

Touch Hologram in Mid-Air

Cédric Kervegant

Immersion, Bordeaux, France
cedric.kervegant@immersion.fr

Delphine Graeff

Immersion, Bordeaux, France
delphine.graeff@immersion.fr

Félix Raymond

Immersion, Bordeaux, France
felix.raymond@immersion.fr

Julien Castet

Immersion, Bordeaux, France
julien.castet@immersion.fr



Figure 1: A setup merging Mixed Reality headset and Haptic in Mid-Air.

ABSTRACT

This demonstration presents a surprising human-computer experience combining a pair of mixed reality smart glasses and a haptic device. This one involves existing technologies: the HoloLens from Microsoft and the touch development kit from Ultrahaptics. By mixing a holographic display and an array of ultrasonic transducers, Immersion gives tangible feedback to a hologram. This collocation of feedbacks drastically enhances the presence of the object. This also gives a spatial reference in order to interact with the virtual environment.

CCS CONCEPTS

• **Human-centered computing** → **Mixed / augmented reality;**
Haptic devices;

KEYWORDS

Mixed Reality, Haptic

ACM Reference format:

Cédric Kervegant, Félix Raymond, Delphine Graeff, and Julien Castet. 2017. Touch Hologram in Mid-Air. In *Proceedings of SIGGRAPH '17 Emerging Technologies, Los Angeles, CA, USA, July 30 - August 03, 2017*, 2 pages. <https://doi.org/http://dx.doi.org/10.1145/3084822.3084824>

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the owner/author(s).

SIGGRAPH '17 Emerging Technologies, July 30 - August 03, 2017, Los Angeles, CA, USA

© 2017 Copyright held by the owner/author(s).

ACM ISBN 978-1-4503-5012-9/17/07.

<https://doi.org/http://dx.doi.org/10.1145/3084822.3084824>

1 INTRODUCTION

With the evolution of Mixed Reality technologies, holograms are emerging in our living environment with higher and higher levels of quality. The current solutions from Microsoft, Daqri or Meta enable users to place virtual elements in a static location beside real objects.

This recent enhancement is giving a great feeling of presence to the virtual elements. Among the improvements of the technologies, the new display system plays a large role, but the evolution of inside-out tracking is probably the more impressive step forward. Yet, despite these innovative technical components, the very latest smart glasses have weaknesses in terms of interaction. There is, therefore, considerable scope for progress from the hardware solutions to the interaction metaphors: how to manipulate this virtual object which seems so real?

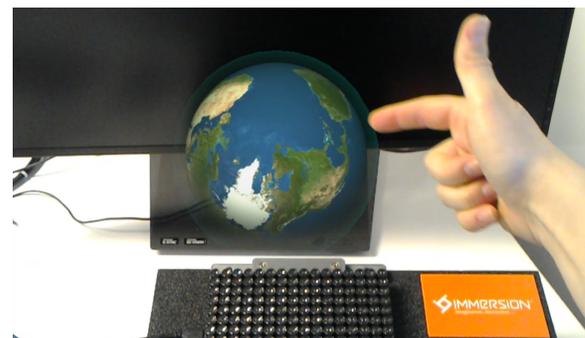


Figure 2: Picture from the HoloLens

In a continuing effort to improve Mixed Reality experiences, this demonstration goes further, providing interaction with holograms by adding a way to touch them. This feedback allows us to implement a natural metaphor such as skimming the surface of the earth to generate a rotation. The touch development kit from Ultrahaptics has been selected because it is the only mid-air tactile feedback technology. It provides a touch feeling without any mechanical equipment in the visualization area that would be inconsistent with the concept of hologram.

With the addition of this interaction modality, the overall impression of presence is drastically increased. The research team from Immersion suggests this simple demonstration to illustrate the power of this combination, but the team does not exclude other features based on the same concept.

