro-innovation deviated from Rousseau's imagination of private meditation on the common interest and instead also displays elements of a constitutional imagination of deliberative democracy "born in the daylight of the public sphere"[1159]. Through a deliberative form of democratic innovation governance, national citizens are envisioned to gradually develop a shared reason

[1156] Jurgen Habermas and Jacques Derrida, 'February 15, or What Binds Europeans Together: A Plea for a Common Foreign Policy, Beginning in the Core of Europe', *Constellations* 10, no. 3 (2003): 293.
Despite calls for a European republic found largely missing by Derrida and Habermas, their essay delineated some of the shared elements of a joint European identity: "In European societies, secularization is relatively far advanced. Citizens here regard transgressions of the border between politics and religion with suspicion. Europeans have a relatively large amount of trust in the organizational and steering capacities of the state, while remaining skeptical toward the achievements of markets. They possess a keen sense of the "dialectic of enlightenment"; they have no naïvely optimistic expectations about technological progress. They maintain a preference for the welfare state's guarantees of social security and for regulations on the basis of solidarity. The threshold of tolerance for the use of force against persons lies relatively low.": 295.
[1157] Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States*, chap. 3.
[1158] Interview 28, November 2017
[1159] Habermas and Derrida, 'February 15, or What Binds Europeans Together'.

on what desirable innovation for the citizens of Europe is and how it ought to be governed in their interest (Rousseau's 'civil religion'); participation and deliberation, in this sense, is imagined to socialize citizens into the European republic of innovation.

To better understand the particular deliberative processes that the constitutional imagination of RRI evokes, we need to make a great jump in history to the ideas of German philosopher Jürgen Habermas on "communicative action" and "discourse ethics" presented between the 1970s-90s. Scattered over several papers and manuscripts, of which "Between Facts and Norms: Contributions to a Discourse Theory of Law and Democracy" is a major reference, Habermas criticized both the liberal as well as the republican model, and instead developed a theory trying to reconcile these two traditions of modern political philosophy. Liberalism, in his view, focused too much on the individual subject and their preferences which, similar to a market, would be conceived as, at worst, competing with or, at best, aggregating each other in defense of their rights. Republican ideas, in turn, overtly rest on the homogeneity of perceptions of the public good, which in a world complex as ours, is an impossible *a priori* condition for democratic politics. While both models depart from individual's possession of practical reason prescribing what actors ought to do, Habermas' "communicative reason" is not "ascribed to the individual actor or to a macrosubject at the level of the state or the whole of society"[1160] and claims to be of pragmatic rather than normative nature[1161]. By taking liberal and particularly republican conceptions of will-formation into account, he presents a "third" proceduralist approach that "integrates these in the concept of an ideal procedure for deliberation and decision-making"[1162].

For Habermas, what the common good is and how it should be regulated needs to be deliberated in the public sphere under a set of particular procedures that "*regulate* bargaining from the standpoint of fairness"[1163], i.e., participants are treated as equals and can equally exert influence on each other's position during deliberations. Here, the political will arises from dialogue in dialectic with others, in the exchange of perspectives and validity-claims (be it of pragmatic, ethical, or moral kind), and through mutual respect for and learning from other's views; it is a form of reason that "puts itself on trial"[1164] as Habermas put on point, and hence is an open-ended and continuous process of political will-formation[1165]. But although democratic deliberation processes are at the heart of this model, they are not what ultimately rules over society, as "public opinion that is worked up via democratic procedures into communicative power cannot 'rule' of itself, but can only point the use of administrative power in

[1160] Habermas and Derrida, 3.
[1161] Whether or not Habermas' theory is normative in nature is debated at length in between Rawls and Habermas himself in the Journal of Philosophy, see in particular Rawl's reply to the critique of Habermas in 'Political Liberalism: Reply to Habermas', *The Journal of Philosophy* 92, no. 3 (1995): 132–80.
[1162] Jürgen Habermas, 'Three Normative Models of Democracy', *Constellations* 1, no. 1 (1994): 1–10.
[1163] Jürgen Habermas, *Between Facts and Norms: Contributions to a Discourse Theory of Law and Democracy*, trans. William Rehg, Studies in Contemporary German Social Thought (Cambridge, MA, USA: MIT Press, 1996), 166. His emphasis.
[1164] Habermas, xli.
[1165] These points are carved out in detail in McCarthy's often cited 'Kantian Constructivism and Reconstructivism: Rawls and Habermas in Dialogue', *Ethics* 105, no. 1 (1994): 44–63.

specific directions"[1166]. Habermas saw the initiation of such 'working up' of public will within the informal, de-centered and autonomous public sphere of civil society, and the state's function in the institutionalization of such "public use of communicative freedom" and "conversion of communicative into administrative power", the latter being the particular task of the law[1167]. We could summarize, then, that it is through the soft fora of public deliberation that legitimate government is formed in Habermas' eyes, not as "a farfetched ideal against which sordid reality must be measured, but an existential presupposition of any democracy that still merits the name"[1168].

The emphasis on deliberation found in the EU's crafting of *soft law* on neuro-innovation reflects such Habermasian ideals of communicative rationality and action, and with them, models of procedural democratic legitimacy produced through an active, engaged, and reflexive European citizenry. The making of European public opinion on neuroscience- and technology within public engagement processes was facilitated through networks of institutions (e.g., the Danish Board of Technology or King Badouin Foundation) that reflected a rising European civil society as locus of future innovation governance. Public deliberation on neuroscience- and technology, its future benefits and risks, and their appropriate governance was also imagined as shaping innovation processes and policy "upstream", allowing a constant "feedback loop" between society, researchers, and policymakers that should help dialogue among scientific expertise and lay knowledge and flexibly accommodate soft norms within innovation processes. Rather than a fixed set of normative principles, the HBP's "Opinions", for instance, were framed as open-ended and dialogic processes between multiple stakeholders – such as citizens, researchers, engineers, sociologists – pointing the governance of dual use research at EU level to a socially desirable direction. In the spirit of Habermas' procedural approach, moreover, the RRI framework that underwrites the constitutional imagination on neuro-innovation in the EU case envisions a specific set of procedural rules that ought to regulate deliberative negotiations towards agreement: "participation in a fairly regulated bargaining practice calls for the equal representation of all those affected; it is meant to ensure that all the relevant interests and value orientations can be brought to bear with equal weight in the bargaining process" Habermas contends in "Between Facts and Norms"[1169].

And in fact, inclusion of diverse perspectives (e.g., expert and lay knowledge, science and philosophy) representative of Europe's plural cultures (e.g., large numbers of participants covering diverse national origins) is framed as a necessary precondition for joint deliberations in the MoM and the HBP's public engagement processes. Here, the rules of discourse also foresee participants shaping each other's opinion "not as something merely given but as inputs that, open to the exchange of others, can be discursively changed"[1170]. Such mutual learning and adjustment of opinions was carefully

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[1166] Habermas, 'Three Normative Models of Democracy', 6.
[1167] Habermas, *Between Facts and Norms*, 176.
[1168] Jürgen Habermas, 'Interview with Jürgen Habermas', in *The Oxford Handbook of Deliberative Democracy*, 2018, 872.
[1169] Habermas, *Between Facts and Norms*, 181.
[1170] Habermas, 181.

documented during the drafting of the HBP's Opinion on "Responsible Dual Use Research" which proved the effectiveness of public deliberation processes in forming a common European will on neuro-innovation. In the words of Habermas, these deliberative procedures evidenced the possibility of creating an "empirical" European popular will – one that is emerging from and through public deliberation – vis-á-vis a purely "hypothetical" forms of will formation and expression that liberal and republican thinkers alike imagine to legitimize the authority of government and the rule of law. The recommendations for neuro-innovation produced by the HBP via public deliberation procedures, in turn, were envisioned to 'work their way up' to EU-institutions and decision-makers, and eventually translate into legal norms and regulations (i.e. "administrative power"): "the citizens' support for continued neuroscience research was contingent on the development of international legislation and ethical guidelines for the research and use of neuroscience, and they suggested setting up a monitoring and enforcement body", a report on citizen deliberations on responsible dual use observed.

