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**A methodology and software environment
for testing process model's sequential predictions
with protocols**

Frank E. Ritter

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School of Computer Science
Carnegie Mellon University
Pittsburgh, PA 15213

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Abstract

Getting the most out of information processing models requires that testing and refining them be straightforward. This requires that (a) large amounts of data be easily compared with the model's performance, (b) descriptions of how and where the model mismatches are readily available and easy to interpret, and (c) the models themselves can be refined in a straightforward way. Current methods for testing the sequential predictions of process models provides none of these. It is a difficult, time consuming, boring task, requiring the full attention of a skilled analyst. Despite the importance and difficulty of testing process models against protocol data, and in contrast to the rich methodology for analyzing samples of numerical data, there is no explicit methodology or set of tools for automatically or semi-automatically doing this task.

This thesis specifies a methodology for testing process models sequential predictions through comparison with verbal and non-verbal protocols. Each of its steps are delineated, and the requirements to perform these steps developed. An environment required by and based on the needs in this specification is built to support these needs and move towards automating them. These needs are primarily to judge the model's predictions by using them to interpret and align the data with respect to the model, to understand the comparison in terms of the model's strengths and weaknesses, and to then modify the model to improve its performance. Although not limited to symbolic models, the focus of this work has been models in the Soar architecture.

SPA-mode, a spreadsheet-type tool developed for this environment supports interpreting the model's predictions with the data. Its tabular display also supports simple visual analyses of the fit. Several graphic displays are developed as ways to summarize the model's performance. One shows which model actions are supported, and the others show the relative processing rate between subject and model. Both can provide suggestions for improving the model.

Process models in Soar exist implicitly in their production rules. By making the structure of these models explicit and allowing the user to directly manipulate the appropriate theoretical objects, the Developmental Soar Interface provides an improved ability to understand and manipulate process models built within Soar, the ability to use their theoretical components to summarize their support, and to use them in further analyses.

The complete Soar/MT environment is demonstrated and developed through use on the Browser-Soar model and its data set developed by Peck and John (1992). The analyses were produced far more rapidly than those used by the original developers, and extend further. Additionally, the verbal sequentiality assumption of Erikson & Simon's (1984) verbal protocol theory was tested, and found to hold. The sequentiality assumption is then extended to apply to motor actions as well. Sequentiality, however, does not appear to hold between modalities for this data set.