

A3 Workstation performance evaluation and design improvement, Christian Vig and Ivan Sjøberg

Theme.

The demand for products in the category of high-variety low-volume (HVLV) has increased. This requires flexible systems to produce the right products, making the manual work of operators a crucial element to be able to achieve the required productivity and to guarantee a constant flow according to the Lean principle of the Just-in-Time. This can lead to extra strain on the workers if their facilities are not ergonomically correct. The thesis is covering how to measure the performance of workstations, how anthropometric measurements affect the performance and, based on these, how to design the workstation.

Background

The average age of the working population of Europe is increasing. Older workers are more prone to injuries and musculoskeletal disorders. With more flexibility being required in manufacturing processes the importance of manual work is increasing. Companies are more invested in human factors now due to knowing the benefit for their own and because of regulation. This leads to the need for procedures to evaluate and improve the performance of workstations thanks to an optimal design of the workstation.

Analysis.

When evaluating the performance of the workstation with regards to productivity the KPIs must be made to what is important for the business. Uncomfortable working postures are related to fatigue and musculoskeletal disorders, which cause longer assembly times due to breaks and absenteeism. Because of human diversity one size of workstation does not fit all. In HVLV manufacturing changeover times and flexibility of the workstation are important factors. By having customizable workstations with assistive technology the production can be more efficient and also lead to better working conditions.

Goal

The main goal of this thesis is to provide a procedure and tools to enable operators to work in an ergonomic manner as well as improve the productivity of the business. Providing KPIs to analyse the performance of workstations with respect to production and ergonomic performance, it is possible to evaluate how the current workstations are performing and evaluate if there is a need for upgrading, which can be done virtually with Virtual Reality (VR). The VR can also be used to evaluate (through the KPIs) virtually different workstation designs, without the need of physically building them. In such a way, we aim to reduce the strain on operators and to help them working efficiently as they get older.

Proposal

Motion Capture (MOCAP) can be used to collect ergonomic data from assembly work to analyse the ergonomic performance as well as recording task times and other KPIs. Based on the ergonomic results and on the KPIs, the design of the workstation can be optimized by testing different solutions in a virtual environment thanks to the VR.

Evaluation.

Through literature review on workstation design and evaluation, it has been found that the design process is often conducted in an arbitrary manner, and that there are few suitable performance indicators used for design processes. Based on the results of the literature review, this thesis has highlighted the relation between ergonomic and production performance. The study found how human features altered the performance measurements, and how this can be mitigated through design and assistive technology (MOCAP and VR).

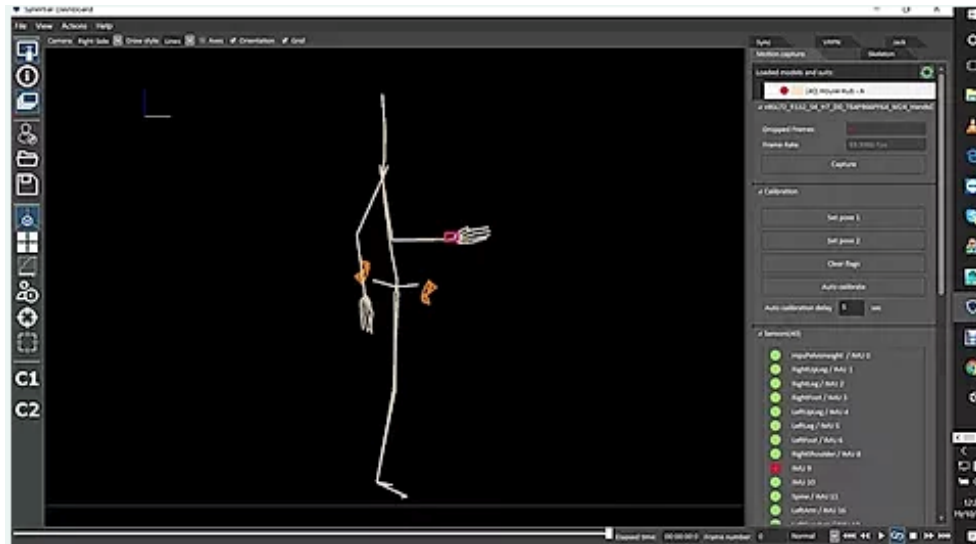
Conclusion

Provided with the optimal workstation design obtained through the assessment of different virtual workstation design possibilities by means of the developed KPIs, the rate of musculoskeletal disorders at the workplace is reduced. This can keep the operators healthy and able to work until retirement with a lower rate of absenteeism. It can also be beneficial for the younger operators, as they will have fewer problems due to workplace related injuries. Flexible workstations along with assistive technology are showing to be beneficial for production and ergonomics.

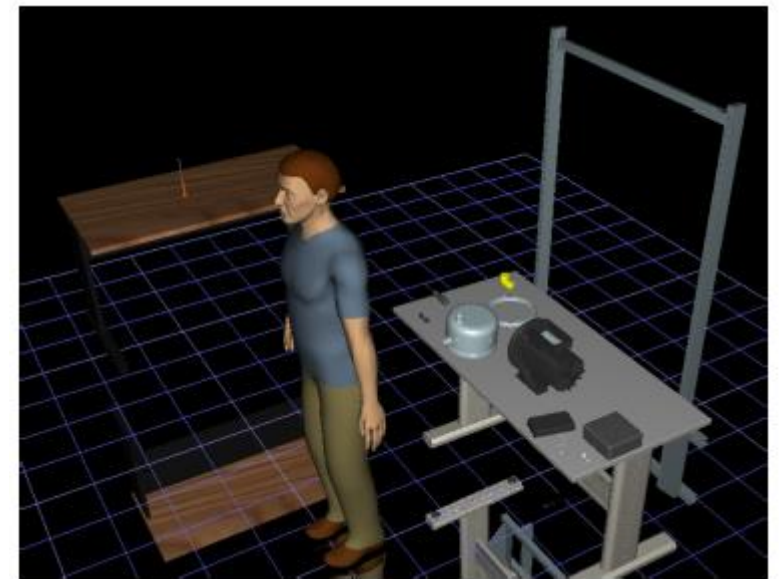
LEAN 4.



Motion capture systems to collect ergonomic data



Software to record data and evaluate workstation performance



Virtual Environment to test different workstation design possibilities