

Using Interactive Design Activity Visualizations for Supporting Collaborative Sketching Sessions

Florian Geyer, Jochen Budzinski, Harald Reiterer

Human-Computer Interaction Group, University of Konstanz

Universitätsstraße 10, 78457 Konstanz, Germany

{firstname.lastname}@uni-konstanz.de

ABSTRACT

In this paper we describe a novel approach for supporting co-located collaborative sketching sessions. Our system is based on digital pen & paper and an interactive visualization that can be used by a session facilitator for examining live design activity. We argue that such visualizations may provide benefits for improving creative group work without the need to change traditional practices.

Author Keywords

Sketching, digital pen & paper, design activity visualization

ACM Classification Keywords

H.5.3 Group and Organization Interfaces: collaborative computing, computer supported cooperative work

INTRODUCTION

Designers frequently collaborate on design problems and design solutions in sketching sessions during early phases of the design process [1]. By externalizing, annotating and discussing sketches in a group, designers are able to generate and refine ideas by not only reflecting and modifying their own ideas, but also each other's ideas. This re-interpretative cycle is often considered a key ingredient of creativity [4]. Several studies have shown that groups can produce more and better ideas than individuals, however, under the premise that inhibitors are minimized. Social factors like evaluation apprehension, production blocking or free riding (social loafing) [5] as well as fixation effects [3] have been shown to have dramatic effects on a group's performance in co-located settings. Consequently, creative sessions may be facilitated by a professional who directs the group's activity with the goal to minimize the negative effects of these factors [1].

Despite recent developments in ubiquitous computing technology, many digital sketching tools replace existing physical practice by entirely digital means (e.g. tablets or tabletops), thereby changing not only the methods that can be applied in the group, but also traditional, often paper-

based workflows that are used to cope with social inhibitors. Often, these tools do also not care for a session facilitator, thereby limiting the control such a trained professional can have over the group activity.

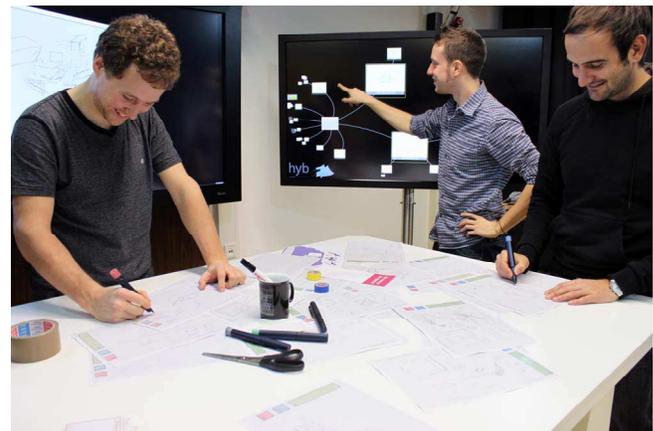


Figure 1. Our system combines digital pen & paper and interactive design activity visualizations.

In our research, we have developed a more subtle approach for supporting sketching sessions with *interactive design activity visualizations*. Therefore, our system combines digital pen & paper tools with interactive visualizations that can be used by creative facilitators for analyzing live sketching sessions. The system generates an interactive visualization from collaborative sketching activities that are performed by a group on traditional paper (see Figure 1).

DESIGN ACTIVITY VISUALIZATION

From a detailed analysis of literature, by observing traditional practices and by interviewing a professional creative facilitator, we have learned that facilitators may benefit from an overview of the process, the ideas created and the re-interpretations made during sketching sessions. Therefore we developed a mechanism that utilizes stroke data retrieved from digital pens to keep track of all changes made on paper over time and their relation to their authors or annotators. Based on the identification data of different pens and different paper sheets, we were able to track a trajectory (time-ordered set of states within a dynamical system) of idea progression or forking as well as original authors or modifiers and annotators.

Figure 2 describes this procedure in detail. Once a sketch is produced on paper, a digital version is recorded in the system

(Figure 2, 1). It stores the pen id and the paper id. When a different pen is used on the same sheet of paper (modification or annotation), a second version is linked to this item (Figure 2, 2). This continues for each unique pen that is used on that paper, building a chain of versions (Figure 2, 3). In the case that paper is duplicated by a print command (available to the users via a paper interface button), the system forks the trajectory, creating a tree-like versioning history (Figure 2, 4). For the printout and the original, the procedure may continue recursively from the second step (Figure 2, 2).

