Getting a Picture of Your Thoughts: Interactive Visualization for Creative Work

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ABSTRACT

Creative work – especially in business – is often connected to highly complex data. While current software tools support manifold areas in working with complex data, they are very limited to support creative work. Little research has been done on what kinds of representations are supporting the externalization of mental efforts in the best way. Especially it is very challenging to give abstract mental concepts an appropriate representation. This doctoral research is creating and investigating novel approaches combining visualizations, interaction concepts and memory techniques to create design guidelines for interactive visualizations for creative work. First experiments have been conducted and the key principles are implemented partially in a prototype called BrainDump.

ACM Classification Keywords

H.5.2. Information interfaces and presentation: User Interfaces – Theory and methods

General Terms

Design, Experimentation, Theory

INTRODUCTION

Creative business work – such as decision making, problem solving, or planning – faces a continuous change between analysis and synthesis. This interdependent process has been coined *reflection-in-action* [p.21, 6]. Neither structure nor amount of data needed during this process is known in advance. A given task is incrementally structured and is subject to highly dynamic change. This results in conflicting goals: on the on hand as little effort as possible should be necessary for creating visualization patterns for creative work, while on the other hand the model should be as much expressive as possible.

The majority of current software tools imply that the goal of a task is clearly specified and the steps towards the solution are known in advance [4]. Thus the interaction is determined by the systems architecture and data constraints. This approach hinders the creative process in its early phase, what makes traditional materials such as whiteboards, pen and paper still most attractive for creative workers. Available software tools focus on displaying and modifying content. Thereby the structure of the mental state of a creative task exists only in the user's mind. However, internal mental representations perform poorly on reflecting upon them or making sense of complex and rich object relations or associations. Consequently, there is a need for well designed external representations that can support this process [5]. The aim of this doctoral research is to identify principles for the visualization of the structure of mental images and connections. As a result these findings shall lead to design guidelines for interactive mnemonic visualizations for creative work. These guidelines are identified through the development and evaluation of experimental setups and prototypes, which are based on initial requirements:

- Task based interaction: the interaction with the system should require as little cognitive effort as possible from the user. "People should learn the task, not the technology".

- Providing an overview: flexible visual shaping of the structure of the ideas, associations and mental concepts should be supported. Important information should be visually prominent.

- Modifying the overview: it should be possible to directly modify the overview (reflection-in-action) while it is being created.

- Flexible (re-)structuring of information: because of the constant dynamic changes, important information can be less important in a next step and vice versa. Thus focus and significance of information needs to be adapted in a dynamic way.

- History: the single steps of the creative process should be saved for later reuse and reflection.

INITIAL EXPERIMENT: THE EXPLORE TABLE

Experiments for inspiration on interface design were conducted using a self-made table setup called eXplore Table [2]. This setup uses a glass plate for the interaction with physical substances. Cameras were filming the experiments from the top and bottom of the glass. Participants had to use real physical substances such as rice, plasticine or eggs. Through their daily life, people have a natural way of interacting with those substances. For instance: plasticine is formed and rice is pushed. This is fundamentally different to the widely spread and dominant

paradigm of mouse and keyboard interaction. Touch-sensitive devices like touch-pads have no need for the cursor-hand-eye detour like desktop systems. Data can be shaped directly by hand. The participants were given the task to imagine that the physical substances on the table setup are like digital data. With these they should perform basic interactions like linking, separating, copy and paste, erasing and creating. Two main goals are pursued with these experiments:

- Visualization: Learning from nature and finding principles for optimal design of visualizations.

- Interaction: Identifying affordances for different substances to interact with them.

The filmed experiments and examples of the first digital prototypes can be seen in a video summary [2].

CASE STUDY: BRAINDUMP

Bringing the observed flexibility of changing fluid structures together with the idea of doing research in the internet, we created a first prototype named BrainDump [1]. The focused type of task is information gathering during web browsing sessions. While performing such a task, the structure and amount of required data is not known in advance. The system provides the possibility to create and manipulate visual images of mental connections in a dynamic way. This is done easily via one single step of interaction. Therefore the focus is on the user's creative work without being distracted by figuring out how to use the system. Further features are: keeping the links' entire information, i.e. source data, annotate content, and hierarchically group collected items. A first user test with 9 participants was designed and conducted, showing that participants understood the purpose of BrainDump completely. All of them would like to use the application more often in their daily work. Participants especially appreciated the easy way to visually change relations and associations between information [1]. An advanced follow-up version of the prototype for multi-touch interaction will be implemented on a tablet-pc.

FIRST CONCLUSION AND FUTURE WORK

In creative business work, problem analysis and solution synthesis are fundamentally interdependent. As they are alternating constantly, information structure is not predefined but changing in a highly dynamic way. It is essential for users to keep track of their mental efforts through visual externalization and to be flexible in changing the shape and structure of this visualization. The next challenge will be to identify implicit affordances for interaction of objects which can be transferred into rich interaction patterns. Since it might be hard for test participants to report on their own mental processes, it will be a further step to analyze methods for measuring results of such processes [3] using BrainDump or similar tools. Participants have already been filmed and asked questions using the first prototype of BrainDump.

Design guidelines for interactive visualization for creative work beyond mouse and keyboard will be derived using these results together with knowledge about affordances of objects for interacting as well as the conclusion of measuring the results of thought processes.

BIOGRAPHY
Marius Brade is a Ph.D. candidate in Media Design at the Chair of Media Design, Department of Computer Science at Technische Universität Dresden in Germany. His PhD program is a specific co-operation between industry and academia. The partner from industry for his research is the User Experience Research Practice at SAP Research. Before starting his doctoral study, Marius obtained a Diploma in Media Computer Science from the Technische Universität Dresden (2009). Next to his studies Marius attended several courses at the Academy of Fine Arts in Dresden. During his studies he developed a deep interest in how people think and memorize information.

REFERENCES
1. Brade, M., Heseler, J. and Groh, R. An Interface for Visual Information-Gathering During Web Browsing Sessions: BrainDump – A Versatile Visual Workspace for Memorizing and Organizing Information. Proceedings of the Fourth International Conference on Advances in Computer-Human Interactions (Le Gosier, France, 2011), 112-119.

2. Brade, M., Kammer, D., Keck, M. and Groh, R. Immersive Data Grasping Using the eXplore Table. Proceedings of the Fifth International Conference on Tangible, Embedded, and Embodied Interaction (Portugal, 2011), ACM Press, 419–420. Video: http://www.youtube.com/watch?v=ygAq8JHGtvM

3. Kerne, A., Smith, S.M., Koh, E., Choi, H. and Graeber, R."An Experimental Method for Measuring the Emergence of New Ideas in Information Discovery." Taylor & Francis. International Journal of Human-Computer Interaction. Issue 5, 2008, Volume 24, 460-477.

4. Nakakoji, K., Yamamoto, Y., Takada, S. and Reeves, B.N. Two dimensional spatial positioning as a means of reflection in design. Proceedings of ACM DIS '00. ACM, 2000, 154.

5. Russell, D., Stefik, M., Pirolli, P. and Card, S. The cost structure of sensemaking. Proceedings of ACM CHI '93. New York: ACM, 1993, 269-276.

6. Schön, D. A. The reflective practitioner: How professionals think in action. Basic Books, New York, 1983.