

CoSke: An Exploration in Collaborative Sketching

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ABSTRACT

Collaboration is a helpful tool for inspiring creativity and promoting idea generation. To assist sketch collaboration using digital sketching, we developed CoSke (short for Collaborative Sketching), a server application that lets multiple users, each sketching on their own client, draw collaboratively on a shared canvas. We performed a user study to investigate how users react to varying methods of collaborative interaction, comparing the shared digital canvas to traditional pen and paper methods, as well as same room versus distinct locations. User surveys recorded participants' qualitative opinions about the methods. Points of communication such as hand gestures, eye contact, and contribution were recorded by proctors. The results from these metrics along with user study comments suggest that paper-based methods may impede collaboration due to the physical constraints inherent in a shared physical drawing space, and that speech is vital to effective sketch collaboration. Proctor recordings also provide insight into which face-to-face methods of collaborative communication can be translated into the digital realm. Further examination of the data collected from this and future studies will provide further insight to these questions and guidance on how developers can envision and build a system that will truly provide for the capabilities and natural flow of face-to-face human sketching communication.

Author Keywords

Collaborative Sketching, Digital Drawing

ACM Classification Keywords

H.5.3. Information Interfaces and Presentation: Group and Organization Interfaces—collaborative computing, computer-supported collaborative work

General Terms

Design, Experimentation, Human Factors, Performance

INTRODUCTION

Collaborative sketching has been shown to benefit idea generation [2]. Several collaborative sketching programs have been developed over the web or for mobile devices, such as [1] and [3]. Despite the existing benefits of collaborative digital sketching, most current problems are inconvenient due to either their over-simplified canvases or small sketching areas. The goal of this project is to design a

program tailored to how users draw not only in a digital setting but also collaboratively. By using iterative design and focusing studies on the benefits of digital over analog drawing and optimizing collaborative techniques, CoSke can become an effective digital shared canvas program.

COSKE

CoSke is a client-server collaborative sketching tool that allows users to draw on a shared drawing surface from multiple computers. The server accepts connections, listens for commands from clients over sockets, and relays string-encoded messages to all clients. Four different types of messages are transmittable: process a stroke segment or complete stroke, clear the screen, and change a user's drawing color. Note that a user erases by changing his or her color to white. Each message contains the operation identifier, followed by the necessary parameters for the clients to perform the tasks correctly. Figure 1 shows an example of the communication that occurs when a stroke is completed. The user interface consists of the drawing area, a color selection palette, a slider to change the size of the brush, and buttons to clear or save the image.

EXPERIMENT

We performed a user study composed of twelve participants in four equal groups. Groups were asked to complete three collaborative drawing tasks: same room using pencil and paper (analog), digitally using CoSke in the same room, and digitally while isolated. The three scenarios were to draw a scene of a house, dragon, and bowl of fruit. Task and scenario order was varied to help remove order bias. Each exercise was observed by a proctor who would mark when users used hand gestures, made eye contact with other users, evoked different emotions or facial expressions, and approximately how much they contributed to the image. After users drew the images, they were given a survey

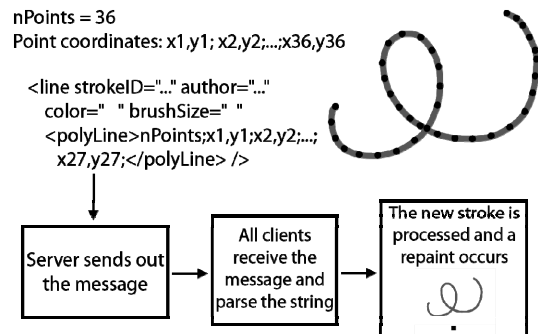


Figure 1: Example communication between CoSke server and clients

asking to rank the methods and explain the rationality behind their rankings; to compare the same room methods, describing which felt more intuitive, easier to use, etc; to compare the digital methods, describing difficulties they had with interaction, etc.; whether they felt like there was a definite leader within the group and how it affected their drawings; and what they felt was the most effective way to communicate with the others in their group in all situations.

RESULTS

We performed an initial examination of the results of the user surveys and proctor recordings. In this examination, disadvantages attributed to paper-based methods focused on fundamental, unchangeable components of the interface. Contrarily, the noted digital disadvantages were concentrated solely on fixable technical issues, such as the program reacting slowly, no undo operation, etc. Specifically, in the paper-based version, users implied that paper impeded the participant's ability to collaborate because the shared physical space restrained their ability to participate as they would otherwise. This was particularly relevant, as although none of the questions specifically addressed the physical interaction of paper sketching, 10 of 12 users, including every user who preferred the paper interface, specifically commented on how paper affected their ability to collaborate because of the shared physical space. One user who preferred digital commented, "The digital method was easier because you didn't have to worry about the physical constraints of the other's hands. You could draw in the same spot more easily." *Given that users felt obliged to mention this perception suggests the importance of further research on the following questions: Does paper impede sketch-based collaboration? Do users need their own "space" in order to collaborate effectively?*

Combining speech with sketch also proved to be pivotal for effective collaboration. Nine participants preferred having others in the same room specifically because it allowed for talking, providing several comments stating that the lack of speech made communication difficult. Interestingly, the three who preferred interacting without speech also noted that the lack of speech impeded collaboration; one user stated, "Isolated drawing made me feel like I was interacting with a language I knew nothing about and yet spoke more naturally than English... Interaction is very hard to coordinate when isolated, but once immersed, it becomes constant." The element of speech also contributed to whether or not a leader emerged in the group. Ten users felt there was no definite leader and only one admitted to taking a leadership position, stating that by being able to communicate, he did not feel the need for a leader. The proctor's recordings support the user's interpretation; contribution was relatively equal in each drawing scenario.

Proctor statements revealed that users always made more eye contact and hand gestures, as well as sharing writing



Figure 2: Examples of sketches from the user study. From the top left clockwise (scene and then drawing locale): A house, digital isolated; a dragon, digital same room; still life, pencil and paper

utensils, during analog drawing sessions. Further research can be done in discovering how to mimic these actions in CoSke, especially when the users are isolated, to make the digital environment as close to paper and pencil as possible.

SUMMARY

The research describes CoSke, an intentionally limited collaborative client-server drawing system, and a user study comparing paper versus digital and isolated versus same-room collaborative interactions. The results of the study suggest that speech and a user's ownership of their own space aid collaboration, and provide some insight as what features of face-to-face communication could be translatable into the digital realm. Over the next year, we expect further user studies, research, and CoSke programmatic enhancements, such as wall-drawing, LED pens, and IR cameras, to provide more insight into how we can enhance digital collaboration.

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