How Visual Cognition Influences Process Model Comprehension (Extended Abstract)

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Abstract: In this paper, we investigate the variation of performance of subjects in comprehension tasks in relation to process models. To reason about the complexity of comprehension tasks we take a theoretical perspective that is grounded in visual cognition. We test our hypotheses using a free-simulation experiment that incorporates eye-tracking technology. We find that model-related and person-related factors are fully mediated by variables of visual cognition. The work summarized here was published in [Pe17].

Keywords: Business process model comprehension; Visual cognition factors; Eye-tracking

1. Introduction

Existing work does not provide any explanation why certain process model comprehension tasks appear to be easy to solve than others. In this paper, we address this research gap from a theoretical angle. We analyze the comprehension process from the perspective of visual cognition in order to build hypotheses of comprehension task performance in relation to process models. We test our hypotheses using a free-simulation experimental design in order to integrate visual cognition data from an eye-tracking device. The results underline the importance of visual cognition for process model comprehension. Factors associated with visual cognition explain a good share of the overall variance in comprehension performance and mediate classical factors such as model complexity and personal differences. This has implications for designing process models in practice and for research on conceptual models altogether.

2. Research Model and Hypotheses

Building on Cognitive Load Theory, we formulate the following hypotheses:

- H1: Higher Personal Knowledge and lower Model Complexity lead to better Visual Cognition Efficiency (measured by Total Fixations and Duration of Fixations).
- H2: Lower Personal Knowledge and higher Model Complexity lead to higher Visual Cognition Intensity (measured by Scan Path Precision and Recall).
- H3: A Visual Cognition Efficiency (measured by Scan Path Precision and Recall) and Visual Cognition Intensity (measured by Total Fixations and Total Duration of Fixations) model better explains comprehension performance (higher Correctness, higher Efficiency, lower Duration) than a Personal Knowledge and Model Complexity model.

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- H4: The effect of personal knowledge on comprehension performance is mediated by visual cognition efficiency and intensity.
- H5: The effect of model complexity on comprehension performance is mediated by visual cognition efficiency and intensity.

3. Results

We conducted an experiment using eye-tracking and obtained the following results:

Hypothesis	Performance Dimension	Explanatory power	Support
H1	Total Fixations	**0.1189**	**Supported**
H1	Total Duration of Fixations	**0.1336**	**Supported**
H2	Scan Path Precision	**0.0236**	Partially supported
H2	Scan Path Recall	**0.0499**	**Supported**
H3	Correctness	Increase in Explanatory power: - **0.033** = (0.032 – 0.065)	Not supported
H3	Duration	Increase in Explanatory power **0.782** = (0.882 - 0,100)	**Supported**
H3	Efficiency	Increase in Explanatory power **0.249** = (0.359 – 0.110)	**Supported**
H4	Correctness	Familiarity mediated by Total Fixations, Total Duration of Fixations, SPP, and SPR	**Supported**
H4	Duration	Familiarity mediated by Total Fixations, Total Duration of Fixations, SPP, and SPR	**Supported**
H4	Efficiency	Familiarity mediated by Total Fixations, Total Duration of Fixations, SPP, and SPR	**Supported**
H5	Correctness	Elements mediated by Total Fixations, Total Duration of Fixations, SPP, and SPR	**Supported**
H5	Duration	Elements mediated by Total Fixations, Total Duration of Fixations, SPP, and SPR	**Supported**
H5	Efficiency	Elements mediated by Total Fixations, Total Duration of Fixations, SPP, and SPR	**Supported**

Tab. 1. Results Summary

References

[Pe17] Petrusel, R., Mendling, J., Reijers, H.A.: How visual cognition influences process model comprehension, Decision Support Systems, 96: 1-16 (2017).