

Action Planning in a Joint Pick and Place Task

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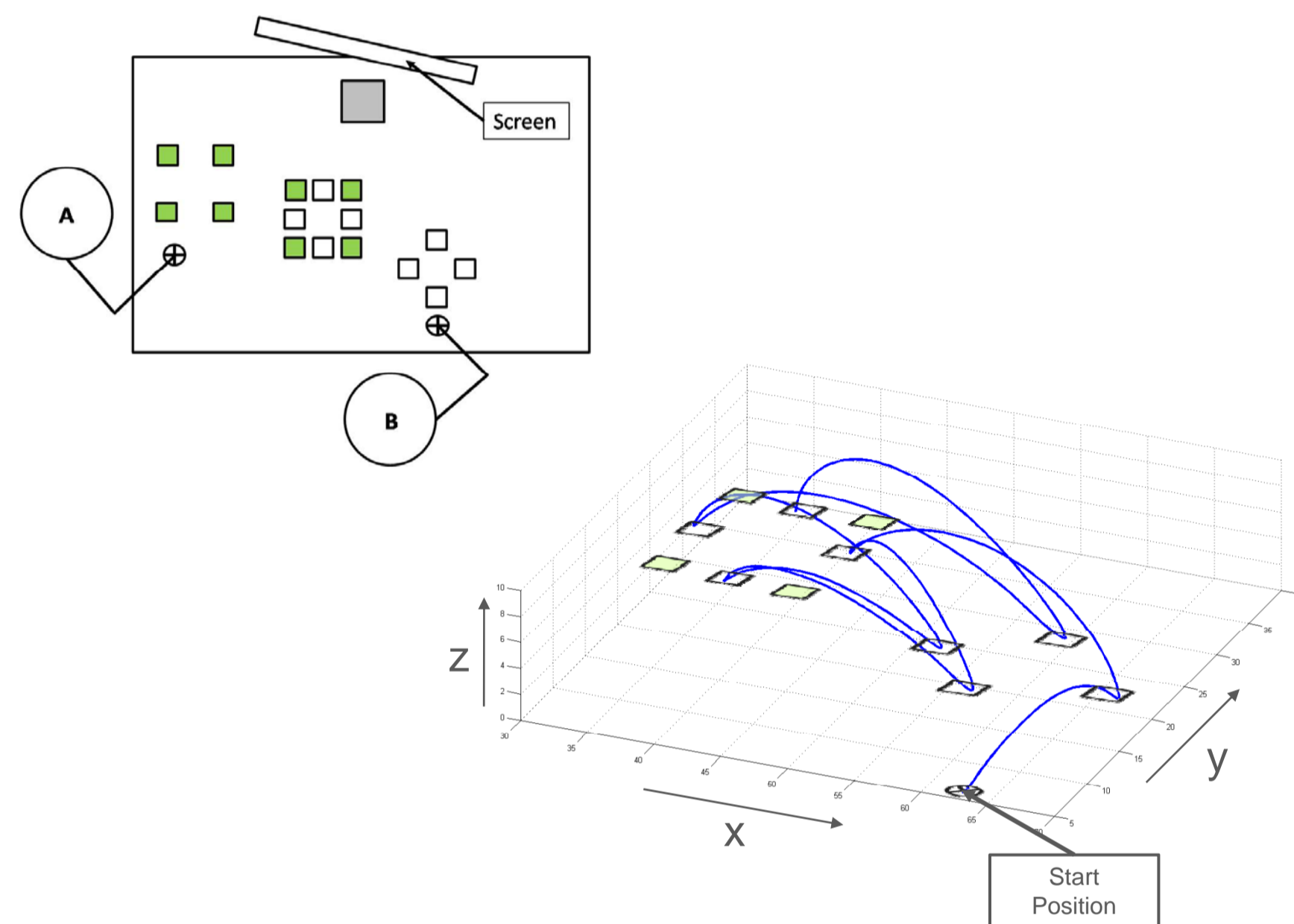
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HOW DO PEOPLE ADJUST TEMPORAL MOVEMENT PARAMETERS WHILE BEING ENGAGED IN JOINT ACTION?

