

Mixed virtuality transducer: virtual camera relative location displayed as ambient light

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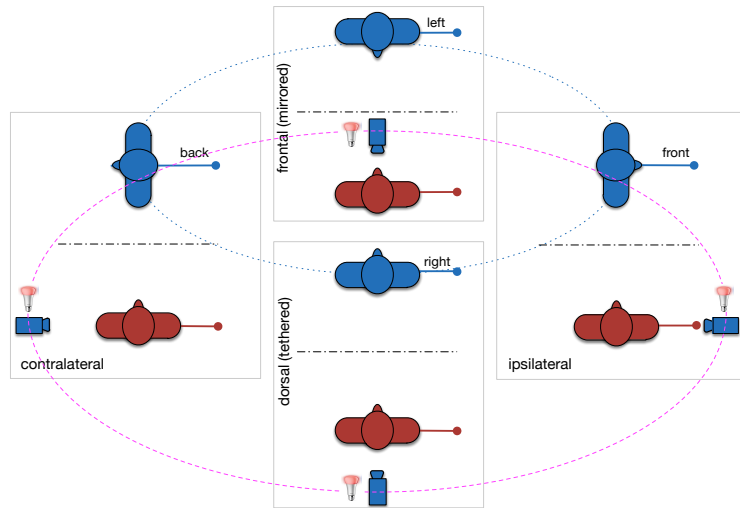


Figure 1: This composite shows four frames from a wrapped cycle of an orbiting virtual camera. For simplicity, the illustration uses a static actor and affordance position, simple “right pointing,” but typically the manipulable will be whirled, even as the virtual camera spins around. Although the human actor frozen here in the figure strikes a static pose across the camera angles, the affordance projection is artificially rotated to accommodate the shifting perspective. Each quadrant (delimited by gray rectangles) associates a subject (red, lower) with a projection (blue, upper) through the graphical display (“dot–dash” segment). (“Real” things are shown in blue, “virtual” things in red, and “hybrid” things in purple.) The user whirls a poi-like affordance (knob-terminated segment), which is adaptively projected into the scene. The virtual camera sweeps around (larger, purple oval), changing the perspective on the self-identified avatar (smaller, blue oval). Environmental lighting surrounding the player represents positions of the virtual camera projected back into user space, the perspective standpoint in the “real” world.

We have built haptic interfaces featuring mobile devices— smartphones, phablets, and tablets— that use compass-derived orientation sensing to animate virtual displays and ambient media. “Tworlds” is a mixed reality, multimodal toy using twirled juggling-style affordances crafted with mobile devices to modulate various displays, including 3D models and, now, environmental lighting. Previous releases of the system introduced self-conscious, ambidextrous avatars that, aware of the virtual camera position, switch manipulating arm to accommodate the human presumed to prefer visual alignment. That is, a player spinning a “paddle”-style flat object or whirling a “poi”-style weight monitors virtual projection in a graphic display with a displaced, “2nd-person” perspective, able to see the puppet, including orientation of the twirled toy. As seen in the figure above, correspondence is preserved even as the camera moves continuously around the avatar between frontal and dorsal views in a spin-around “inspection gesture,” phase-locked rotation and revolution.

To elucidate the virtual inspection gesture and the relationship between the real and virtual spaces, we use networked lighting:

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Philips Hue wirelessly networked LED bulbs and original middleware are deployed to indicate the relative position of the virtual camera in user space [Cohen et al. 2014]. Even though a toy might be twirled too fast for such lights to follow in the real world, the speed of orbiting of the virtual camera can be adjusted to accommodate even sluggish lighting switching. The roomware light system takes about a second to adjust distributed bulbs, but virtual camera position and invocation of tethered or mirrored perspective mode has the luxury of separate timing: even though a user might be whirling an affordance with a typical angular tempo of around 1 Hz, the virtual camera can accommodate lumbering distributed lighting, swinging around in synchrony.

“Mobile–ambient” describes integration of personal control and public display, such as Tworld’s mobile affordances projected onto social screens and back-projection of virtual camera position. This mixed reality environment, using playfully fluid perspective to blur the distinction between sampled and synthesized data, is literally illuminated by networked lighting.

References

- COHEN, M., RANAWEERA, R., RYSKELDIEV, B., OYAMA, T., HASHIMOTO, A., TSUKIDA, N., AND TOSHIMUNE, M. 2014. Multimodal mobile-ambient transmedial twirling with environmental lighting to complement fluid perspective with phase-perturbed affordance projection. In *SIGGRAPH Asia Symp. on Mobile Graphics and Interactive Applications*. <http://dx.doi.org/10.1145/2669062.2669080>.