Considering the deliberative elements of the EU's constitutional imagination for neuro-innovation furthermore helps us to carve out how collective governance could be framed as a particular kind of neutral, and hence legitimate process for generating "responsible" innovation in the future. For Habermas, both moral and truth claims presented throughout public will-formation should not be measured against criteria of objective evidence defined in advance. Instead of *objectivity*, he asserts that the universal *validity* of claims can be judged rationally, and it is through adherence to the rules of ideal deliberation and discourse described above that such judgement will always be positive. Habermas' long-time sparring partner on procedural theories of democracy Rawls summarized his formula for the production of rationality in the following way: "the more equal and impartial, the more open that (deliberative) process is and the less participants are coerced and ready to be guided by the force of the better argument, the more likely truly generalizable interests will be accepted by all persons relevantly affected"[1171].

This communicative rationality and its validity played out at length in the EU case. The HBP's progressive counter-rationale to governance through scientific expertise, for instance, highlighted the "contamination" of objective scientific knowledge with normative viewpoints by ordinary citizens in the "Ethics and Society" subproject at the same time as it framed the RRI framework as politically neutral set of procedures for reaching a common vision on *in silico* innovation and its benefits for society. And even the framing of deliberations on the highly controversial theme of using *in silico* neuroscience beyond civil purposes alone insisted on the abstention from normative judgement on the desirability of dual use research, and with it, ethical questions of war and peace more generally. In other words, by mobilizing RRI as an impartial framework guarding the rules of rational deliberation around emerging neuroscience and -technology, the governance of innovation was imagined to be turned "into a communicative *structure* purified of all substantive elements"[1172]. Structur*ing* public deliberation on

[1171] Rawls, 'Political Liberalism: Reply to Habermas', 173.
[1172] Habermas, *Between Facts and Norms*, 228. His emphasis.

neuro-innovation in this way facilitated the stabilization *soft law* as collective and rational procedure with the capacity to build democratically legitimate EU policies on science and technology. As I have argued for this case, it eventually allowed envisioning a shift of authority in the governance of innovation from member-state to the EU's system of institutions, which figure as enablers and guardians of the European publics' deliberative freedom and adherence to rational discourse in the constitutional imagination of RRI.

Imaginaries of a collective, deliberative, and procedural governance in the future "Innovation Union" also foresee a particular social function of and for science in catering to innovation's future public benefit. In stark contrast to the American ideal of a strict separation between science and politics, the European turn to RRI foresees science to be embedded within democratic processes of decision-making and deliberation, and to be guided by the interests, needs, and political will of the citizens of Europe. While I have argued that in the US, we see Polanyi's "Republic of Science" guiding the purification of science from ethics, the EU's constitutional imagination on "science *with* and *for* society" can be interpreted along the lines proposed by British scientist J.D. Bernal in the late 1930s, a fierce adversary of Polanyian ideals of a free, self-governing science[1173]. Bernal's *opus magnum*, "The Social Function of Science", aimed to convince the WWII-torn scientific enterprise and its governance that scientific freedom and democratically organized research is reconcilable:

> Many present-day scientists fight hard against organization because of the restriction they fear on individual freedom, but if we could achieve the double safeguard of democratic organization and the right to individual research, those fears would be found groundless. The primary condition is that any research for which there was a demand from inside or outside should not only be permitted, but also aided.[1174]

Described as a "Sage of Science"[1175] today, Bernal's defense of Marxism often led intellectuals of his time to accuse him of advocating a planned system of science organization and funding resembling that of Stalin's UDSSR. Yet, his insistence on the double standard of scientific freedom and democratic decision-making can also be interpreted as inspiring democratic imperatives of public participation in orienting innovation towards the common good that simultaneously keep ideals of free scientific research intact. Similar to the imagination that underwrites the EU's RRI framework, Bernal imagined that the best way for society to encourage and profit from the fruits of science could be achieved by balancing its freedom, flexibility, and open-endedness with an "ordered scheme"[1176] that ensures

[1173] Roger Pielke, 'In Retrospect: The Social Function of Science', *Nature* 507, no. 7493 (1 March 2014): 427–28.
[1174] John Desmond Bernal, *The Social Function of Science* (London: George Routledge & Sons, 1939), 277–78.
[1175] See Andrew Brown's fabulous biography of Bernal, Andrew Brown and Director of Humanities Publishing Andrew Brown, *J. D. Bernal: The Sage of Science* (OUP Oxford, 2005).
[1176] Bernal, *The Social Function of Science*, 278..

science to be coordinated "for the benefit of humanity as a whole"[1177]. Neither a hierarchical, nor an anarchic, but a "democratic organization can assure its full vitality, and that democracy must begin at the very bottom, in the laboratories where the essential work of science is being done."[1178] This type of science governance should include participation of citizens in the scientific enterprise and its governance, lending science the "popular base that the advance and even the continuance of science depends"[1179].

From the "Science and Society Action Plan" embraced by the EC in the early 2000s and its operationalization in the "MoM", to the RRI framework's "key" for citizens to participate in research, innovation, and governance that was employed by the HBP's "Ethics and Society" subproject to unlock *in silico'*s social benefits, the democratic governance of science figured centrally in the EU's constitutional imagination of publicly desirable neurotechnology innovation. Such social function of and for science did not preclude a framing of science as free and autonomous enterprise, quite the contrary. As we have seen in the citizen's recommendations developed during the "Meeting of Minds", for example, a "purification" of science from political or economic instrumentalism was seen as key to ensure neuro-innovation in fact caters to society's welfare. At the same time, the advance of science in the public interest was envisioned as legitimate only when being shaped by participation of citizens in the EU's science governance. In the citizen's *soft constitution*, science would provide the EU the knowledge needed to take decisions on neuroscience in the public interest, which, in turn, could only be expressed and achieved through participation in, and hence collective responsibility of, the governance of science. Neuroscience was granted an elementary role in the provision of the public good, yet a reflexive understanding of its political economy was deemed essential to regulate its advancement towards socially desirable ends. Here, the ontological categories proposed by neuroscience were regarded with suspicion, whereas their normative dimensions were expected to guide the Union's laws.

Different to Polanyi's "Republic of Science" governing itself towards society's maximum advancement, the citizens of Europe hence imagined the European republic of innovation to be governed in a democratic way so as to achieve the maximum welfare for all of its people. This imagined order of democratic science governance also entails a specific idea of how power in the governance of innovation ought to be distributed: science would guard research's economic and political disinterestedness (i.e., its own freedom), while citizens would ensure that the interest of society is what regulates science towards such ends (i.e., its public communication freedom). The reasoning that enabled such vision to gain stability throughout the EU case study respectively did not rely on strict boundary between science and politics (i.e., a bioconstitutional regime) – it deliberately muddled, or blurred, such boundaries in the name of a democratic steering of neuroscience- and technology for the common good.

