IllumiRoom: Peripheral Projected Illusions for Interactive Experiences

Brett R. Jones[1,2] **Hrvoje Benko**[1] **Eyal Ofek**[1] **Andrew D. Wilson**[1]
[1]Microsoft Research
Redmond, WA
{benko, eyalofek, awilson}@microsoft.com
[2]University of Illinois at Urbana-Champaign
Urbana, IL
brjones2@illinois.edu

Figure 1. *IllumiRoom* is a proof-of-concept system that augments the physical environment surrounding a television to enhance gaming experiences. For example, (a) with a 3D scan of the physical environment we can (b) directly extend the FOV of the game, (c) selectively render scene elements, (d) augment the appearance of the physical environment (here as a cartoon). The images are un-edited; showing the real-time, working prototype.

1. Abstract
IllumiRoom is a proof-of-concept system that augments the area surrounding a television with projected visualizations to enhance traditional gaming experiences. Our system demonstrates how projected visualizations in the periphery can negate, include, or augment the existing physical environment and complement the content displayed on the television screen. We can change the appearance of the room, induce apparent motion, extend the field of view, and enable entirely new physical gaming experiences. Our system is entirely self-calibrating and is designed to work in any room.

2. Introduction
The *IllumiRoom* proof-of-concept system consists of a projector and a depth sensor that covers a wide area surrounding a television screen (Figure 2). The projected visuals enhance the viewing experience and blur the boundary between the on-screen content and the surrounding room. We demonstrate how projected visualizations in the periphery can negate, include or augment the physical environment, and thus enhance the content displayed on the television screen. We call such visualizations *peripheral projected illusions*.

Similar to Focus+Context displays (Baudisch, Good, & Stewart, 2001), the television provides a traditional, high-resolution gaming experience and the projector provides low-resolution information for the user's peripheral vision. In contrast to previous work, we do not use flat, white projection screens, but instead adapt the projection to the existing living room environment. We are the first project to consider the geometry and appearance of the surrounding room and use that information to create novel, interactive visual experiences.

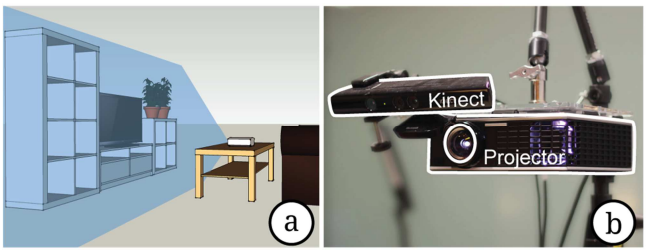

Figure 2. (a) Our vision for a productized *IllumiRoom* system includes an ultra-wide field of view device that sits on a coffee table and projects content in the area surrounding the television. (b) Our current proof-of-concept prototype uses an off-the-shelf projector and a Kinect sensor.

SIGGRAPH 2013, July 21 – 25, 2013, Anaheim, California.

ACM 978-1-4503-2261-4/13/07

We explore the design space of peripheral projected illusions and demonstrate eleven example illusions. For instance, we can directly extend the game content into the living room by displaying a wide field-of-view rendering of the game on the surrounding physical environment with radiometric compensation (Figure 1b). We can also selectively introduce game elements into the living room; e.g. only displaying weapons fire and explosions in a first person shooter (Figure 1c). Or, we can augment the living room to match the theme or mood of the game; e.g. the room can transform into a 'cartoon world' by super-saturating the colors and adding black silhouette edges. We can also enable physical-virtual gaming experiences by using the 3D data of the living room; e.g. a grenade can roll out of the television, then bounce off the coffee table, and roll on the floor of the room. All of these effects adapt to the color and geometry of the living room, and are design to work in any room.

Ideally, *IllumiRoom* would be directly integrated into a next generation console and new games would be designed for *IllumiRoom* from the ground up. We envision an API that enables triggering illusions, changing surface appearance, controlling room lighting, inserting objects into the physical environment, etc. In our prototype, we demonstrate how to connect existing commercial game content to drive illusions: using controller input, optical flow, and source code integration.

3. SIGGRAPH Demonstration
This work will be initially presented at ACM CHI 2013 in May 2013 (Jones, Benko, Ofek, & Wilson, 2013), but will not have a live demonstration. At SIGGRAPH Emerging Technologies we will demonstrate the full working prototype with a 'mock' living room (shown in Figure 1). Visitors will sit down on a couch and experience a magical, immersive gaming experience. Visitors will take turns using an Xbox controller to play video games, which are coupled with eleven peripheral projected illusions. We can live switch between the peripheral projected illusions for each example game. We believe this system will be very popular among conference attendees.

References
Baudisch, P., Good, N., & Stewart, P. (2001). Focus Plus Context Screens: Combining Display Technology with Visualization Techniques. *ACM UIST*.

Jones, B., Benko, H., Ofek, E., & Wilson, A. D. (2013). IllumiRoom: Peripheral Projected Illusions for Interactive Experiences. *ACM CHI (to appear)*.