

egaku: Enhancing the Sketching Process

Jennifer Yoon, Kimiko Ryokai, Chad Dyrner, Jason Alonso, and Hiroshi Ishii

Tangible Media Group, MIT Media Lab

20 Ames Street

Cambridge, MA 02139

{jennyoon, kimiko, cdyner, jalonso, ishii}@media.mit.edu

1 INTRODUCTION

Architects sketch using a translucent vellum tracing paper with a thick pencil or marker. The translucency of the paper allows architects to employ a layer-drawing technique for the exploration of ideas derived from their basic design. For example, working with a single base layer such as a map of the site, architects can design upwards of *hundreds* of possible variations. This ultimately leads to a great pile of drawings, which compose the piles of papers typically strewn about an architecture studio. Individually, these “referential” sketches represent small pieces of a much larger design concept [Graves 1977]. Although they are valuable, they are often cumbersome to manage during the ideation process because it interrupts the flow of ideation, and even difficult to understand when a single sketch is taken out of associated sketches.

Traditionally, augmented drawing systems attempt to digitize the sketching process by eliminating the paper interface, and having users draw on a digital sketching surface with digital ink [Aliakseyeu 2002; Mackay et al. 1993]. This, in effect, removes the tactility and intimacy offered by the basic tools of pencil and paper architects are used to.

2 ANALYSIS OF ARCHITECTURAL SKETCHING

Our observational studies with architects show that architects use the papers to capture roughly the following different relationships between individual sketched layers: 1) Map/Base (e.g., working with the floor plan of the site); 2) Structural (1st floor, 2nd floor, etc.); 3) Alternatives (e.g., the same site may have alternative designs); 4) Scale (detailed/magnified drawing); 5) Additives (chronological progression). *egaku* (a Japanese word for “sketch” or “draw”) is our attempt to support architects’ ideation process by retaining and building on the value of reference sketches. *egaku* does this by identifying these relationships and building a sketch/layer database, visually mapping out the relationships so that users can visualize, retrieve, reference, navigate through, and switch between layers of information without having to search through multiple sheets of physical paper. Users sketch ideas as the system captures digital images of the sketches. Using intrinsic referential information, such as the base layers an architect chooses to project for a particular sketch, the sketch is arranged in a preliminary layer management database. Users can also directly interface with the layer database, to manipulate the placement and associations of individual sketches. For example, an architect who has created dozens of variations on a design may decide that he prefers one of his first iterations. Rather than having to search through piles of paper, or re-sketch from memory, the architect can glance at the visual layer database and use the layer relationships to locate and retrieve the specific sketch while maintaining the current designs neatly in the digital stacks.

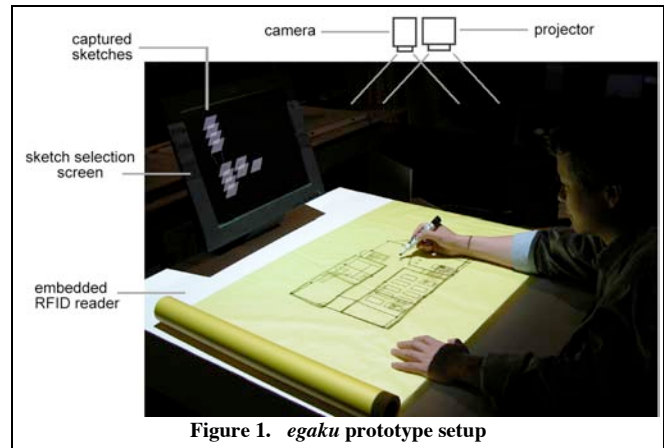


Figure 1. *egaku* prototype setup

3 EGAKU PROTOTYPE

Our first prototype incorporated a digital camera and a projector mounted above the desk. The camera continuously captures the progression of sketches in a cache. Using the architects’ instinctive action of using the ruler (with an embedded RFID tag in *egaku*) to create a clean tear in the paper as a trigger, the system determines the most recent frame without obstructions (such as hands) and places it in the visual database as a completed sketch. The software simultaneously generates a thumbnail of the sketch and it is transferred to the “digital stack” on the vertical screen. The user can manipulate the digital stack of thumbnails and can quickly switch between different layers to compare and choose earlier sketches. The system simulates underlying layers of user-defined sketches with a front projection on the surface of the drawing desk, which allows users to specify the levels of opacity and to create compound layers of multiple sketches.

4 CONCLUSIONS & FUTURE WORK

We are further exploring the integration of annotation layers and physical objects to explore visualizing and sketching in different perspectives, and using the layer management system in other fields, such as animation or mechanical design. By providing users with a means of archiving, searching through, and reviewing previous sketches, *egaku* supports an uninterrupted ideation process to encourage more creative design.

5 ACKNOWLEDGEMENTS

We thank Bill Mitchell, Yao Wang, Carlo Ratti, and TMG.

6 REFERENCES

- ALIAKSEYEU, D., 2002, “Direct Manipulation Interface for Architectural Design Tools”, Proceedings of *CHI*
- GRAVES, M., 1977, “The Necessity for Drawing: Tangible Speculation”, *Architectural Design 6*
- MACKAY, W., VELAY, G., CARTER, K., MA, C., AND PAGANI, D., 1993, “Augmenting Reality: Adding Computational Dimensions to Paper”, *Communications of the ACM*