In conclusion to the different elements that constitute the EU's constitutional imagination on

[1177] Bernal, 261.
[1178] Bernal, 276.
[1179] Bernal, 308.

neuro-innovation, we can note that the public good of innovation in this context is constructed through the ideals of republicanism, procedural political will-formation, and civic engagement and deliberation that target the *collectivization* of decision-making on emerging technoscience. We could even go a step further and argue that this vision of rightful innovation governance through *soft law* essentially foresees a *politicization* of science and technology so as to render their outputs beneficial to the citizens of Europe. Upon closer reflection, however, it is primarily European society itself that is envisioned to produce the norms, values, and political will that ought to regulate innovation towards desirable ends by way of a general will emerging from deliberation, building the solid base that Rousseau had imagined for the ideal republic and Habermas for the ideal way to achieve rationality therein. Innovation, in turn, is framed as an inherently value-neutral enterprise that can be used for society's good as well as against its interest (as so vividly exemplified by the dual use deliberations in the HBP), and it is the responsibility of the collective to ensure it is attuned to its desires. As I have argued above, these particular ways innovation and society are co-produced in the EU case are deeply entangled with the ever-lasting quandaries of European unification.

The reasoning advanced around what desirable innovation *is* as well as how it *ought* to be governed in the public's will was not only the product of its embeddedness in a Union struggling to re-frame its raison *d'être* beyond market harmonization and economic prosperity; it was inseparable from imaginations of a unification of European societies via democratically-driven innovation as the EU's *finalité.* If we follow the diagnosis of a deficit in Europe's broader constitutional imaginary that legal scholar Jan Komárek has described as "its inability to offer a utopia that could give a sense of direction to those who cannot identify with the present state of affairs"[1180], the EU's innovation activities and corollary RRI politics thus represent a potentially powerful fix that constructs exactly such utopia and sense of direction toward a European republic. Such fix effectively adds to the often criticized "thin utility-maximization perspective of welfare economics"[1181] through which the EU's leaders justified integration efforts up until the threat of disintegration in the early 2000s the thick imagination of a shared, European public good beyond market goods alone. In this sense, Europe's ordoliberal "Economic Constitution"[1182] that identified the EU merely as an "Economic and Monetary Union" was re-imagined as a *soft constitution* laying the foundation for a European "civic-republican Innovation Union".

[1180] Jan Komárek, 'European Constitutional Imaginaries: Utopias, Ideologies and the Other', SSRN Scholarly Paper (Rochester, NY: Social Science Research Network, 29 October 2019).
[1181] Walker, 'The European Public Good and European Public Goods'.
[1182] A detailed history of the imaginary of a European Economic Constitution is provided by Quinn Slobodian in *Globalists: The End of Empire and the Birth of Neoliberalism* (Cambridge, MA: Harvard University Press, 2018), chap. 6. A World of Constitutions. He explains that the "concept of an economic constitution had two meanings, It was both descriptive of a given sociological reality and normative of a desired legal order. Ordoliberals did not mean "economic constitution" primarily in the literal form nor did they assume that it had to be embodied in a founding legal document…what was necessary for a genuine economic constitution was the unity of vision for an economic order, as first defined against the compromises of the Weimar Republic" (p. 211).

A Concert of Free Market Democracies: The Constitutional Imagination of RI at the OECD

The OECD's constitutional imagination on neuro-innovation could be read along similar lines as that of the EU, as both of these institutional arrangements share an identity as international organizations and as in both cases, the financial and economic crisis of the early 2000s proved to be a stress-test on their legitimacy to rule, however hard or soft, over the sovereign people of nation-states. Moreover, and as I have described earlier, the existential threats that these two entities faced in the crisis aftermath provoked their re-configuration as democratic agencies geared towards social welfare instead of pure economic instrumentalism alone via the development of "responsible" innovation paradigms. However, the OECD and its approach to "Responsible Innovation" in neurotechnology differs from the EU in that its approach to soft jurisdiction goes beyond the unification of a region and towards "fixing globalization" as one of the reports reviewed in the OECD case study proclaims. Compared to the US and the EU's shift to *soft constitutions* developed around neuro-innovation, from its founding days onwards the OECD stands out as *soft law* organization *par excellence,* and has once again proven its power as "ideational artist"[1183] for the global harmonization of science and technology policy when shaping the "Recommendation on Responsible Innovation in Neurotechnology". In the following, I will hence discuss the OECD's vision of desirable neuro-innovation and its governance along the lines of its unique institutional trajectory of pioneering *soft laws* for the world economy, which shifted to promoting a constitutional imaginary of democracy as panacea for globalization and innovation imperatives in crisis. As we will see, the ideas that underwrite the surge of "Responsible Innovation" imperatives at the OECD emanate as much from the political philosophies of international relations proposed during the first half of the 20th century, as from 18th century Kantian visions of establishing "perpetual peace" among countries that laid the foundation of republican-liberal ideals in the governance of global politics.

The constitutional imagination evoked by the OECD's *soft law* on neuro-innovation foresees a "concerted action across governmental levels and across the public and private sectors"[1184] in which free market economies reinforce their commitment to liberal democracy for the governance of technoscience. The metaphor of a concert among countries and sectors invites a number of questions: What music is being played? Who are its performers and by whom are they conducted? And what is being imagined as the public of such concert? With regard to the first question, I have argued that the OECD's *soft constitution* does not necessarily present a completely novel piece of music but rather a remix of the EU's and US' diverging governance approaches to innovation through *soft law* – Neuroethics and RRI, liberal and republican elements are reassembled in this case to form a joint voice in the OECD's RI concert. If we follow the definition provided by the Cambridge Dictionary that a remix changes or improves different parts of existing music "to make a new recording", we can

[1183] Martin Marcussen, *Soft Law in Governance and Regulation : An Interdisciplinary Analysis* (Northhampton, MA; Cheltenham, UK: E. Elgar, 2004).

[1184] OECD, 'Recommendation of the Council on Responsible Innovation in Neurotechnology, OECD/LEGAL/0457', sec. Preamble.

nevertheless understand the constitutional imagination produced through remixing as an innovation in itself at the organization, a new approach which aspires to change or improve the *soft constitutionalism* on neuro-innovation of its member-states and beyond so as to attune them better to each other. The OECD's role in the concert is envisioned as that of the conductor "assisting" and "guiding"[1185] governments in their performance; it is what brings harmony into the different melodies played by each of the OECD's constituents with regard to their heterogeneous forms of reasoning and governing neuroscience- and technology towards socially desirable ends. Different to the EU's mobilization of citizens for the performance of a European republic, the OECD's musicians are governments, their administrators, policymakers, and bureaucrats that represent the interest of their people in the global space. The spectators of this concert, the "fans" of the orchestra, in turn, are the citizens of member-states and beyond, who are pictured as the primary beneficiaries of the OECD's turn to RI and with it, a more inclusive globalization that "works for all"[1186].

