

STUDY AND DEVELOPMENT OF EXTENDED REALITY TOOLS FOR BAGAGEX



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Context

Luggage search is the rate-determining step of airport checkpoints. Agents must focus on the luggage, the passenger and the contents of their luggage. This leads to loss of concentration.

Then, one solution to reduce operational time is to merge the luggage and its virtual contents.

In 1995, Paul Milgram suggested a solution to do this : the Reality-Virtuality Continuum. Reality and virtuality are not anymore two separated worlds, they can be merged to allow interactions with real and virtual objects at the same time.

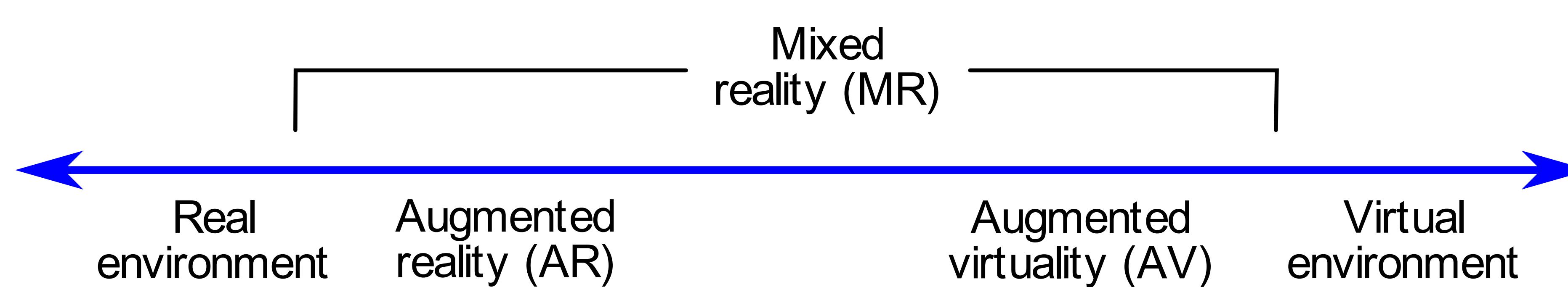


Figure 1: Reality-Virtuality Continuum, 1995 [1].

Methods and materials

Projection mapping is an augmented reality technique which allow merging real and virtual objects without any headset for the user. In 2014, Brett Jones et al. created RoomAlive, a system which uses Kinect depth cameras and projectors to bring an entire virtual scene into the real world. By tracking the user's head position, they can project the perspective of the scene with the point of view of the user.

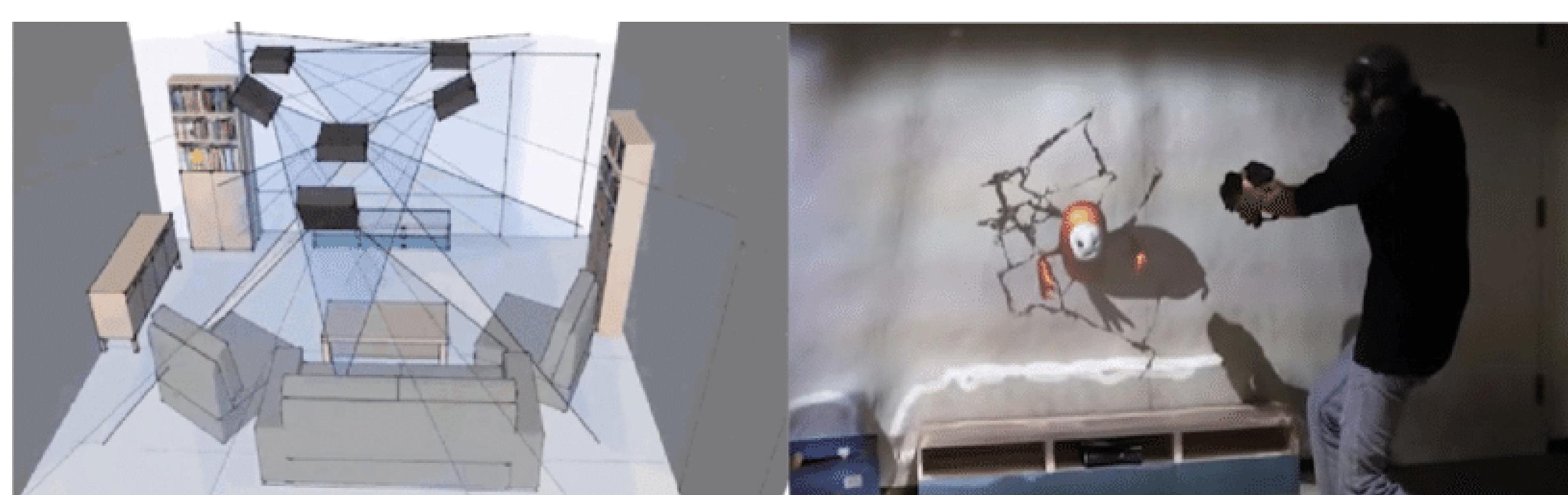


Figure 2: RoomAlive is a proof-of-concept system that transforms any room into an immersive, augmented gaming experience, 2014 [2].

In 2017, Francois Berard and Thibault Louis brought the proof that some puzzle were easier when they were solved with augmented reality projection. They justified that by the fact that they could easily control the light. Therefore, some part of the puzzles were more visible than with natural light.



Figure 3: Real puzzles can be reproduced with augmented reality to become easier to solve, 2017 [3].