Research Interest

Additional temporal effort in movement planning when

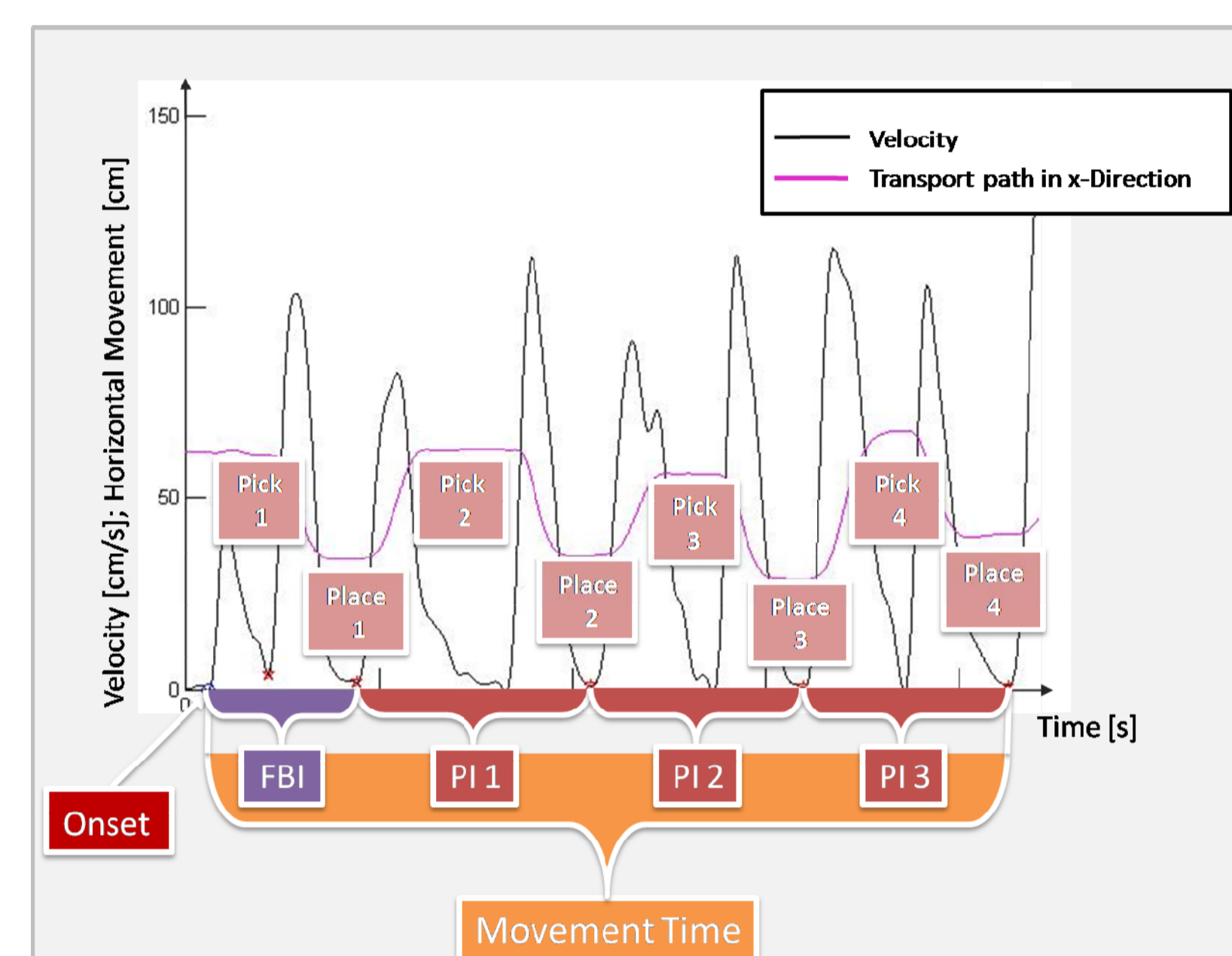
- people performed together or alone (joint vs. single)
- the pick and place order was predefined compared to random choice (predefined vs. random)
- obstacles are placed in the goal area or not (obstacles vs. empty)
- focus person B is starting the joint movement or not (beginner vs. follower)



Task: pick a wooden building brick and place it alternately into the corresponding goal position

DATA ANALYSIS

- ONSET** was defined as the last Minimum in Velocity before the participant started his movement from the starting position in order to reach for the first brick (first velocity peak). As an additional criterion velocity had to be smaller than 10 cm/s.
- MOVEMENT TIME** was defined as the time span between Onset and the placement of the 4th brick (Place 4).
- FIRST BRICK INTERVAL (FBI)** was defined as the time span that is needed to fulfil the first pick and place movement (beginning at start position).
- PLACEMENT INTERVALS (PI 1 – 3)** were defined as the time spans between two brick offsets. Thus they all include on complete pick and place movement.



