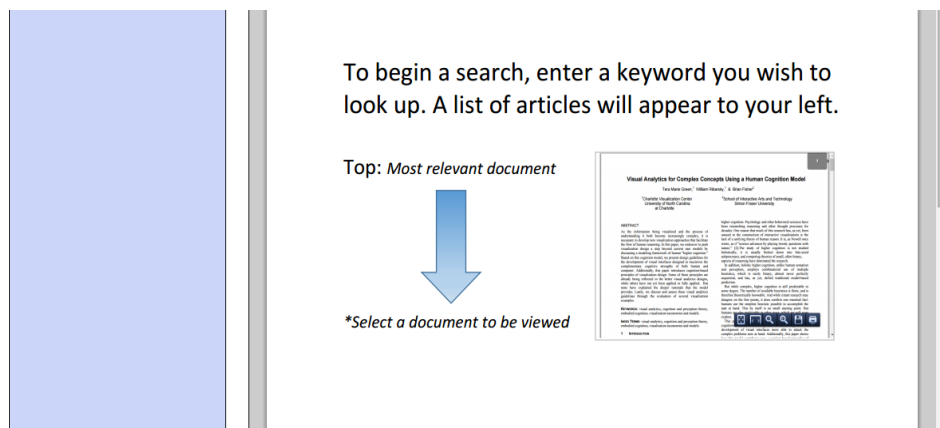
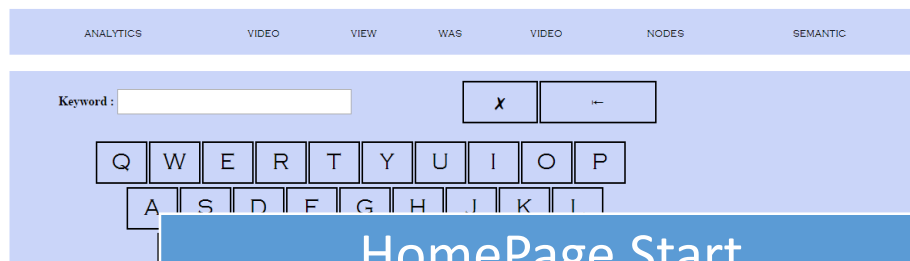


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Visual Analytics for Complex Concepts Using a Human Cognition Model

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ABSTRACT

As the information being visualized and the process of understanding it both become increasingly complex, it is necessary to develop new visualization approaches that facilitate the flow of human reasoning. In this paper, we endeavor to push visualization design a step beyond current user models by discussing a modeling framework of human "higher cognition." Based on this cognition model, we present design guidelines for the development of visual interfaces designed to maximize the complementary cognitive strengths of both human and computer. Additionally, this paper introduces cognition-based principles of visualization design. Some of these principles are already being reflected in the better visual analytics designs, while others have not yet been applied or fully applied. But

higher cognition. Psychology and other behavioral science have been researching reasoning and other thought processes for decades. One reason that much of this research has, as yet, been unused in the construction of interactive visualizations is the lack of a unifying theory of human reason. It is, as Newell wrote, as if "science advances by playing twenty questions." [2]. The study of higher cognition is not holistic; it is usually broken down into bits and sub-processes, and competing theories of small, often binary aspects of reasoning have dominated the research.

In addition, holistic higher cognition, unlike human sense and perception, employs combinatorial use of many heuristics, which is rarely binary, almost never purely sequential, and has, as yet, defied traditional modeling and prediction.

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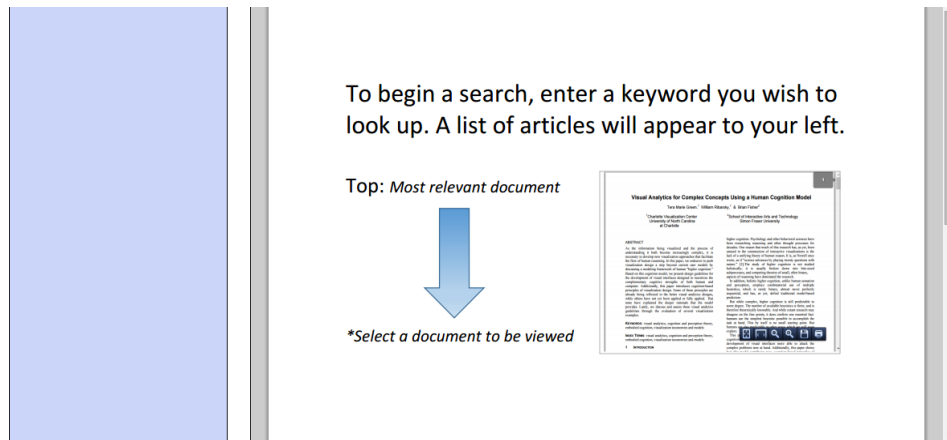
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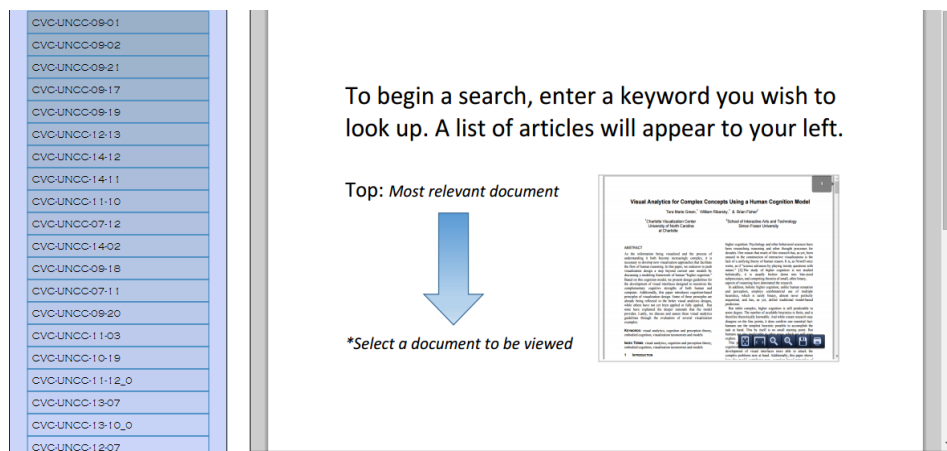
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