

ERGONOMIC DESIGN BY MEANS OF HUMAN MODELS

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The main differences between traditional ergonomic design "*a posteriori*" and the modern "*a priori*"-design using computer based human models are described. This development is leading from an earlier "*corrective ergonomics*" to a new "*prospective ergonomics*". There is an incredible improvement in the depth and also in the width of the abilities of the human models. And it can be expected that this development will continue for some time.

In principle traditional ergonomic design is done as follows: On the base of previous experiences and therefrom resulting rules, a limited number of different alternatives is technically realized. These prototypes are presented to a group of subjects. Then behavior, reactions, and performance of the subjects are observed in relation to the alternatives. On the other hand the subjects opinions in regard to the various aspects of alternatives are inquired by means of psychological methods. From this combination of observations and opinions ergonomically optimized solutions can be deduced. Since this procedure is rather large-scaled, ergonomic recommendations are seldom applied during the "planing and definition phase" of the development of a product or a production process. This leads - often complained about by ergonomists - to the so called "*corrective ergonomics*" at an already largely defined object where in most cases only slight alterations can be made.

The application of so-called "soft-dummies", i.e. computer models of human shape and behavior, is representing quite a different method of ergonomic design. Since human models are able to simulate a remarkable amount of human attributes within the population, the most probable human reactions can be tested in the early stages of development. On the base of CAD-techniques this method enables the desirable "*prospective ergonomics*".

In the past human models mainly represented anthropometric (e.g. geometrical) human proportions. New approaches however are also able to consider real body postures related to outward boundary conditions. We can find models with applied forces and finally models moving like real persons under the aspects of safety and comfort. Such human models are useful in regard to product design (especially the design of closed up vehicle cabins) as well as production design (illustrating for example the MTM-method). Modern human models are capable of representing mean data of a special population group as well as data of an individual. They may have the shapes, body masses and the mobility of the humans they represent. Therefore they can be used as dummies in dangerous situations just as well as for instance Taylor's dummies.

But the development is not finished yet. In the near future human models will lay, stand, sit, and run like real people. It would be an exaggeration to say that they will feel like hu-

mans, but the development of comfort models leads exactly to this. This prognosis is supported by the fact that a lot of modern branches of industry like the film industry or IT-industries have a great interest to use such realistic human models.

This symposium will demonstrate the latest results gained in this area considering the various important human models. But we shall also put forward the aspects and problems arising in regard to usability. The purpose of the symposium is to create a base of exchange of experience for all scientists working in the area of human modeling. On top of this we should like to draw attention to everybody who is only slightly connected to this relatively new division of ergonomics. And last but not least we should like to invite you to take a new far-reaching step into this new area of ergonomics.

In the first session "*Human models - state of the art*" there are presented four human models developed for different purposes. Therefore they have a different mathematical and human data base and consequently different strong and weak points. On the one hand the theoretical background of human models is examined, on the other hand the practical issues of the modeling are described. Especially the integration of human models into the world of virtual reality is of special interest.

A second session deals with a main application field of human modeling: the *vehicle design*. If designing cars, trucks, or airplanes, digital modeling seems to be a more and more indispensable element of the development departments of those industries.

In the third session special problems of *data acquisition and management* are presented. The topics are ranging from mathematical improvements in the field of the inverse kinematics over statistical solutions for human modeling to the presentation of an automatic data acquisition system.

The fourth session will give a forward look at the future research. It can be expected that computer models will be developed for nearly all imaginable fields of human life. Most of the research effort is expended on dynamic models, but even cognitive models are now imaginable.

Together 18 presentations in 1½ days should offer an excellent view over this field of modern ergonomics.