EFFECTS OF EXPERTISE AND HYPERTEXT PRESENTATION FORMATS ON DYNAMIC MENTAL MODELS USING BOTH CLASSICAL AND NOVEL STATISTICAL SEQUENTIAL ANALYSES

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The study investigated whether hypertext comprehension is influenced differently when reading takes place in three different types of hypertext environments: semantically-organized, fully-connected, and linear-sequential. The surface and semantic structure of the hypertexts were carefully equated across the three knowledge domains of Psychology, Neuroscience, and Archaeoastronomy. Furthermore, the influence of domain knowledge expertise was investigated by considering undergraduates who participated as either having high content expertise (experts) in Psychology or in Neuroscience, or having low content expertise (novice) in these knowledge domains. All students navigated three distinct hypertext presentation formats or web sites while reading the content from three knowledge domains and thus acted as an expert, novice and a person with no content expertise for the neutral, Archaeoastronomy text.

This dissertation proposes a semantic-based content design theory reflecting the idea that a hypertext reader's mental model is not merely static but has dynamic features that guide sequential navigation and summarization behaviors. Conventional analysis of variance (ANOVA) complemented by a categorical sequential analysis, Knowledge Digraph Contribution (KDC) was used to observe effects of expertise and hypertext presentation formats on memory and traversal performance.

Both classical ANOVA and KDC analyses of traversal patterns suggest that experts compared with novices and participants with no content knowledge tends to visit less number of overall and irrelevant nodes (web pages) yet visit and spend more time on important or key nodes. Furthermore, these expertise differences were most prominent in the fully-connected (mesh) environment and least in the semantically organized hypertext (semantic-based) environment. Similarly, not only did experts tend to mention more important nodes and fewer irrelevant nodes across all three web presentation formats in their summary data but these expertise differences were most prominent in the mesh condition, and were minimized in the semantic-based presentation formats. Moreover, KDC sequential analyses revealed dynamic latent expertise traversal and summarization patterns by showing that experts were focused and generated semantically influenced navigation and summary patterns across all three hypertext presentation formats. Novice and participants with no content expertise were greatly influenced by the presented hypertext formats and also exhibited greater random erratic behavior in their summary and traversal patterns.

This dissertation supports advancement of human comprehension in web-based hypertext learning environments by exploring the traversal and summary behaviors between experts

and novices and, by identifying conditions where these levels of expertise are most or least prominent. Additionally, by integrating semantic network analysis methodologies from the fields of discourse analysis and cognitive psychology with new time-series data analysis methodologies, this project explored how expertise interacts with the semantic structural organization of a web-site by observing web-site navigational strategies and by the organization of free response summarization data. Furthermore, observed results are expected to have a broad impact on instruction, usability and web design as it pertains to education, content design and the promotion of more effective human-computer interactions (HCI).