The music that the OECD's RI concert performs echoes constitutional imaginaries of international relations that have surged from US American and European aspirations to build a global cosmopolitan order of peace and commerce throughout the world in response to the Great and the Second World War. A vision of world governments uniting in concert already guided the building of one of the first fora for multilateral deliberation among countries – the League of Nations - after WWI. Finding many supporters on both sides of the Atlantic, it was US President Woodrow Wilson's fierce advocacy for the League that set the tone for liberal international policies that pervade global politics until today. In an attempt to convince the American senate in January 1917 to endorse the League and find a peaceful end to the war, Wilson proposed that

> All nations henceforth avoid entangling alliances which would draw them into competitions of power, catch them in a net of intrigue and selfish rivalry, and disturb their own affairs with influences intruded from without. There is no entangling alliance in a concert of power. When all unite to act in the same sense and with the same purpose all act in the common interest and are free to live their own lives under a common protection.[1187]

In Wilson's vision, there could only be peace if countries treated each other as equals and if they acted in unison towards the shared interest of peace and prosperity within and across nations. Such concert would not diminish national sovereignty, quite the contrary – it would help in building up those institutions that could effectively protect the freedom of people to govern themselves without foreign intrusion. These institutions, according to Wilson, needed to rest on the American principles of liberal

1185 OECD, sec. Background Information.
1186 OECD, *Fixing Globalisation*.
1187 Woodrow Wilson, 'A World League for Peace'.

democracy and "free access to the open paths of the world's commerce" – principles that "forward looking men and women everywhere, of every modern nation, of every enlightened community" would endorse as "principles of mankind" that "must prevail"[1188]. While the speech did not persuade the US senate to join the League, the idea that democracy and participation in free trade are universally desirable and hence must be protected to establish long lasting peace significantly legitimized American intervention in the First World War. In his declaration of war to Germany in April 1917, Wilson coined the famous phrase that "the world must be made safe for democracy" by defending

> Principles of peace and justice in the life of the world as against selfish and autocratic power and to set up among the really free and self-governed peoples of the world such a concert of purpose and of action as will henceforth ensure the observance of those principles.[1189]

It took another World War and another institutional set-up, the Bretton-Woods System, for countries to join Wilson's imaginary concert and commit to the principles of political and economic liberty as guarantees for world peace. By the end of WWII, these principles came to be envisioned as following a particular logic – that of an integration of countries into a joint global economic order that would inevitably also favor the instalment of liberal democratic governments across the countries of the free world. This logic has been shaping the OECD's DNA from the onset, when it was conceived through the Marshall plan during the immediate post-WWII reconstruction of Europe to oversee the harmonization of European economic policies and to make them favorable to free trade with the US. As Marshall himself stated in his often-cited Harvard lecture of 1947

> It is logical that the United States should do whatever it is able to do to assist in the return of normal economic health in the world, without which there can be no political stability and no assured peace…Its purpose should be the revival of a working economy in the world so as to permit the emergence of political and social conditions in which free institutions exist[1190].

As an organization set up to promote and protect the new, free world of democratic capitalism, the OECD quickly expanded its sphere of influence, both in terms of integration of new members, as well as with regard to the policy-domains studied and structured through the OECD's "economic conscience" that manifested itself in the "construction of an international economic philosophy that

[1188] Wilson.
[1189] Woodrow Wilson, 'Address to Congress Requesting a Declaration of War Against Germany'.
[1190] Wilson, *The Marshall Plan 1947-1951*.

guarded the principles of liberal capitalism and the interests of its imagined community"[1191]. Such philosophy, as I have shown in the OECD's genealogy of science and technology policy since the 1950s, was central to the ways through which the OECD approached its objects as well as its subjects of reasoning: for much of its history, the organization primarily orchestrated the gospel of a liberalization of markets across its member-states with a decisive emphasis on economic cooperation and development for the achievement of global economic growth.

This pro-market liberal democracy stance also shaped the way innovation was conceived by the OECD and its member-states, and how its governance was imagined, namely as a growth-driving enterprise that either saw society as both the natural beneficiary of technological progress and a potential threat to such progress. With the triumph of democracy and capitalism at the end of the Cold War, the OECD lost much of its original appeal, and the search for a new constitutional imaginary for the concert of free market economies began. A report from the late 1990s that set out to answer the question "what kind of new OECD should we have today?"[1192], for instance, concluded with the simple message that "the OECD is uniquely equipped to become the World's Window on Globalization"[1193]. Attuning science and technology policies of member-states better to the new global economy became an integral element of the ECD's imaginary as the window to globalization processes, and it indeed pioneered a number of instruments and conceptual vocabularies such as the "National Systems of Innovation" approach during the transition to the new millennium.

Yet, the organization's coming of age as think-tank of economic globalization quickly faced another identity-test when global financial markets crumbled in the wake of the 2008 crisis and when citizens around the world demanded an end to liberalization policies that favored markets and growth over people and their welfare. It is here that we can locate the birth of a constitutional imaginary that turned the logic inherited from Wilson and Marshall upside down – a turn in the organization's music that did not occur without friction as I have shown in the OECD case study. If the OECD's competitive advantage in the international arena had always rested on its distinguished economic expertise of liberal capitalism, it is in the crisis aftermath that we can see first attempts to re-frame the organization's purpose as guardian of democratic values and institutions vis-á-vis unfettered markets and globalization processes that leave much of the world's population behind. Rather than visions of global economic integration and liberalization as precondition of democratic liberalism, we could observe the surge of ideas that envision a re-commitment to democracy within countries so as to ensure the further deepening of a world economy that "leaves no one behind".

Science, technology and innovation policy became a crucial site to experiment with the new vision, which needed to be linked to the rationales of the organization's economic growth paradigm on

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1191 Schmelzer, *The Hegemony of Growth*, 335.
1192 The Reinventing Bretton Woods Committee, 'The OECD at the Turn of the Century: The World's Window on Globalization Conference Report and Recommendations' (New York City: The Reinventing Bretton Woods Committee, 1997), 40–41.
1193 The Reinventing Bretton Woods Committee, 14.

the one hand at the same time as it had to integrate the various constitutional imaginaries on innovation of its member-states on the other hand so as to gain legitimacy and traction as global "view from nowhere". As we have learned in the OECD case, the turn to democratic imperatives was cautiously tried and tested in the DSTI, itself a champion of an "Innovation Imperative" that primarily catered to the organization's expertise in conducting the concert of globalization and free markets. Through the establishment of a new working Party, the BNCT, and its task to negotiate a socially inclusive governance framework for neuro-innovation, a process of convergence kicked off within the Directorate in which the economic knowledge regime of innovation was brought into harmony with new perspectives on the governance of innovation in and for society.

Such convergence was enabled by a particular logic of deficit construction, in which insufficient and incongruent attention by member-states to social values and ethics in innovation was framed as barrier to the development and dissemination of socially desirable neuro-innovation and with it, global economic growth. The solution presented to this deficit set a different melody for the OECD's orchestra: a socially inclusive governance of innovation enhances the diffusion and uptake of innovation, better orients the supply of innovation toward social demand, and achieves coordinated science and technology policies based on comparable and harmonized "principles". Following historian of economic thought Quinn Slobodian, the emergence of this constitutional imaginary for the particular case of neuro-innovation could be interpreted as neoliberal through and through. Slobodian reminds us that the intellectual project of neoliberal proponents such as Friedrich A. Hayek was not geared towards letting free markets reign at the expense of national democratic sovereignty as is commonly assumed. Instead, neoliberals were concerned with "the secret how to keep the nation but defang it"[1194]. And in fact, a particular vision of democracy amenable to global innovation imperatives permeates the OECD's *soft constitution*, which offers legitimacy and renewed purpose to global governance and the stabilization of a neoliberal economic order at global scale. Yet, the Recommendation on Responsible Innovation in Neurotechnology also bears witness to a changing rationale in which imperatives of globalization and innovation are presented as amenable to democratic procedures and principles, and hence to the formation of public opinion and values on what constitutes globally desirable innovation.

These different elements of the OECD's constitutional imagination on neuro-innovation can be traced 200 years back to Immanuel Kant and his vision of "Perpetual Peace" proposed in 1759. An unusual piece for Kant's broader *oeuvre* on ethics, metaphysics, and epistemology, "Perpetual Peace: A Philosophical Sketch" is written in the style of an imaginary international treaty and lays down three principles essential to the maintenance of harmony among countries. First, states need to have a republican government that represents the common interest of its populations, which will inevitably be to preserve peace and prevent wars; second, republican nation-states should not form a world-state but a federation in which the sovereign right of people is not subjected to a higher authority; and third, people should come together in a cosmopolitan spirit that encourages exchange of perspectives, culture,

[1194] Slobodian, *Globalists: The End of Empire and the Birth of Neoliberalism*.

and goods, so that "the human race may be brought nearer to the realisation of a cosmopolitan constitution"[1195].

