Ergonomic simulation – investing in greater company competitiveness and improved productivity

Safeguards the health and satisfaction of the workforce in production lines, too

Workplace ergonomics

We spend the major part of our time in the workplace, so the environmental conditions in which we work are critical. Many larger companies have already recognized the importance of office ergonomics and experience shows that taking just a little care to apply simple ergonomic measures can improve both worker satisfaction and work efficiency.

How can comparable results be achieved in workplaces where physical

work is done? The workers in these jobs are under constant time and performance pressure. How can the various parameters of their workstations and the whole work process be optimized to shorten work-cycle times and simultaneously improve the levels of worker satisfaction? How can we protect our most important resource -- the human workforce -- while maximizing its performance?

Challenges in the manufacturing industry

Production companies are confronted with some typical problems of our times, including aging populations and labour fluctuations and shortages, and must solve the corresponding challenges and difficulties. The protection of employees' health has become a central issue; the risks of musculoskeletal disorders and occupational accidents must be reduced.

The rapid development of technology pressurizes companies to innovate, which comes with additional costs, yet companies still need to remain competitive. However, there are disturbing factors that prevent worker concentration, create stressful situations and slow down work processes. Unnecessary strain causes pain in various parts of the body and has serious health effects. If the tension in a body part regularly exceeds a certain threshold, it leads to diseases that require long-term treatment resulting in a significant loss of working time. Frequent sick leave and, consequently, the training necessary for new or replacement employees generate significant additional costs for a company.

The solution is simple. Optimal working conditions have to be created to ensure a reliable and efficient production process. Often just a few simple changes are sufficient. This objective can be achieved with ergonomics, a scientific discipline, and some modern technology.

Traditional ergonomics

As a discipline, ergonomics has always had a rather peculiar relationship to technology. Glancing through its history, it becomes clear that this field has always been rooted in methodologies, databases, guidelines and principles -- in short, academic knowledge.

Because of its history and the strong dependence on other fields of technology, ergonomics experts are inclined to use traditional methods and approaches during ergonomic assessments. These usually consist of checklists, risk assessment sheets, guidelines or other techniques that use paper and a pencil. Paper-based information or evaluation has been around since the birth of ergonomics, which dates back to the first anthropometric databases created for military purposes.

These risk assessment methods usually incorporate some sort of scoring system, which determines the overall ergonomic adequacy of a given workplace. This numerical categorization provides a somewhat objective system that helps ergonomists to identify possible deficits and to compare the ergonomic appropriateness of different workplaces with each other. The final score is based on numerous factors, which may concern the work environment, the working postures, the work tools or other aspects, depending on the comprehensiveness of the method. The RULA (Rapid Upper Limb Assessment) sheet for example focuses mainly on body postures, whereas the EAWS (Ergonomic Assessment Worksheet) considers an extensive range of factors during evaluation. This means, however, that the scores of different assessment methods cannot be compared with each other, as they are derived from highly distinct calculation processes.

Another disadvantage of these techniques is that they are only applicable to existing and well-established work tasks through a framework of so-called "corrective" analysis. This means that a workplace that is still being designed cannot be evaluated, because there are not yet any tangible sources of information regarding the working postures and movements, or even the work environment. So, paper-based ergonomic risk assessments cannot be incorporated into the early phases of a workplace development project.

