Optimization-based Analysis and Training in Complex Problem Solving

M. Engelhart[1], **J. Funke**[2], **and S. Sager**[3]

Abstract: Over the last years, psychological research has increasingly used computer-supported tests, especially in the analysis of complex human decision making and problem solving. The approach is to use computer-based test scenarios and to evaluate the performance of participants and correlate it to certain attributes, such as the participant's capacity to regulate emotions. However, two important questions can only be answered with the help of modern optimization methodology. The first one considers an analysis of the exact situations and decisions that led to a bad or good overall performance of test persons. The second important question concerns performance, as the choices made by humans can only be compared to one another, but not to the optimal solution, as it is unknown in general.

Additionally, these test-scenarios have usually been defined on a trial-and-error basis, until certain characteristica became apparent. The more complex models become, the more likely it is that unforeseen and unwanted characteristics emerge in studies. To overcome this important problem, we propose to use mathematical optimization methodology on three levels: first, in the design stage of the complex problem scenario, second, as an analysis tool, and third, to provide feedback in real time for learning purposes.

We present a novel test scenario, the $IWR\ Tailorshop$, with functional relations and model parameters that have been formulated based on optimization results. The implementation of the new model features a web-based interface and uses the widely spread AMPL interface, which allows, e.g., the use of a variety of powerful optimization algorithms.

[1,3] Interdisciplinary Center for Scientific Computing
University of Heidelberg
Im Neuenheimer Feld 368, 69120 Heidelberg, Germany
{*michael.engelhart, sebastian.sager*}*@iwr.uni-heidelberg.de*

[2] Department of Psychology
University of Heidelberg
Hauptstr. 47–51, 69117 Heidelberg, Germany
joachim.funke@psychologie.uni-heidelberg.de