Two facts legitimized the ideal of a republican order within nation-states as pre-condition for world peace according to Kant. On the one hand, a republican constitution depended on the consent of subjects to go to war, which guaranteed that citizens deliberate and "weigh the matter (of war) well before undertaking such a bad business"[1196]. Here, consent to war would equal consent to "bring down the miseries of war upon their (own) country"[1197], which no reasonable people could possibly desire. On the other hand, Kant contended that "in a government where the subject is not a citizen holding a vote (i.e. in a constitution which is not republican), the plunging into war is the least serious thing in the world"[1198] – without a government representing the will of its people, there could only be rulers going to war "for the most trifling reasons, as if it were as kind of pleasure party"[1199].

Kant hence foresaw not only a particular set of conditions for an international peaceful order, but an order that rested on the civic-republican stability of states, something we can imagine akin to a Russian doll where the same elements in different sizes build up to a greater whole. In his ideal of a "free federation of states" as the only legitimate form of international rule, the natural relationship between states was imagined along the same lines as liberal philosophy imagined individuals in a state of nature, i.e. as primarily hostile to and in perpetual war with each other. By transitioning into a regulated system of a federation of states, "every state, for the sake of its own security may – and ought to – demand that its neighbor should submit itself to conditions, similar those of the civil society where the right of every individual is guaranteed"[1200].. But although such conditions could best be guarded through forming a world-republic with shared laws, Kant assumed that nation-states would "by no means desire this" loss of national sovereignty; instead, a federation of states "averting war, maintaining its ground and ever extending over the world may stop the current of this tendency to war and shrinking from the control of law"[1201]. Last but not least, a federal international framework also granted the right of universal hospitality to people, "a permission to make an attempt at intercourse with the original inhabitants" of another country. In comparison to countries that did not grant such right to strangers while "no satisfaction is derived from all this violence", particularly not commercial profits, a universal right of hospitality could help in "gradually approaching that ideal"[1202] of perpetual peace.

Although Kant wrote this first essay of liberal international theory in the form of a hypothetical treaty, he thought of these rights as "complement to the unwritten code of law", both at national as well as international level. It is important to note that Kant's pacific union of republican states with

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1195 Immanuel Kant, *Perpetual Peace*, EBook #50922 (Project Gutenberg, 2016), 139.
1196 Kant, 122.
1197 Kant, 123.
1198 Kant, 123.
1199 Kant, 123.
1200 Kant, 129.
1201 Kant, 137.
1202 Kant, 142.

cosmopolitan spirit was envisioned as a "center for other states wishing to join"[1203] – leading to a gradual expansion of the union to eventually assemble all of the world's nation-states under common international principles that safeguard their individual freedom and collective peace.

A number of joint threads among Kant's ideal of "perpetual peace" and the OECD's constitutional imagination on neuro-innovation can be drawn. In the post-crisis years, the OECD imagines an inclusive governance of innovative economies in antagonism to its disruptive and unequal distributional effects. Similar to Kant's first article, that of a republican order within nation-states as precondition for peace among states, we can read a related ideal in the OECD's RI recommendation of "building the capacity of key *institutions*" and "*processes* of societal deliberation, inclusive innovation, and collaboration"[1204]. With the help of democratic institutions and processes of public participation in the governance of neuro-innovation, member-states are envisioned to become more representative of the interest of their people in innovation and its responsible governance, which inevitably will be to reach socially desirable neuro-innovation in the future. Built-in optimism that a greater attention to the public will on neuro-innovation will lead to a positive appraisal of innovation as global good indeed permeates the OECD's deliberations and recommendations on neuro-innovation. As much as Kant saw reasonable people naturally rejecting the misery of war, so does the OECD's *constitutional imaginary* project that the people of its member-states would not desire "irresponsible" innovation, or no innovation at all. By assuming that liberal values such as freedom, self-determination, and transparency are shared among the publics of the organization's member-states, a more inclusive approach to the governance of innovation is envisioned as safe pathway to reach a "responsible" dissemination of innovation across societies. Put differently, democracies in this imaginary must be designed in a particular way in order to contribute to inclusive globalization enabled by responsible innovation – "not to liberate markets but to encase them, to inoculate capitalism against the threat of democracy, (and) to create a framework to contain often irrational human behavior"[1205] as Slobodian has so pointedly argued with regard to the globalist agenda.

Such vision primarily integrates the *soft constitutionalism* of the OECD's most powerful constituents, the US and the EU, which have developed distinct ways to "encase" neuro- innovation and discipline publics through diverging commitments to Neuroethics and RRI as we have discussed above. Here we touch upon Kant's second article of an international federation of countries rooted in an unwritten code of law rather than in a "world republic" that would transgress the boundaries of national sovereignty and freedom. Throughout the process of aligning the US and EU's governance approaches to neuro-innovation, we have seen how the OECD's authority to intervene in the sovereignty of national forms of reasoning and governing innovation could only become legitimate through an impartial "view from nowhere" and by suggesting *soft law* as morally binding norm among its member-states. Issues in

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[1203] Kant, 142.
[1204] OECD, 'Recommendation of the Council on Responsible Innovation in Neurotechnology, OECD/LEGAL/0457', sec. Background Information.
[1205] Slobodian, *Globalists: The End of Empire and the Birth of Neoliberalism*, 2.

neurotechnology governance touching upon fundamental ethical values and norms (e.g. the "ethics of war" in dual use research) were repeatedly delegated to the national level, whereas seemingly a-political soft principles on "responsible" governance institutions and processes fell under the legitimate purview of the OECD's technocratic assistance function to member-states. To come back to the metaphor of a concert among OECD countries, the organization's performance as conductor envisioned that it merely suggested the structures and procedures (which in fact are fittingly described as instruments) to be taken up by musicians rather than the specific music to be played. The OECD's emphasis on soft governance instruments and circulation of "best practices", however, should not distract attention from the constitutional dimensions of its turn to "responsible innovation" as new strategy to bring member-states together in a concert of free market democracies. As I have argued in this case, the OECD gains significant authority to declare appropriate solutions to deficits in national innovation governance through which not only particular ideals of democracy but also ideal forms of citizenship in the future world economy are proclaimed. Just as Kant imagined that the federation of republican nations would gradually expand to other countries which would be naturally transforming into peace-desiring republics, so does the OECD envision its *soft constitution* to work like a persuasive center to which member-states, non-members (e.g., China), and markets will eventually gravitate, forming a harmonized whole.

Let us now turn to the last article of the treaty for perpetual peace, the cosmopolitan right to hospitality which could better be understood as a right to free exchange of ideas and goods within the world economy to which the OECD directs its globalization efforts. Kant's right to hospitality was not only thought of as enabling intercourse among people of different nations, but as a way of learning from each other's culture and habits and of cultivating respect for the differences among them. As the well-known proponent of liberal international relations theories Michael Doyle has argued, "these conventions of mutual respect have formed a cooperative foundation for relations among liberal democracies of a remarkably effective kind"[1206]. And indeed, the OECD's process of converging different sets of expertise, governance approaches, and understandings of "responsible" innovation was earlier described by one of my interlocutors as "discussing together, showing each other good examples of how to do things, communicating, peer reviews and peer pressure at some point" which she saw as a major advantage of the organization's soft rather than hard law approach. Further, the Recommendation itself recognizes in its preamble that "given the different cultural understandings of the brain and mind, there may be diverse ways of putting responsible innovation into practice, and that such diversity creates an opportunity for learning."[1207] It is thus in a cosmopolitan spirit that the OECD envisions its concert, both in terms of learning from each other's diverging governance approaches as well as with regard to different, culturally situated epistemologies and ontologies of the human brain ultimately targeted by

[1206] Michael W. Doyle, 'Kant, Liberal Legacies, and Foreign Affairs', *Philosophy and Public Affairs* 12, no. 3 (1983): 213.
[1207] OECD, 'Recommendation of the Council on Responsible Innovation in Neurotechnology, OECD/LEGAL/0457', sec. Preamble.

neuroscience and -technology. We may want to add that the vision of responsible governance of neuro-innovation proposed by the OECD also includes sectors to learn from each other, and in particular emerging neurotech-business, on how innovation can be delivered in globally desirable ways in the future.