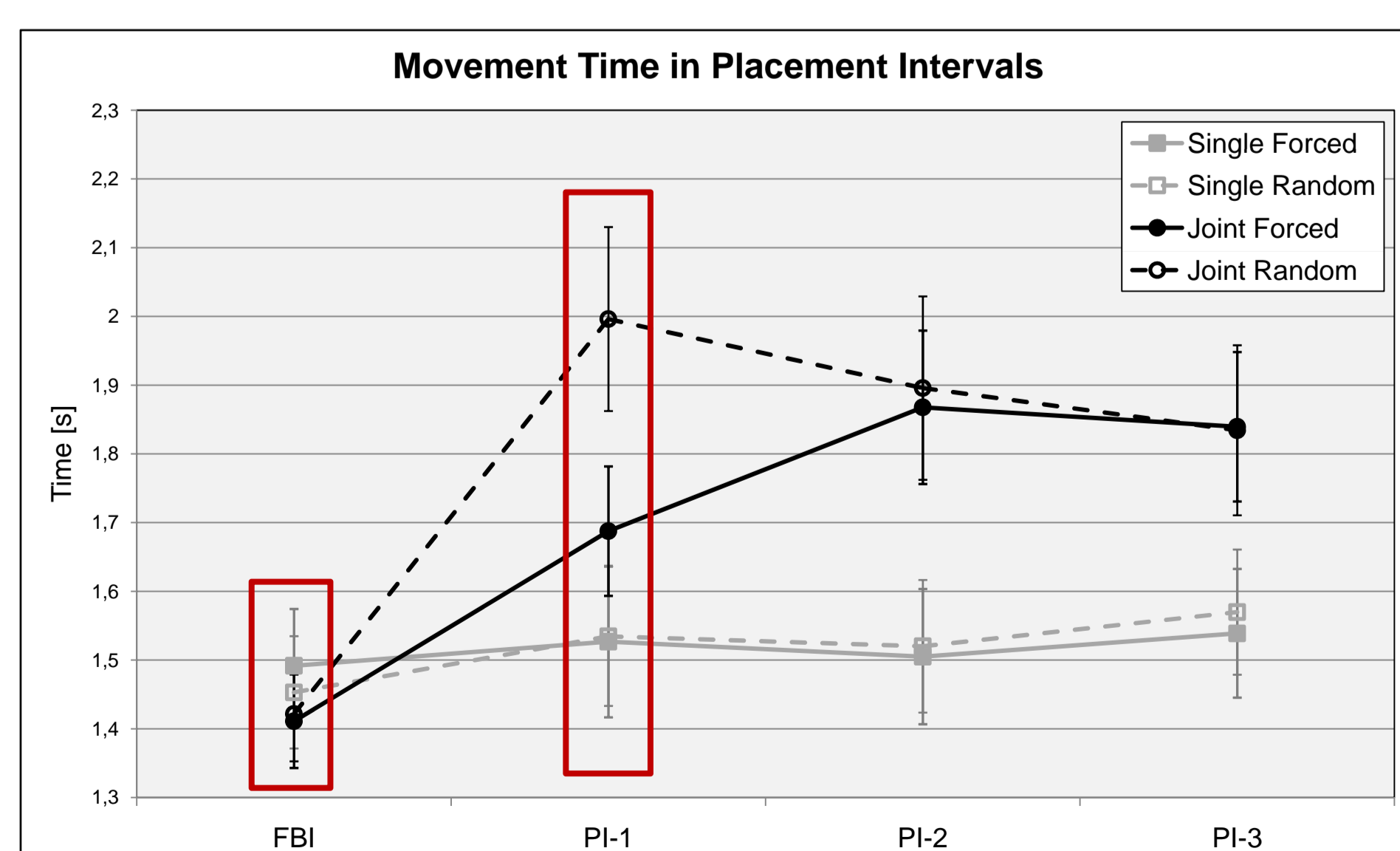
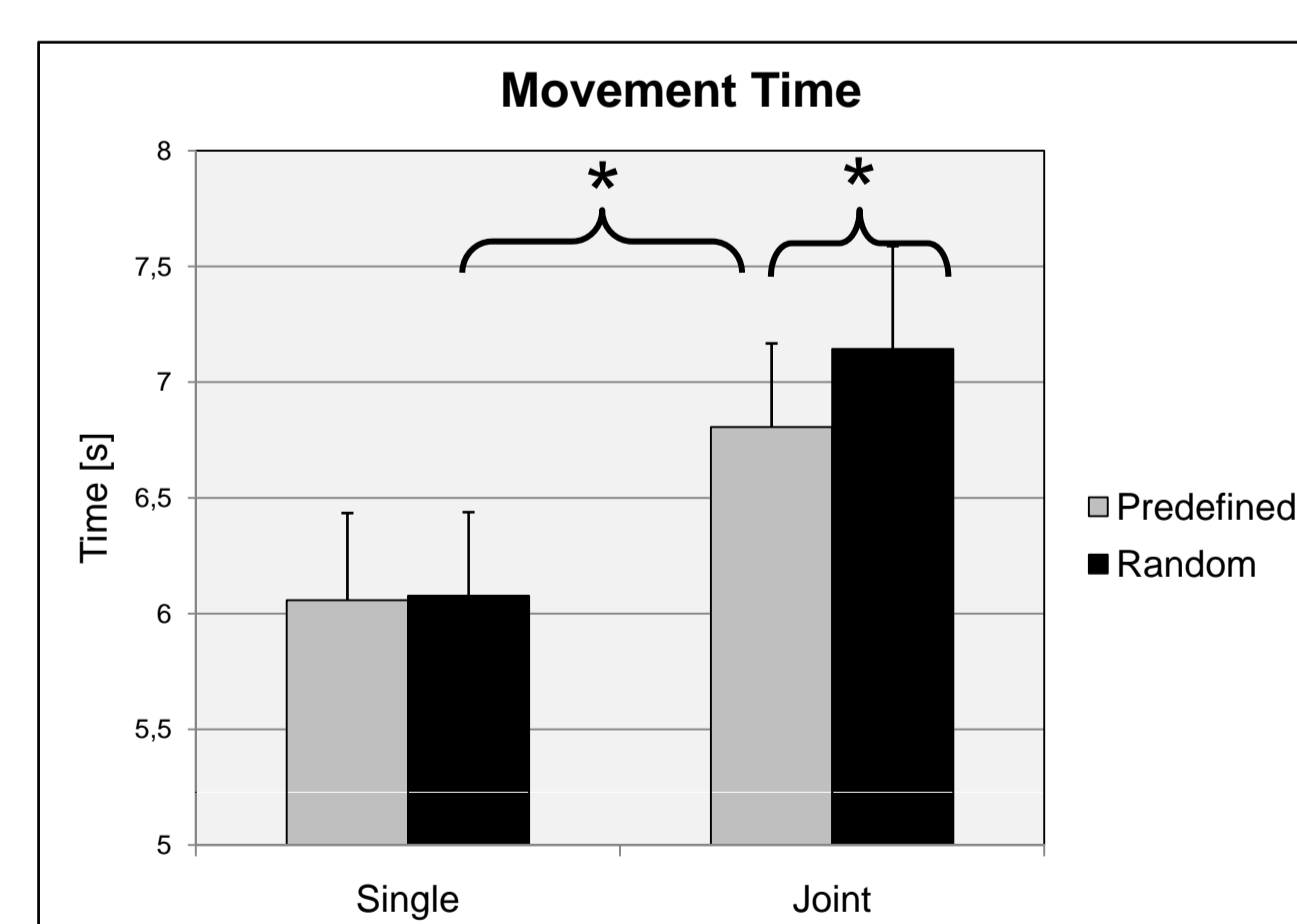
