Is chunking a useful concept to reduce cognitive complexity while operating coating machines? Results from an experimental online study

Tina Morgenstern*, Esther Abraham, Ben Herrmann, Leonie Lude, Hanna Strauß, Arian Voigt & Franziska Bocklisch

*tina.morgenstern@psychologie.tu-chemnitz.de

Professorship of Cognitive Psychology and Human Factors, Institute of Psychology, Faculty of Behavioural and Social Sciences, TU Chemnitz, Wilhelm-Raabe-Str. 43, 09120 Chemnitz, Germany

Learning and problem solving works effectively when cognitive complexity is reduced so that processing capacity is not exceeded. According to Halford et al. (1998), cognitive complexity is defined by the number of relations between variables that must be processed in parallel. Currently, control systems in the engineering area often consist of many variables and relations that must constantly be monitored and adjusted. Thus, operators' processing capacity can be exceeded, which might result in errors. To minimize operators' processing load, (conceptual/perceptual) chunking (i.e., reducing variables into fewer, larger representations) could be used to design displays for control systems. Goal of our experimental study was (a) to create and evaluate test material to examine the impact of conceptual chunking on cognitive processing capacity in the field of thermal spraying and (b) to get some insight into the effectiveness of using such a strategy in this application. For this, an experimental online study was conducted using simplified versions of real thermal spraying displays. Participants (*N*=83, mainly students) were randomly assigned to one of two conditions in which the relevant information was presented using visual representations that favored/did not favor chunking strategies. We found a significant difference between the test conditions regarding completion time, meaning that participants in the unchunked condition needed more time to complete the tasks. However, test material had some limitations (e.g., regarding difficulty). Therefore, the material is currently being further developed to find more suitable presentations and to transfer results to thermal spraying, for instance, for developing cognition-based assistant systems.