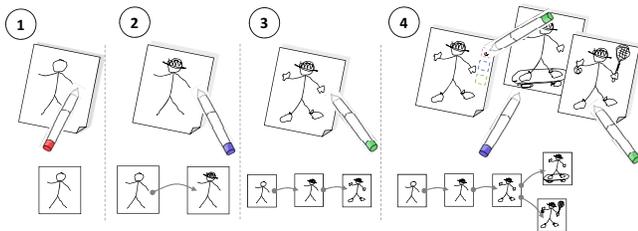


Figure 2. Digital stroke data is analyzed for creating trajectories of ideas, manipulations and their authors/annotators.

We used the data provided by the versioning trajectory for the design of an interactive visualization for supporting facilitators. Because extensive sketching sessions result in a large number of ideas and very deep trajectories, we decided that a focus & context visualization technique would be most adequate. We found an adequate concept in the hyperbolic tree visualization [2], which supports the interactive exploration of large hierarchies within a circular fisheye view. We adapted the concept for our purpose, using sketches as nodes (see Figure 3). Sketches that are produced during the session are dynamically added to the tree in clockwise direction around a central node (see Figure 3, 1). The central node serves as a hub, displaying statistical information such as the number of unique ideas, the number of pens and a link counter (which is a measure of the degree of re-interpretation). Once links are created in the trajectory, child nodes are dynamically added to the tree (see Figure 3, 2) which makes it grow over time. We use color coding around the border of the sketches to indicate whether a sketch is an original, a re-interpretation or a copy (see Figure 3, 3). Sketches that are currently being manipulated by the participants of the session are highlighted with a circular glow that fades over time (see Figure 3, 4). This awareness mechanism allows a facilitator to detect the current focus of the group's activity.

A facilitator can interact with the visualization with touch gestures. By dragging the tree to the center of the display, the respective nodes are enlarged for a more detailed view. At the same time, nodes that are situated at the opposite end of the central node are scaled down, thereby keeping the context in reach of the facilitator. Zooming gestures can be used to focus on a specific node in detail (tap gesture) or to examine a region of the tree (pinching gesture). Each node is a live

view of the paper sketch, instantly displaying the stream of strokes from all digital pens.

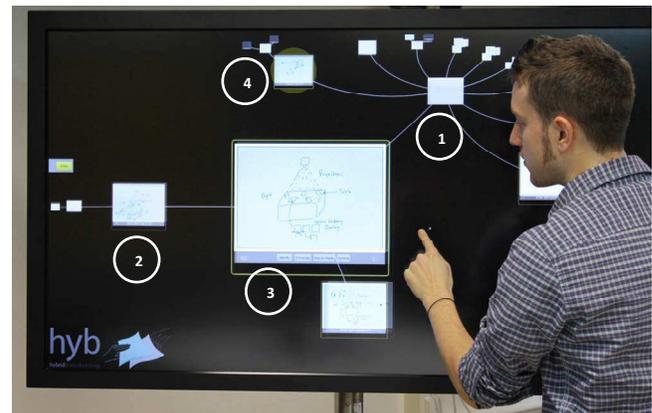


Figure 3. An interactive hyperbolic tree visualization conveys the recorded data for exploration by the session facilitator.

CONCLUSION

In this paper we presented a novel approach for supporting sketching sessions with interactive visualizations of design activity. Our design activity visualization conveys information such as the history of the session (clockwise arrangement), the number of ideas (size of the tree), the degree of re-interpretation (depth of the tree), fixation (uneven distribution of nodes) and the activity of the group (highlighting). We argue that this information can be used by a creative facilitator to detect inhibitors or fixations for better controlling the session. The visualization allows augmenting collaborative sketching sessions without the need to change traditional practices. In future user studies, we will examine if and how professional facilitators can make use of this information and how it might influence the creative process.

REFERENCES

1. Herring, S. R., Jones, B. R. & Bailey, B. P.: Idea generation techniques among creative professionals. In Proceedings of HICSS'09. IEEE. 1-10. (2009)
2. Lamping, J., Rao, R., Pirolli, P.: A focus + context technique based on hyperbolic geometry for visualizing large hierarchies. In Proceedings of CHI '95, ACM Press. 401-408. (1995)
3. Purcell, A.T., Gero, J.S.: Design and other types of fixation. *Design Studies*. Vol. 17, 363-383 (1993)
4. Schön, D. A.: *The reflective practitioner: How professionals think in action*. Basic Books. (1983)
5. Warr, A. & O'Neill, E.: Understanding design as a social creative process. In Proceedings of C&C'05. ACM Press. 118-127. (2005)