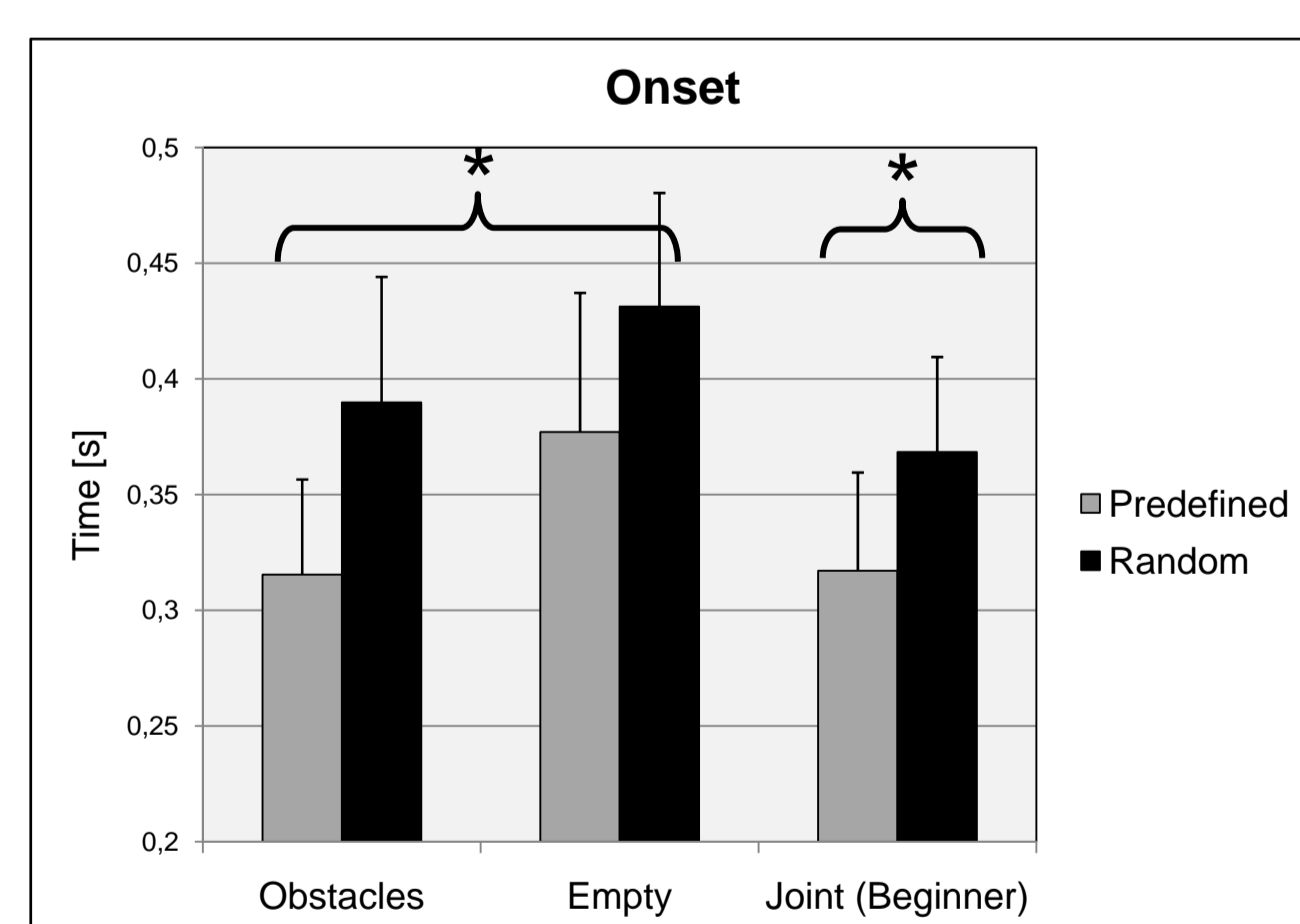
RESULTS