Yet, the constitutional tones of the OECD's *soft law* on neuro-innovation cannot be overheard in the Recommendation's cosmopolitan concert. From the re-construction of Europe to the construction of policies to globalize the world economy[1208], the OECD has been central to the ways modern states imagine themselves and their relationships in the liberal global order, and our case study at hand forms no exception to such trajectory. If we follow Sheila Jasanoff and understand cosmopolitanism as a model of subsidiarity enacted by global governance institutions in which societies "respect not only the outcomes of each other's (…) governance choices but seek to understand the disparate bases on which those judgements rest"[1209], the OECD's imaginary goes a step beyond mere respect for idiosyncratic difference in reasoning and governing neuro-innovation. Rather, the principles set forth in the OECD's RI Recommendation demand a "recognition, within and between nations, of fundamental decision-making principles that may never have been explicitly articulated in law and policy"[1210]. How countries reason and deliberate on innovation – i.e., what their "civic epistemologies" are, to stay with Jasanoff – makes exactly all the difference for the coming into being of an inclusive globalization that works for *all,* countries and markets alike. In the OECD's cosmopolitan model of constitutionalism, RI works as an "overarching normative structure which specifies duties and obligations across jurisdictions"[1211], such as those of "promoting responsible innovation", "prioritizing safety assessment", "enabling societal deliberation" or "anticipating potential unintended use and/or misuse"[1212]. It is not a law ordained from above but the softness of such norms that binds governments and businesses to particular decision-making principles in the *constitutional imagination* on neuro-innovation of the OECD.

Although the OECD's front-stage role in the concert of free market democracies seems to be merely that of its conductor, the epistemic and normative ordering processes put in motion by the organization in the crisis aftermath remind us that conductors not only guide the musician's performance but also select the piece to be played and shape the way it is performed. Like Kant's irresistible idea of perpetual peace, the composition at the heart of the OECD's constitutional imagination on neuro-innovation sounds closest to Niccolò Paganini's *moto perpetuo* - a constant stream of notes repeating themselves infinitely. The difficult project of developing a shared imagination of what desirable innovation in neurotechnology could mean on a global scale, as well as how it ought to be governed in

[1208] Robert Wolfe, 'From Reconstructing Europe to Constructing Globalization: The OECD in Historical Perspective', in *The OECD and Transnational Governance* (Chicago, IL: The University of Chicago Press, 2009).
[1209] Jasanoff, 'Epistemic Subsidiarity – Coexistence, Cosmopolitanism, Constitutionalism', 138.
[1210] Jasanoff, 140.
[1211] Jasanoff, 136.
[1212] OECD, 'Recommendation of the Council on Responsible Innovation in Neurotechnology, OECD/LEGAL/0457', sec. Principles.

a way that it does not disrupt but serve societies across countries, at least, was indeed the result of a virtuous streamlining of the different instruments, interests, and idiosyncratic forms of reasoning vis-á-vis neuro-innovation found among OECD's stakeholders and constituents. Their convergence throughout the process of deliberating on and developing shared *soft law* for neuro-innovation is what lends the OECD's *soft constitution* on neuro-innovation its authority to proclaim the *is* and *ought* of future global orders around neuroscience and -technology; their harmonization forms that center of gravitation envisioned by Kant to be gradually expanding and eventually including all of those "organisations involved in, or affected by, neurotechnology, directly or indirectly"[1213].

The *soft law* constructed within the process of reaching a shared vision on how to govern neuro-innovation responsibly is thus at the same time a normative device for designing particular kinds of democracies and citizens, and for producing a future order of globally desirable innovation in which all can take part. To stay with my comparative categories, governments – the OECD's subjects – ought to commit to liberal-republican forms of reasoning and deliberating on emerging neurotechnology, which promise the development of globally desirable innovation that will not be rejected by their own as well as by other's societies. In Wilson's words, the globalization of neuro-innovation must be made safe for democracy, but not of a democracy of any kind, but one embedded in a liberal global order and contributing to the further expansion of free markets.

What does this mean for the construction of neuro-innovation as global public good? Innovation, as in the US and EU case, is conceived of as holding "great promise" for societies and markets, as well as that it is produced as a "challenge"[1214] for policymakers in ensuring such promise comes to fruition. It is the right kind of government and governance that distinguishes "responsible" from "irresponsible" innovation, whereas innovation in itself is an inherently value-neutral enterprise. Such conception not only legitimized the OECD in moving epistemic and normative authority over responsible policies and practices firmly into the global arena, elevating questions of comparability, compatibility and harmonization over more localized forms of reasoning and governance of neuro-innovation. It also solidified the shift of OECD's identity as "window on economic globalization" to that of an organization "delivering better policies for better lives in a globalized world", for which "responsible" innovation came to be imagined as key. Through such shift, the OECD's liberal constitutional imaginary as knowledge-orchestrator of free markets was again reconciled with Wilson's vision of a "concert of free market democracies" geared towards perpetual globalization.

[1213] OECD, sec. Preamble II.
[1214] OECD, sec. Preamble.

10. Conclusion

Our era seems to be marked by multiple crises – and by the urgent need to fix them. The sense that political, economic, and material achievements from the past are beginning to collapse, that institutions and societies are increasingly disintegrating, and that the grand narratives of progress once cherished have not materialized, is provoking increasing calls to remake the worlds that we live in. Since the start of the millennium, intellectual and political leaders have been keen on proposing solutions for "restarting the future to fix the economy"[1215], reforming "liberalism and its discontents"[1216], accepting that it is "time for socialism"[1217], "saving our health, our economy, our communities, and our planet"[1218], "fixing climate"[1219], "staying human in the digital age"[1220], and "reviving innovation, rediscovering risk, and rescuing the free market"[1221]. While until recently, the victory of capitalism and the wonders of scientific and technological revolutions in the 20th century were believed to drive history, societies, and their forms of life into an ever more prosperous future, we are witnessing a return of emphasis on human agency and power in taking control over their fate. As the broadcaster and commentator Andrew Keen concludes a series of interviews with some of the most important liberal thinkers of our time on the difficult question of "How to fix democracy?",

> The solution is not hand wringing. It's not despair. The solution is optimistic. Action fighting for our democracy. Yes, the way to fix democracy is through action. And that involves another word: agents, human agency, the power to shape our buildings, to shape our tools, to shape our society before they shape us. Agency, the power of all of us to be sovereign, over our own lives, in the end is about the agency of individuals to help carve their own lives.[1222]

In this thesis, I have inquired the ways through which this broader turn to social agency and democratic control is configured in the specific domain of governing neuro-innovation. Breaking with long-held beliefs that science and technology in themselves can shape society for the better, my case studies illustrate a rise in reasoning and imagining that we can indeed 'shape our tools before they shape us'. By analysis of the mobilization and production of *soft law* for the development of socially desirable