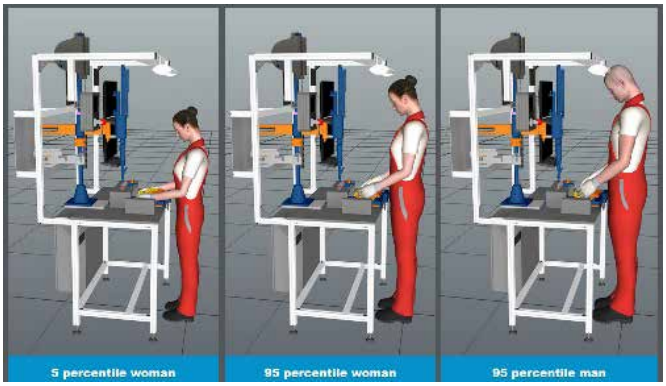
Despite the disadvantages, these traditional risk assessment methods (like RULA, OWAS, EAWS) have not become obsolete because they provide ergonomists with more or less unbiased scoring scales to evaluate workplaces. What has become obsolete, however, is the way the data is gathered for the calculation of the scores. Most of the factors that determine the final score require accurate data to ensure the authenticity of the evaluation – such as in the REBA (Rapid Entire Body Assessment) risk assessment where the position of the body segments primarily determines the final score. However, the established method among ergonomists is to simply observe the worker over several work cycles and then estimate the effect of the specific factors.
Another similar approach consists of recording the work task on camera and then analyzing the recording using still frames to find the most inconvenient postures and measuring the position of the body segments with a ruler and protractor. Not only is this method inefficient but it is also inaccurate because it is impossible to measure the exact angles of a 3D human's posture on a 2D photo.

Virtual ergonomics

An accurate ergonomic analysis requires objectively measured motion data. The Xsens motion capture system has been developed to measure and record the movements of the whole body. The equipment works with inertial sensors, biomechanical models and sensor fusion algorithms. The suit is non-obtrusive, ensuring that the workers can move naturally and realistically. The motion capture system can be used in all environments, including industrial plants with lots of magnetic interference; the motion capture data will not be affected.
While the motion capture equipment registers every detail of the movement in a realistic, fast and objective way, it does not answer the following questions: whether the frequently repeated body positions are comfortable or at least acceptable, whether the loads on the different parts of the body are within the acceptable limits, or whether the health of the employee is endangered in the long run.

ViveLab Ergo

ViveLab Ergo was developed by ergonomics experts and is based on more than 30 years of professional experience in the fields of software development, human simulation and ergonomics.
This cloud-based ergonomic simulation system is perfectly capable of modeling and analyzing machines, robots, and people moving in a given physical environment more precisely, faster and more easily than ever before. Harmonizing the co-operation of these three elements is an indispensable task in the Industry 4.0 era.
The software uses an extensive anthropometric database to realistically model the geometric features of 99% of the human population. The simulation can be carried out for any nationality, gender, age group and body structure.
Seven internationally known and recognized ergonomic analysis methods have been integrated into the ViveLab Ergo Software. These methods include RULA (Rapid Upper Limb Assessment), OWAS (Ovako Working-



posture Assessment System), NASA-OBI (examines static physical forces affecting the skeletal and muscular systems) and the already standardized body position assessment systems, such as ISO11226 (evaluation of static working postures) and EN1005-4 (safety of machinery for human physical performance). Furthermore, the reachability test (measures the reach of the arms for the location of devices and objects) and the spaghetti diagram (measures the length of a journey by a worker) are also available. These methods evaluate the body postures and check whether the loads on different body parts exceed the acceptable limits. Some methods define only acceptable and unacceptable categories, while other methods use a scale of rating.Evaluation points are given based on each analysed factor. These are summarised at the end to indicate the risk category of the analysed object. This allows the user to determine the seriousness of the problem and the urgency of taking action.
The results can be seen in real time. It is also possible to create a PDF document of the detailed analysis with only a few mouse clicks. The report highlights the positions where ergonomic measures have to be taken to

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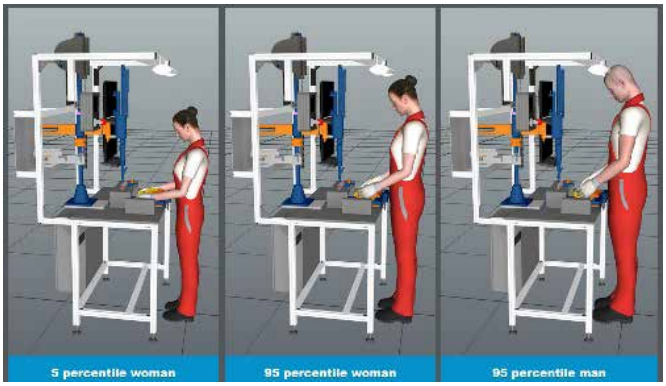