ONSET

- showed no significant differences between joint and single performance
- was smaller for predefined movements (0,316s ; $F = 20,454$; $p = 0,001$ with obstacles/ 0,347s; $F = 4,865$, $p = 0,05$, empty)
- was shorter when obstacles are placed in the goal area (0,353s; $F = 4,885$; $p = 0,49$) compared to the onset in an empty goal area (0,404s)

MOVEMENT TIME

- was shorter when participants were performing alone (6,067s; $F = 18,678$; $p = 0,001$) instead of working together (6,975s)
- random movements is significantly higher (7,144s) than for predefined accomplishment (6,806s; $F = 5,661$; $p = 0,037$) especially in the joint condition



FIRST BRICK INTERVAL (FBI)

- showed a longer movement time for single performance (1,472s; $F = 5,765$; $p = 0,035$) compared to joint (1,416s)
- single random performance takes less time (1,453s) single predefined performance (1,492s; $F = 16,253$; $p = 0,002$)
- random performance in joint situations takes more time (1,422s) than the predefined performance (1,411s; $F = 16,253$; $p = 0,002$)

PLACEMENT INTERVAL 1

- shows longer movement time for joint performance (1,842s) than when performing alone (1,531s; $F = 25,521$; $p < 0,001$)
- when the order can be chosen randomly in joint performance participants needed more time (1,996s) compared to when the order was predefined (1,688s; $F = 25,632$; $p < 0,001$)

PLACEMENT INTERVALS 2-3

- differences in random and predefined performance (single like joint) disappear
- longer movement times for joint performance remain

CONCLUSIONS

- People seem to need more time for planning a movement before they actually start with the movement when the pick and place order is not defined in beforehand.
- It appears to be easier to plan the movement when there are obstacle in the goal area because they define the goal positions more precisely.
- Movement time in the First Brick Interval shows that getting started with the first brick may cost less planning effort for joint performance than for single acting.
- From PI 1 on, joint performance becomes more challenging compared to single acting which could be due to higher effort for action planning while coordinating the movements with a partner.