Augmented Participatory Design

Sheng-Ying Pao
MIT Media Lab
Cambridge, MA, USA
aithpao@media.mit.edu

Kent Larson
MIT Media Lab
Cambridge, MA, USA
kll@mit.edu

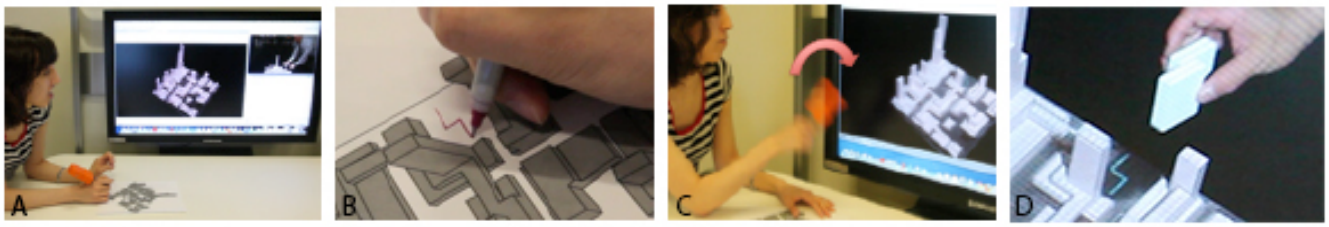

Figure 1. *Augmented remote reality, leveraging familiar design tools such as pen, paper and prototyping building blocks. (A) The physical prototype is manipulated by a remote collaborator, with whom a designer communicates through a videoconference. (B) The pen gesture-based Augmented Participatory Design system captures sketches. (C) Flicking the pen towards the model on the screen instantly transfers the paper sketch to the corresponding spot on the remote model, with which the remote collaborator creates new physical prototypes (D).*

1. Introduction

Although various tools have been developed to transform 2D sketches to 3D geometry on digital platforms, they are still far from offering the same rich experience that manipulation of physical models can provide. It is particularly important for designers to have access to their familiar tools, such as physical prototyping models and traditional pens and paper, in order to support design activities.

Augmented reality attempts to address such problems by re-integrating electronic information back into the real world [Van Krevelen and Poelman 2010]. However, it also introduces new challenges: First, the augmented physical surfaces require digital input and the digital content to be overlaid is usually pre-defined, making it difficult to utilize pen and paper in real time. This also neglects the designer's need to incorporate their intuitive sketches as they design and modify prototypes. As we further move into a digital-oriented augmented reality, the well-known modality of pen and paper has become increasingly segregated in its own analog world.

In addition, the majority of the augmented reality solutions focus on the combination of virtual elements and local objects. As knowledge work becomes more distributed and mobile, the challenges come from not only the gaps between the physical and digital worlds, but also from those between the remote workspaces, especially when the physical prototypes are not accessible to the distant collaborators. Registering remote real-world objects and precisely matching the corresponding real-time content generated from familiar input devices is increasingly important to innovations for augmented participatory design.

2.1 Augmented Remote Reality

An innovative application for augmented reality is to connect people through technology, leveraging familiar tools in the real time. Rather than immersing people in an artificially created digital world, we developed a pen-mediated system for augmented remote design (Figure 1). Wireless sensing technologies and computer graphics algorithms were developed, with the goal of augmenting objects in remote locations to provide a wealth of digital information and communication capabilities for remote collaborators. This is accomplished through the FlickInk system [Pao et al. 2012], with its recent development in wireless sensing capability, augmented reality, MIT CityScope's parametric 3D computer models and urban simulations.

3. Editing Physical Objects with Familiar Tools

Instead of replacing physical objects with computers, we created systems that allow people to interact with the real world with familiar tools (Figure 2). The augmented pen interaction offers opportunities to manipulate physical models remotely as well as to dynamically annotate physical prototypes in co-located design activities. Gesturing at surrounding environments with the pen enables augmented expression and superimposes design drafts onto the intended physical objects. This allows designers and collaborators to take advantage of using familiar analog design tools such as pen and paper to interact with surrounding objects and benefit from the power of augmented reality in real time.

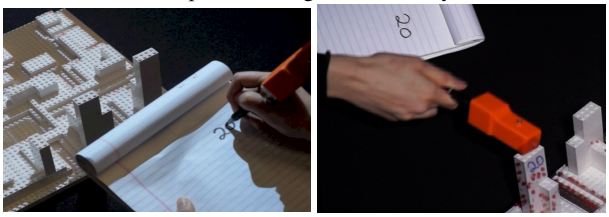

Figure 2. *Tapping the pen on co-located physical objects allows for augmented annotation of the physical model with real-time written content.*

References

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