Objectives of the PhD thesis

To use Extended Reality Technologies to create a system which :

- Improves safety for the agent while searching the luggage.
- Improves time required to search the luggage.
- Does not use any equipment that could disturb agents' tasks.

Application to luggage search

On a closed luggage, the agents need to locate the 3D position of objects in order to know exactly where they need to search for the threats. Thus, they need to see the virtual scene in perspective to be able to explore it.

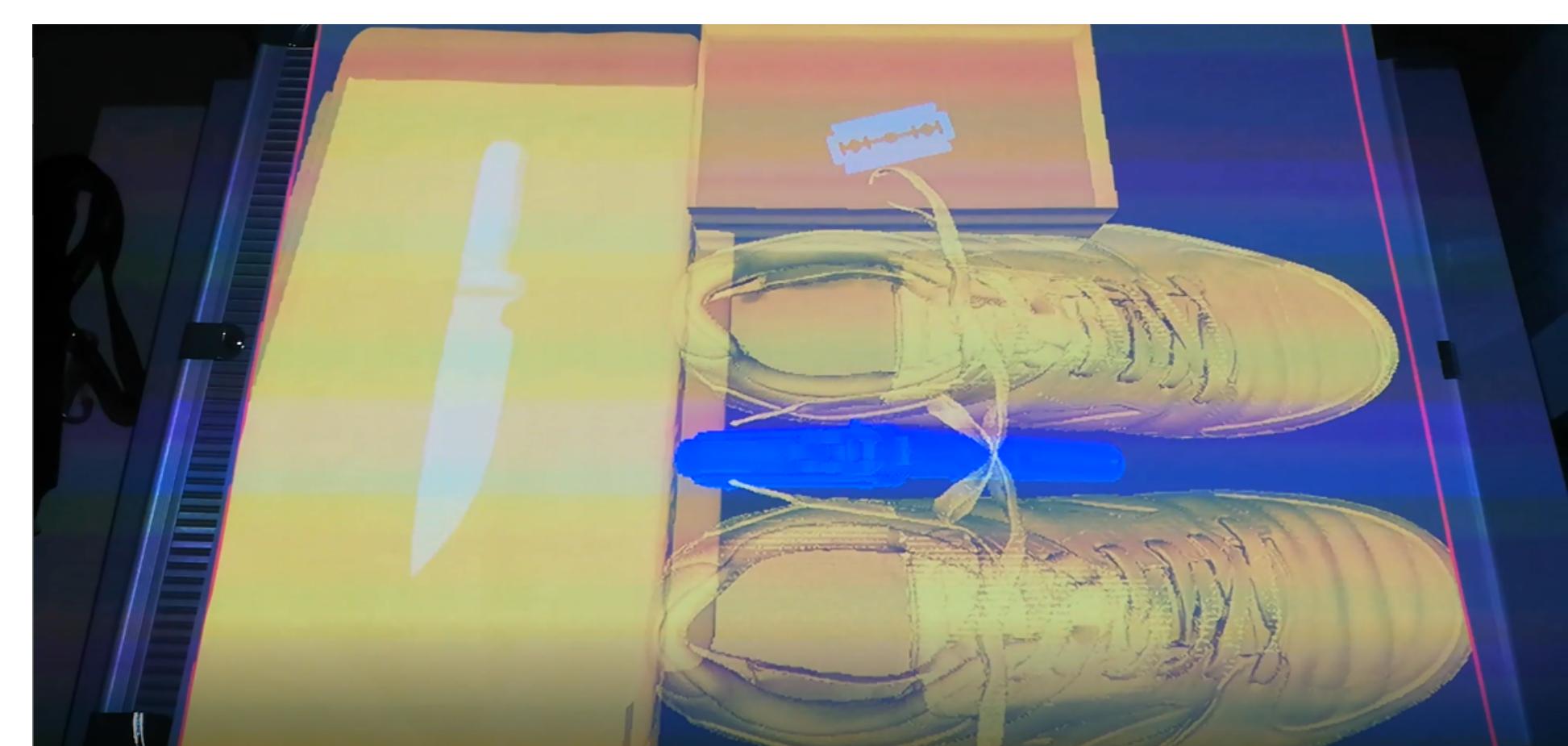


Figure 4: 3D virtual scene is projected on the luggage with the user's perspective.

On the contrary, when they open the luggage, when they open the luggage, virtual objects have to perfectly match their real representation to be able to highlight threats. Therefore, it requires to display the scene without the user's perspective.



Figure 5: Virtual objects are merged with their real representation.

Tests with safety agents

The first prototype has been tested by five safety agents from Toulouse-Blagnac airport. They gave feedbacks about the fact that this technology was easier to handle than virtual reality and it allowed to avoid loss of focus by switching between the screen and the luggage.

References

- [1] Milgram, Paul and Takemura, Haruo and Utsumi, Akira and Kishino, Fumio, "Augmented reality: A class of displays on the reality-virtuality continuum", Telemanipulator and telepresence technologies, vol.2351, pp. 282-292, 1995
[2] Jones, Brett and Sodhi, Rajinder and Murdock, Michael and Mehra, Ravish and Benko, Hrvoje and Wilson, Andrew and Ofek, Eyal and MacIntyre, Blair and Raghuvanshi, Nikunj and Shapira, Lior, "Roomalive: Magical experiences enabled by scalable, adaptive projector-camera units", Proceedings of the 27th annual ACM symposium on User interface software and technology, pp. 637-644, 2014
[3] Berard, Francois and Louis, Thibault, "The object inside: Assessing 3d examination with a spherical handheld perspective-corrected display", Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems, pp. 4396-4404, Feb 2017