[1215] Jonathan Haskel and Stian Westlake, *Restarting the Future: How to Fix the Intangible Economy* (Princeton University Press, 2022).
[1216] Francis Fukuyama, *Liberalism and Its Discontents* (Macmillan Publishers, 2022).
[1217] Thomas Piketty, *Time for Socialism: Dispatches from a World on Fire, 2016-2021* (Yale University Press, 2021).
[1218] Mark Hyman, *Food Fix: How to Save Our Health, Our Economy, Our Communities, and Our Planet-One Bite at a Time* (Little, Brown Spark, 2020).
[1219] Wallace S. Broecker, *Fixing Climate*, First edition (New York: Hill & Wang, 2009).
[1220]Andrew Keen, *How to Fix the Future: Staying Human in the Digital Age* (Atlantic Books, 2018).
[1221] G. K Kasparov, Max Levchin, and Peter A Thiel, *The Blueprint: Reviving Innovation, Rediscovering Risk, and Rescuing the Free Market* (New York: W.W. Norton & Co., 2012).
[1222] Andrew Keen in Bertelsmann Foundation, *How to Fix Democracy | Documentary, Part 3*, 2020t.

neuroscience and -technology across three governance settings – from national, international, to global –, I have shown how optimistic fixes were constructed to the potential problems resulting from increasing knowledge of the human brain and its technological modification. As with grand diagnoses of crisis that are haunting democracies and economies today, my dissertation shows how actors in this domain have constructed the issues that neuro-innovation might generate for individuals and societies, as well as the solutions deemed adequate and appropriate for their settlement. Key to the soft rules and norms that have been proposed in the US, EU, and OECD to steer neuro-innovation towards beneficial ends has been the conjuration of the democratic sovereign to help carve desirable forms of life vis-á-vis emerging neurotechnology. While for Keen and his interlocutors, answers to the query of 'how to fix democracy' consists in an ubiquitous and seemingly universal ideal of liberal democracy, my case studies reveal that the ways democracy is put to work differ substantially across contexts, evidencing the intricate ways in which political collectives reason on and envision their power over future innovation and its place within society.

Through a research approach that relies on the theoretical lens of interactional co-production in STS, I have carved out the idiosyncratic forms by which new ideals of human agency and control in the governance of neuro-innovation have been accommodated within larger imaginaries of democratic order and the role of science and technology therein. Processes of embedding soft rules for the governance of neuro-innovation within public reasoning in each context relied on historically grown narratives of how societies should organize themselves in ways that protect individual freedom, social justice, and self-government of the people; such ideals, in turn, shaped how socially desirable innovation in neurotechnology was defined and how it was differentiated from developments in the field that could put societies at risk and harm individuals. I have argued that the *soft constitutions* for neuro-innovation resulting from these different forms of co-production represent important means in contemporary policymaking to revive imperatives of innovation on the part of public institutions, the legitimacy of which has increasingly come into question in the beginning of the 21st century. The crafting of powerful *constitutional imaginaries* that convey a sense of sovereignty by society to shape innovation in its interest was central to the closure of controversy on large-scale public investments in emerging neurotechnology. By reconfiguring instrumental frames of high-risk, high-reward neuroscience research and development advanced by policymakers, these *soft constitutions* and their visions of democratic governance were critical to fixing neuro-innovation as a means to attain the common good in the public imagination. In this sense, they achieved to resolve both, a simmering crisis of technoscientific innovation and its contribution to social progress, and a seething crisis of democracy and its ability to steer technology toward the public interest.

In conclusion of this thesis, I want to reflect on the implications of my findings for the STS agenda of a democratization of science and technology governance. Since its founding days in the 1970s, STS has been key for dismantling the common assumption that scientific and technological development drives social progress, and for replacing it with a great number of fine-grained case studies analyzed with conceptual and methodological tools that allow us to see the relational, co-constructed nature of socio-technical change. Amongst others, STS deconstructed "linear models"[1223] of scientific and technological development, "technological fixes"[1224] proposed as an answer to social problems, the idea that "technology drives history"[1225], or that social institutions and the law perpetually "lag behind"[1226] technoscientific innovation. But rather than a plain rejection of technological determinism, STS has argued that science, technology, and society mutually shape each other in ways that complicate causal narratives of technoscientific and social power. Such a stance comes with a corollary critique of technoscientific politics, which has been summarized by Sally Wyatt in the following way:

> It leaves no space for human choice or intervention, and moreover, absolves us from responsibility for the technologies we make and use…This serves the interests of those responsible for developing new technologies, regardless of whether they are consumer products or power stations. If technology does indeed follow an inexorable path, then technological determinism does allow all of us to deny responsibility for the technological choices we individually and collectively make and to ridicule those people who do challenge the pace and direction of technological change.[1227]

Ever since the uptake of frameworks and instruments in policymaking on science and technology that aim to bring the social dimensions of technoscientific development into decision-making processes, STS has been equally keen on criticizing the ways social agency is re-configured by larger, persisting frames of scientific and technological rationality, risk, and divide between expert and lay knowledge[1228]. Repeatedly, scholars in the field have troubled such frames, for instance by arguing that technological artifacts do contain politics and value judgements[1229] or that differences between lay and scientific knowledge are "not just epistemic conflicts between ways of knowing, but reflections of different ways of being, of practicing and relating"[1230]. Following early and ongoing engagements of STS with scientific and technology governance, these insights are translated into a broader political

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[1223] Benoît Godin, 'The Linear Model of Innovation: The Historical Construction of an Analytical Framework', *Science, Technology, & Human Values* 31, no. 6 (1 November 2006): 639–67.
[1224] Volti, *Cars and Culture*.
[1225] Leo Marx and Merritt Roe Smith, *Does Technology Drive History?: The Dilemma of Technological Determinism* (Cambridge, MA, USA: MIT Press, 1994).
[1226] Sheila Jasanoff, *Science at the Bar: Law, Science, and Technology in America* (Cambridge MA: Harvard University Press, 1997).
[1227] Wyatt, 'Technological Determinism Is Dead; Long Live Technological Determinism', 169.
[1228] Detailed, amongst many others, in Wynne's critique of the communication of scientific information in the aftermath of Chernobyl, Brian Wynne, 'Sheepfarming after Chernobyl: A Case Study in Communicating Scientific Information', *Environment: Science and Policy for Sustainable Development* 31, no. 2 (1 March 1989): 10–39.
[1229] Langdon Winner, 'Do Artifacts Have Politics?', *Daedalus* 109, no. 1 (1980): 121–36.
[1230] Brian Wynne, 'Introduction: Science, Citizenship and Globalisation.', in *Science and Citizens : Globalization and the Challenge of Engagement.*, by Brian Wynne, Melissa Leach, and Ian Scoones (London: Zed Books, 2004), 5.

agenda that aspires to open-up decision-making to democratic contestation and deliberation. As Richard Sclove argued in 1995, "insofar as (1) citizens ought to be empowered to participate in shaping their society's basic circumstances and (2) technologies profoundly affect and partly constitute those circumstances, it follows that (3) technological design and practice should be democratized"[1231]. As I have shown in this thesis, this agenda is increasingly embraced in policymaking, not least due to the active engagement of STS expertise in public engagement, policy design, and research projects concerned with 'ELSI', 'RRI', 'Co-creation' and the likes.

My findings discern that these projects, frameworks, and instruments today form an indispensable ingredient of public policies, in that there is hardly an area of emerging science and technology that can do without including at least an appeal to ethics, public engagement, or inclusion of social science and humanities. The field of neuro-innovation provides but one example of this turn, which can, for instance, also be observed in the stark emphasis on and commitment to "AI Ethics" by policymakers over the last years[1232]. Many of the scholars I have cited throughout my thesis engage with this turn critically (see in particular chapter 2 and 3), yet critique is primarily directed towards the technocratic, technodeterministic frames that seemingly persist in proclamations of an imperative to innovate in modern societies, which are argued to continuously reduce human subjectivity and agency in instrumental rather than substantive terms[1233]. While the analyses that prompt such critique have shown how and why "we must take technological determinism more seriously, disentangle the different types, [and] clarify the purposes for which it is used by social actors in specific circumstances"[1234], less attention is directed to what we may call a new form of 'social determinism' that has colonized science and technology governance over the last decades.