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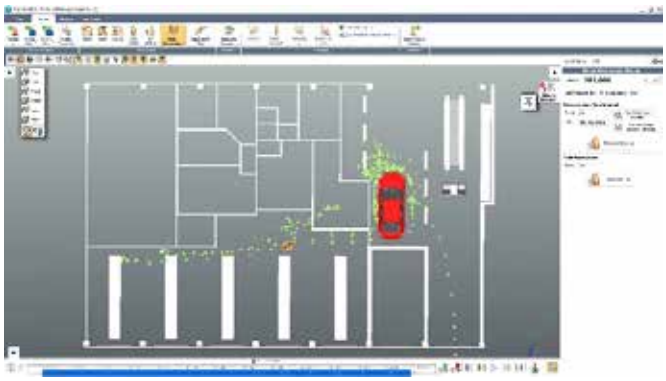
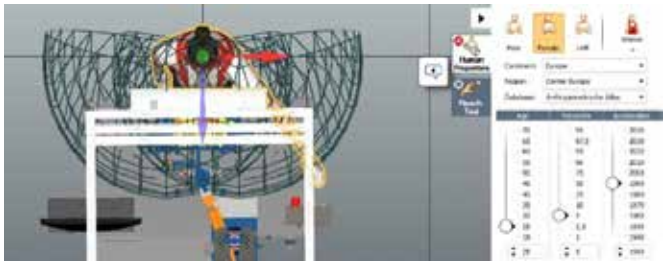
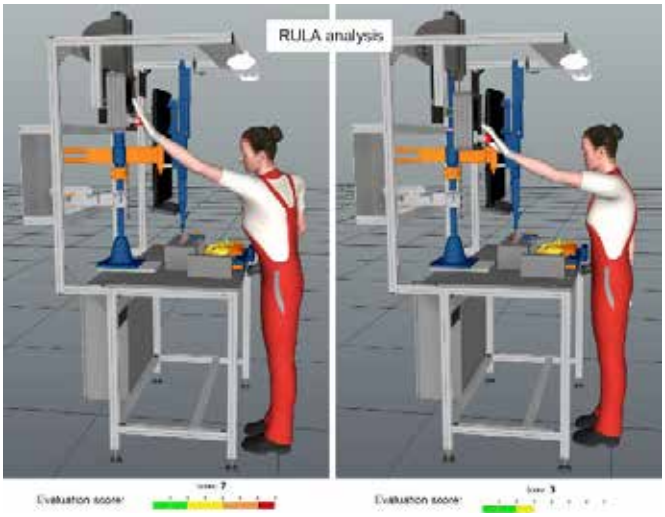




improve the quality of the workplace. In addition to the corrective analysis of existing workplaces, ViveLab Ergo also offers ergonomic analysis of new constructions during the planning phase, without the necessity of producing prototypes, by conducting virtual simulations.
All these steps can be performed independently by any user, even without a qualification in ergonomics. However, the company also provides a team of ergonomics experts that offer their services to help the users learn the software functions and to interpret the evaluation results.

The services of these ergonomics experts are available on request, and they make a significant contribution to successful outcomes. Thanks to the cloud-based software, the experts can be invited by the user from geographically distant parts of the world to collaborate in the user's own virtual laboratory. In this

way, they can carry out the analyses and interpret the results together.
To eliminate the problems that were identified during the analysis, the ergonomics experts will create an action plan that includes the necessary and recommended ergonomic measures with suggested deadlines. The action plan can include different possible solutions. The user can select the solutions from the action plan that best meet their goals and are within the company's financial framework.
Upon request, the entire process -- from the inspection in the production area through the motion measurement and analysis up to the evaluation of the results and the elaboration of the necessary measures -- can be carried out by the expert ergonomics team. The ergonomics experts can also optionally check which workplaces can be automated or where it is possible to employ ageing workers or workers with altered work abilities.



Conclusion

A satisfied employee can work in a concentrated, motivated and productive manner. A well-designed workplace that meets ergonomic requirements allows for comfortable and painless work. By optimizing workplace performance, reserves can be activated and productivity can be increased in the long run.