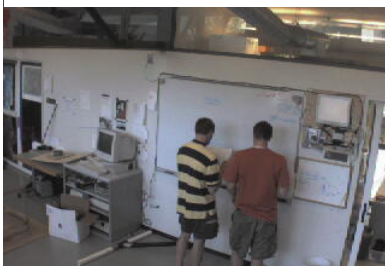


Drawn Together Whiteboard Sketching in Engineering Design

Wendy Ju
Center for Design Research
Stanford University
wendyju@stanford.edu



Figure 1. Members from a design team collaborate on a state diagram. Notice how they switch “driver” and “navigator” roles, and frequently “pull over” to discuss their work.



“Drawing is a way of communicating with the world, of listening to what the world has to say and answering back.” –Peter Steinhart, “The Undressed Art: Why We Draw”

Sketching is an important tool in the collaborative engineering design process. Despite the enduring myth of the single genius designer, most projects of any significant scale are undertaken by design teams. In studying design teams in a project-based learning environment using a system called WorkspaceNavigator [Ju ‘04], we have observed how whiteboard sketching plays an important role in the sharing of ideas, the development of details and the generation of consensus. In this position paper, we will draw upon examples from data captured during the course of a team project in a graduate mechatronics class to discuss the role whiteboard sketching plays in engineering design, and the implications for the design of collaborative sketching technologies.

In the mechatronics course, we observed teams using the shared laboratory whiteboard for a great variety of activities: Teams used the board to propose physical form factors; They wrote lists of things to do; They developed state diagrams for their robots; They worked on shopping lists for materials and tools. Given the wide variety of things that must be collectively decided and done, the whiteboard’s versatility is a boon. Also useful is the impermanence of the ink; the ephemerality of ideas written in wipe-away ink suit the provisional nature of the information recorded, and encourages correction, and contribution from team members that permanent ink on paper would not. In our record of whiteboard activity, we found that constant revision of sketched ideas was common as the team members debated and refined their plans.

One common misconception that people have is that the primary result of sketching activity is a sketch. We have found that the sketch is not a complete representation of the sketching activity, only an artifact of the social interaction. Sketchers work nearly in shorthand, focusing on communication, and recording only enough information

to provide visible representation to the idea at hand; writing from such sketch sessions is often illegible or incomprehensible to post-facto observers. The context, gestures, conversation, as well as the tacit understanding which accompanies the drawing are important aspects of the sketching activity [Tang '88]; this is a reason why ideas captured in a sketch are seldom transferable to non-participants unless the sketch is accompanied by a descriptive narrative. However, sketches may still serve as a powerful tool in framing or anchoring discussions, much as a photo portrait might make the description of a person more vivid.

Perhaps because sketching is part of a social dialogue, we have observed that though people often stand close to the whiteboard when collaborating [Russell '02], it is extremely rare for two people to sketch simultaneously at a whiteboard. Instead, one person draws while the others on the team stand back. The observers are not necessarily passive; in fact, we often observe them behaving as "navigators" to the "driver" at the board. This role-playing and turn taking may help provide insight into different aspects of sketching activity—it is not solely about putting ideas out, but also about reflection and refinement.

These qualities of whiteboard sketching—versatility, mutability, performance and dialogue—highlight both the promise and shortcoming of current digital whiteboard systems for collaborative idea generation. Many systems, such as the SmartBoard system from Smart Technologies, are primarily presentation tools with “whiteboard” capabilities built in. Presentation software such as Microsoft Powerpoint makes it possible to introduce prepared material to the sketching activity, but this material is not as editable as wipe-away ink, and achieves neatness and accuracy at a cost to versatility of form. These systems can record the sketches, not only in snapshot form, but also as time-lapse movies; this, however, runs the risk of emphasizing the sketch above the sketching, making for less social dynamic and flow. Finally, we theorize that it is this focus on presentation, this sacrifice of the social dialogue to the neatness of presentation quality artifacts, not the inability for multiple people to sketch simultaneously, that makes digital whiteboards less conducive than their old-fashioned counterparts to good whiteboard sketching activity,

References

Ju, W., Ionescu, A., Neeley, L., Winograd, T. "Where the Wild Things Work: Capturing Physical Design Workspaces." In Proc. of Conference on Computer Supported Cooperative Work. November 2004. Chicago, IL, 533-541.

Tang, John C., and Larry J. Leifer. "A framework for understanding the workspace activity of design teams", Proceedings of Conference on Computer-Supported Cooperative Work, Portland OR September 1988, pp 244-249.

Daniel M. Russell, Clemens Drews, Alison Sue, Social Aspects of Using Large Public Interactive Displays for Collaboration, Lecture Notes in Computer Science, Volume 2498, Jan 2002, Page 229

Biography

Wendy Ju is a doctoral candidate at Stanford University. Her research interests lie in the arena of interaction design; her dissertation is focused on the design of implicit interactions. Wendy is also Editor-in-Chief of *Ambidextrous*, Stanford University's Journal of Design.