2 THE EXPERIENCE

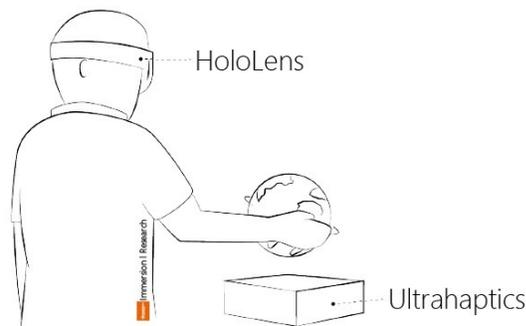


Figure 3: Touch Hologram in Mid-Air

More information: <https://youtu.be/PaIpd9Fa7ns>

2.1 Technical details

Touch Hologram in Mid-Air is combining the HoloLens glasses from Microsoft and the Ultrahaptics device. This last one comes in the form of a rectangular base (29mm x 186mm x 221mm (height/width/depth)). It enables the production of focal points with an accuracy of 8.6mm diameter. In order to be in line with the hardware specifications, a physical model of a sphere is simulated over the base at 100-500mm from the surface of the transducer board. The user is invited to rotate the sphere around its center of gravity. For that purpose, the hands of users are tracked with leap motion over the base. Using 40 contact points per hand, the physical simulation computes a collision algorithm between the hands and the sphere. The result of this computation, running on an HP Z400, is used as input for the haptic device.

To keep some consistency between touch feedbacks and visual perception of the hologram, a client/server connection allows the demonstration, with a simple calibration phase, to ensure in real time the colocalization of these two entities. The server is broadcasting the position and orientation defining the physical state of the hologram via Wi-Fi. The HoloLens can, thus, get the features from the simulation and use these for the embedded graphical rendering.

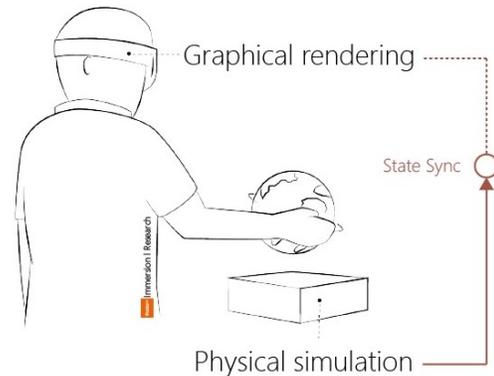


Figure 4: Illustration of the sync between physic and graphic

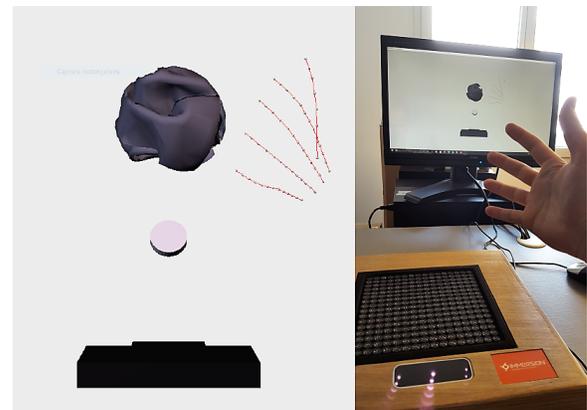


Figure 5: Screenshot of the physical simulation

2.2 Hardware setup

This space-saving and highly disruptive MR experience requires no specific needs from a logistical perspective. It is autonomous given its local network. Here are the main hardware components for Touch Hologram in Mid-Air.

- 1 HoloLens from Microsoft
- 1 touch development kit from Ultrahaptics
- 1 Leapmotion
- 1 Graphical station HP Z400
- 1 network router ASUS RT-AC66U

The demonstration will need a standard tabletop, 7 outlets, and a space without important light sources. The demonstration will become increasingly «WOW »in low-light conditions.

3 CONCLUSION

Touch Hologram in Mid-Air is a singular and surprising experience that opens a large field of experiment, both from a technical and use point of view. This experience is supported by the most recent Mixed Reality technologies from the latest trends, but it goes further by enhancing the interaction modality with the holograms. Therein lies the strength of this experience: it is unique in giving physical presence to intangible objects.