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Adapting the Cognitive Walkthrough Method to Assess the Usability of a Knowledge Domain Visualization

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Abstract

The usability of knowledge domain visualization (KDViz) tools can be assessed at several levels. At the user interface level, how easily users can learn to navigate and use a tool can be examined. At the user performance or outcome level, how successfully a tool helps users accomplish their tasks also can be investigated. Cognitive Walkthrough (CW) is a well-known usability inspection method that focuses on how easily users can learn software through exploration. Typical applications of CW follow structured tasks where user goals are reasonably well-defined and action sequences leading to those goals are known. KDViz and other information visualization tools, however, are typically designed for users to explore the data being visualized and user goals, tasks, and actions are harder to define. Users may be working to achieve broad, unstructured goals and may be engaged in multiple, evolving tasks simultaneously. Creating meaningful action sequences for these systems for use in CWs is challenging. In this paper, we describe how the traditional CW method may be adapted for assessing the usability of these systems. We apply our adaptation of CW to CiteSpace, a KDViz tool that uses co-citation and other bibliometric analyses to create visualizations of scientific literatures. We describe usability issues identified by the CW and discuss how CiteSpace supported the completion of tasks, such as identifying research fronts, and the achievement of goals. Finally, we discuss improvements to the adapted CW and issues to be addressed before applying it to a wider range of KDViz systems.

Document Co-Citation Analysis

Wasserman, S., Faust, K., Iacobucci, D., & Granovetter, M. (Eds.) (1994). *Social Network Analysis: Methods and Applications.* Cambridge, UK: Cambridge University Press.

Granovetter, M. S. (1973). The strength of weak ties. *American Journal of Sociology, 78*(6), 1360- 1380.

Haythornthwaite, C. (2002). Strong, weak, and latent ties and the impact of new media. *The Information Society, 18,* 385–401.

Among 120 citations in the article

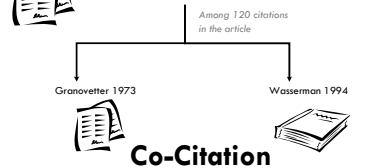Granovetter 1973   Wasserman 1994

Co-Citation

Figure 1. The main CiteSpace screen that the evaluators used. The visualization is the colorful area in the center. The area on the right controls important parameters. The area on the bottom is a readout area when nodes are selected and more information about the node is needed.

Fictive User

Before the CW begins, evaluators create a "fictive user" who they will pretend to be during the walkthrough. The more thorough the fictive user description, the more easily evaluators can put aside their own knowledge and biases.

Education
Is a graduate student pursuing a master's degree in information science. Is currently taking a graduate seminar on information visualization.

Relevant work experience
Has 3-5 years experience designing information systems, primarily databases accessed through web browsers. This experience included graphical and user interface design work. This experience also included some programming and administration.

Experience with user interface design and usability assessment
The user has taken two courses in human-computer interaction and has designed user interfaces as part of class projects and professional work

Operating systems and software packages used frequently (at least once a week)
Microsoft Windows XP, Apple OS X, Microsoft Office (Word, Excel, PowerPoint), Microsoft Outlook, Microsoft Internet Explorer; Mozilla Firefox; Apple iTunes; Microsoft Media Player, Adobe Photoshop; Adobe Illustrator; Macromedia DreamWeaver

Experience with bibliometrics, co-citation analysis and related LIS topics
Has been exposed to these topics in readings and coursework. Has conducted several bibliometric analyses as part of class projects.

Experience using CiteSpace or other tools for visualizing literatures/domains
Has seen demonstrations of CiteSpace and several other information visualization tools during coursework and has read one short, general textbook chapter about the field. Has never used CiteSpace or a similar tool to visualize a literature in support of a class or professional research project.

Experience with digital libraries and databases such as ISI Web of Science, LEXIS-NEXIS, Dialog, etc.
Uses Web of Science and ACM Digital Library around weekly for research to support class projects

Experience with social network literature
Very little experience with social networking literature. Has heard the term occasionally discussed during coursework and has read one short, general textbook chapter about the field. Has never taken a course, conducted a literature search, or written a term paper about social networking. Does not know names of important authors, papers, or journals in the field. Does not know any "hot topics" in social networking.

User Tasks for Session

Evaluators are given a larger goal of preparing to write a term paper about the social networking literature. To do this, we asked them to complete the following <u>tasks</u>:

1. Identify important clusters or research areas in the domain

2. For the important clusters, identify critical authors, terms, and papers that serve to characterize or describe the cluster

3. From the important clusters, identify new and active ones that may constitute a research front or revolution in the domain

4. Identify important connections between clusters.

Original CW Method	Adapted CW Method for KDViz
Will the user be trying to achieve the right effect?	What effect was the user trying to achieve by selecting this action?
Will the user know that the correct action is available?	How did the user know that this action was available?
Will the user know that the correct action will achieve the desired effect?	Did the selected action achieve the desired effect?
If the correct action is taken, will the user see that things are going ok?	When the action was selected, could the user determine how things were going?

Table 1. Because KDViz systems are exploratory and the "correct" sequence of actions is not defined, the standard CW questions must be modified. The left column presents the traditional CW questions. The right column shows the adapted versions of these questions used in the study.

Results

- Evaluator/users were able to identify
  - Important clusters in domain
  - Important works, authors, terms in the prominent clusters
  - New & active clusters (research fronts)
  - Connections between clusters
- About 2 hours to complete
- Identify several usability problems
  - Provide information to CiteSpace developer
- Expert reviewed evaluators' conclusions about the domain, judged to be accurate & reasonable

Future Work

- Now we have one "correct" action sequence for social-networking literature
  - Could rerun with more traditional CW questions
  - Better sequences for this literature; how applicable to others?
- How can KDViz communicate limitations of the underlying data?
- Communicate capabilities of the tool?
- How to support examination of cause-effect?
- How to encourage good strategies without restricting exploration & interactivity?
- How can CW better handle systems where the "correct" action sequence is hard to determine?
- How can CW better handle systems where the goal is exploration & enjoyment?
- How can CW better handle systems where the goal is social interaction?

Figure 2. The yellow area is a cluster of recently published articles in the small-world-networks cluster. Documents in this cluster cite each other frequently and were all published at about the same time.

Figure 3. This shows a connecting document (Wellman, 1990) that creates a connection between two large structures in the field. Evaluators were able to identify this document without prioir knowledge of the social networking field.