HoloLeap: Towards Efficient 3D Object Manipulation on Light Field Displays

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ABSTRACT
We present HoloLeap, which uses a Leap Motion controller for 3D model manipulation on a light field display (LFD). Like autostereo displays, LFDs support glasses-free 3D viewing. Unlike autostereo displays, LFDs automatically accommodate multiple viewpoints without the need of additional tracking equipment. We describe a gesture-based object manipulation that enables manipulation of 3D objects with 7DOFs by leveraging natural and familiar gestures. We provide an overview of research questions aimed at optimizing gestural input on light field displays.

Author Keywords
Light field displays; 3d interaction; object manipulation.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

HOLOLEAP
We propose HoloLeap – a system for interacting with light field displays (LFDs) using hand gestures. LFDs [1] offer several advantages over volumetric or autostereo displays including adjacent view isolation, increased field of view, enhanced depth perception and horizontal motion parallax.

For our initial investigation, we designed manipulation gestures for translation, rotation, and scaling. We also included continuous rotation ("spinning"). After reviewing previous work [2], we designed a custom gesture set, as the increased depth perception of a LFD may affect object manipulation. Our goal was to enhance the ad-hoc qualities of mid-air gestures. Compared to handheld devices (e.g., a mouse) gestural interaction allows one to simply walk up and immediately begin manipulating 3D objects.

Rotation uses a single hand. The user rotates their wrist in the desired direction to rotate the object. It allows for fast correction for each rotational degree of freedom and multiple axes of rotation in a single gesture. Moving two hands at once without increasing the distance between them translates the object. Scaling is activated by increasing and decreasing the distance between palms. HoloLeap does not use zooming as LFDs have a limited depth range. Scaling is provided as an alternative to facilitate model inspection and to easily provide an overview. Continuous rotation (spin) is activated with a double-hand rotation gesture. Rotation and translation gestures are shown in Figure 1.

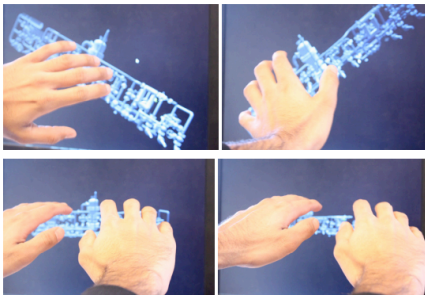

Figure 1. Top: Z-axis rotation. Bottom: Z-axis translation.

HoloLeap uses a Holografika HoloVizio HV640RC large-scale light field display (http://www.holografika.com/). It offers continuous motion parallax. The installation covers an area of 3050mm x 2150mm x 2700mm.

OPEN QUESTIONS
Firstly, transformation speed, especially in relation to large sized displays, requires more study. Different mappings between the gesture speed and transformation are as yet untested. While this is a known challenge, the increased depth perception of a LFD complicates it, as viewing an object from different angles by different users creates relative differences in perception. We see a need for additional user studies addressing this problem in greater detail.

Broadly, we aim to start discussion on the appropriateness of gestural input for light field displays and investigate how users can capitalize on the unique features of these devices.

REFERENCES
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