Whereas the tradition of co-production in particular aims to "avoid the charges of both natural and social determinism" to advance a "critique of the realist ideology that persistently separates the domains of nature, facts, objectivity, reason and policy from those of culture, values, subjectivity, emotion and politics"[1235], an overt focus on patterns of technological determinism often precludes symmetrical engagement with the causal narratives that are currently emerging with regard to social power and agency in innovation governance. As I have reviewed earlier, ANT perspectives made a similar observation in the early days of STS theorizing yet I have also argued that their counter-proposal is widely inadequate for analysis – and critique – of the ways society is 'held together' by actors and processes that rely on devices such as *soft law* stretching well beyond science and its material 'actants'. My thesis has attempted to adhere to the principle of symmetry in approaching controversies and

[1231] Richard Sclove, *Democracy and Technology* (New York: The Guilford Press, 1995), ix.
[1232] See, for instance, an upcoming collection of articles on the rise of ethics in tech: Schiølin, K. and Frahm, N (Eds.) (forthcoming) Innovation under Fire: The Rise of Ethics in Tech [special issue]. Science and Engineering Ethics.
[1233] Stirling, '"Opening Up" and "Closing Down": Power, Participation, and Pluralism in the Social Appraisal of Technology'.
[1234] Wyatt, 'Technological Determinism Is Dead; Long Live Technological Determinism', 169.
[1235] Jasanoff, 'The Idiom of Co-Production', 3.

settlements on the social desirability of neuro-innovation, and it is up to my readers to judge whether I have stayed consistent in this regard. I may be charged, for instance, with over-emphasizing the role of *soft law* in constituting a new logic of socio-technical order, spending too much time and space with analysis of 'democratic fictions' rather than the 'science fictions' of emerging neurotechnology, or for zooming merely into the deliberations among ethicists, citizens, and social scientists of the projects discussed instead of paying equal attention to what neuroscientists and engineers in these projects are envisioning as adequate epistemic and normative order for neuro-innovation. However, reflecting on the findings of my thesis holds some lessons that I've learned over the course of my inquiry, which include heightened caution toward the standard, sometimes unidirectional critique of STS vis-á-vis technological determinism, and some ideas for a research agenda that situates new forms of democratic solutionism in science and technology policy within the analytic frame.

Despite representing a challenge to both our personal and wider disciplinary ideals of social agency and democratic government, it is probably more important than ever to acknowledge uncertainty, complexity, and our own 'situated vision'[1236] when researching and participating in policy-worlds. What Helen Verran has proposed as "epistemic disconcertment" for the "postcolonial impulse" she observes when engaging with indigenous knowledge traditions – "the sense of being put out in some way, [implying] that our taken-for-granted account of what knowledge is has somehow been upset or impinged upon so that we begin to doubt and become less certain"[1237] – can equally be translated to the study of how society or innovation is put to work in governance. We may be unsettled in a disconcerting or comforting way, depending on our situated stance on what society and its needs, values, and rights are, how democratic participation is best achieved, or which processes of governance deserve to be regarded as democratically legitimate or not. When too comfortable in our own ideals regarding these questions, we may repeatedly find flaws in the ways other actors mobilize society in science and technology governance and make use of the many arguments presented by STS on how to overcome their discourses and practices. When too confident with our own propositions for change, we may lose sight of the struggles that actors face when trying to bring society closer into the strategies and frames that dominate policymaking, as the many challenges actors in my case studies have confronted in their respective settings evidence. And when too unsettled with our own agendas and their usefulness in the policy space, we may not be granted an invitation to them, since policymaking is, after all, a matter of finding solutions to the problems perceived to be challenging social, economic, political and technoscientific order.

In any case, we may not be certain where we – or other actors – stand vis-à-vis these often difficult and inherently ambivalent landscapes in which knowledge and politics are co-produced, therefore we can only remain open toward being unsettled by the pathways that research and engagement

[1236] Haraway, *Primate Visions*.
[1237] Helen Verran, 'Engagements between Disparate Knowledge Traditions: Toward Doing Difference Generatively and in Good Faith', in *Contested Ecologies: Dialogues in the South on Nature and Knowledge*, ed. Lesley Green (HSRC Press, 2013), 144.

with science and technology governance takes. Pessimism and optimism with regard to science and technology's potential in providing for the public good, or in society's capacity to put new knowledge and tools under its control, has a political economy of its own, and is performed quite differently depending on to whom we listen and when. Economic, political, and social crises produce all kinds of authoritative narratives regarding their sources and pathways for their resolution, which seldom rely only on one problem, solution, or actor, such as society, innovation, or (*hard* or *soft*) law. And policymaking usually does not shift rapidly from one set of instruments to the other, but rather accommodates new challenges and demands through the negotiation of various interests and values in a step-wise fashion. Moreover, science, technology, and innovation are not monolithic entities that can be ordered and re-ordered as a toddler would arrange LEGO pieces to construct the landscapes of her fantasy. Knowledge and its material embodiment are subject to interpretive flexibility and might mean quite different things to different people at different times, including diverging views on whether science and technology have their source in nature and follow natural laws, or if they are the result of particular cultural practices and forms of governance within and across societies. Political landscapes formed through visions of what society and technology are, and how they should be put into use in the achievement of the greater good, are the work of much imagination and fantasy, yet such fantasies have material outcomes which are not as easily re-arranged as LEGO pieces in a child's room. Put more succinctly, the worlds that we study are complex, and our research should reflect this complexity.

Openness and acknowledgement of complexity does not inhibit analytic capability to detect the often-times instrumental, hierarchical, or even hegemonic logics that are being mobilized in the name of the public in science and technology policy at the expense of people's epistemologies, ontologies, and norms. As Wiebe Bijker has argued for a "need for public intellectuals" in STS that can "contribute to the agenda of democratizing technological culture" since it "has created the basic ingredients of this agenda and…now should work to realize its potential"[1238], so do I argue for a need for STS scholars to unfix the causal narratives presented by policy on the role and agency of individuals and collectives in bringing about desirable technological change. Such an agenda would rather ask questions than provide answers, for instance toward what political ideals underly the forms of reasoning on society in innovation, which sources have been consulted to speak on behalf of social values and norms, or at which level of jurisdiction publics are intended to mobilize their agency to make a difference in decision-making. My thesis has argued that the sensitivities of interactional co-production do indeed provide us with the 'basic ingredients of this agenda', as well as with the argumentative tools 'to realize its potential'.

Unfixing the relationship between innovation and society through this perspective might not only bring alternative forms of social organization and mobilization into the picture that do not rely on democratic fictions that have guided our politics since the Enlightenment. It can also equip STS research and engagement with the possibility of envisioning alternative futures that may evolve beyond recourse

[1238] Bijker, 'The Need for Public Intellectuals', 444.

to a democratization of technoscientific innovation for the achievement of social wellbeing, an analytic modality that somehow remains reductive of both forms of reasoning and imaginations of democracy, as well as the objects and issues that are or should be at the heart of democratic deliberation and control. I have no fix to offer on how these alternatives might be conceived, or which better version of socio-technical order could be achieved. All I have are the thoughts and arguments developed in this thesis, and the humble hope that others might find it worthwhile engaging with them to chart different futures – for science, technology, and society.

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