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Comparison of Digital Tools for Ergonomics in Practice

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Abstract

Nowadays science is characterized by a phenomenon that has become the link. This trend is digitalization. Ergonomics has also not avoided this trend. The results of these trends are software tools, which include sophisticated digital human models and the latest ergonomic methods. Each instrument has its strengths and weaknesses. Therefore it is not only important to control the software, but also to be able to interpret and apply their outputs. This paper discusses a specific case study of a production workplace model. This model was evaluated with the help of digital human models by means of two software packages (Tecnomatix Jack and Delmia) and theirs ergonomic analysis. Three analyses focused on carrying conditions, lifting and lowering conditions and finally biomechanical conditions were performed. The results from these analyses from both software were compared and eventual differences are explained.

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Keywords: Ergonomic analyses; Digital human models;Tecnomatix Jack; Delmia; Digital factory; Simulation

1. Introduction

Over the last few years there has been a massive development and use of information technology. These technologies are probably the only answer to success in a highly globalized and turbulent market environment. The development of computer and communication technology enables that the methods of engineering work can be changed from scratch.

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This trend in digitalization has an effect on ergonomics. As a result of these trends there are software tools that include complex (sophisticated) models of humans and modern ergonomic methods. Each tool has its strengths and weaknesses. It is therefore not only important to control the software, but also be able to apply their outputs.

Probably the most significant ergonomic benefits of digital modelling is the ability to verify the suitability of the workplaces or the products during theirs development as stated by Regazzoni and Rizzi [1]. The fact that 90% of all errors can be debugged before the actual physical model is constructed reflects dramatically in financial savings. This so called proactive approach [2] is currently the trend and regarding to energy, material and other resources savings in the context of sustainable development becomes the only right way. It is easier to prevent problems in the early stages when theirs removal is very simple and inexpensive than later in production phases when production slowing or damage of workers health threatens. The opposite of proactive approach is so called reactive approach [3] which distinguishing feature is that the solution to problems is searched after they occur, but this may be in many cases too late.

Digital human models are 3 dimensional representation of the reality. Since 1960 when the first attempts to construct visualize first 3D models started, a great progress has been done. Many historically important solutions have been created. Digital human models like Anthropos, BoeMan, CombiMan, CrewChief, CyberMan, ERGOMan, Franky, Safework or Sammie shaped the future. Currently there are several digital human models that are of common use. These are Santos, Anybody, Ramsis, Catia/Delmia Human Model and Jack. Only several digital human models are however suitable for production planning. For example as described by Seidl [4] Ramsis is mostly suitable for designing an interior of cars. For our purposes we selected digital human models represented in Catia/Delmia software [5] [6] and model called Jack from Tecnomatix software [7]. Digital Factory systems represent the next logical step in the gradual creation of tools to support processes across the whole product lifecycle. Already during the planning phase all parts of production system can be verified, so that the subsequent real production of real products will be ensured in terms of quality and in terms of time and cost.

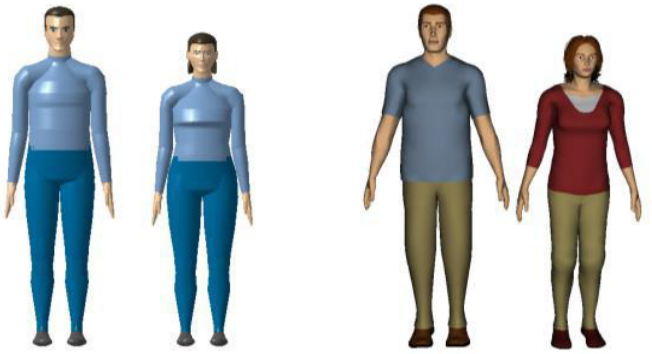

Fig. 1. Male and female digital human models in Delmia and Tecnomatix Jack.

The selected digital human models are fully customizable, so that results of studies carried out are perhaps the most realistic. If we talk about customization of a digital human model, we mean setting its gender, nationality, percentile or specific body measurements, so that our digital human model as much as possible corresponds to specific employees in production. With employee defined like this we then have the possibility to perform a variety of ergonomic analysis. The two mentioned software packages offer various kinds of analysis, however the core part of both software is material handling and work position evaluation. The digital human is placed in a virtual environment, a task is assigned to him and then his performance is analyzed by ergonomic analyses.

Ergonomic analysis tells us how the worker will work at a simulated workplace. We can find out how workers (from different population size) will perform a given task, analyze the risk of injury, needed power, reach, grips, fatigue, timing of operations, the sequence of work, optimization of tools and machines placement in the workplace, verification of parts assembly and many other factors. The result is a workplace that reflects the abilities and needs of the worker and leads to more efficient, more productive and safer production or assembly with less work