

Requirements for mixed-reality game applications.

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Abstract

*Mixed-reality gaming*¹ not only incorporates location, but also other types of highly personalized, local and up-to-date contextual data which is best gathered through sensors in real-time on site. Also, it is not restricted to the most obvious visual augmentation. In this position paper, we investigate what context is in fully immersive environments, a list of possible sensors and types of augmentation are provided and the need for new interaction metaphors is highlighted.

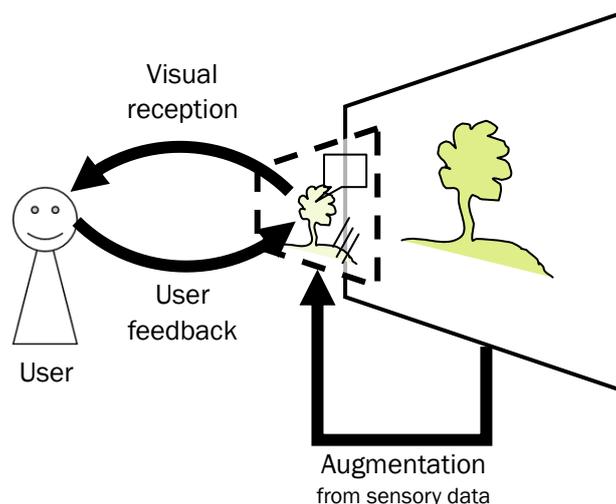


Figure 1: interaction model user - AR system - reality

Context in mixed-reality gaming

Mixed-reality gaming takes the individual context of participants into account to tell fully immersive stories. Examples of contextual artefacts include location, local conditions (eg. weather, temperature), proximity to friends, opponents and objects. Due to the real-time nature of gaming, it is also required that the contextual information is up-to-date. Therefore, contextual data needs to be gathered through mobile and/or ambient sensors next to the user.

A standard should cover scenarios for the following types of sensors which can fully catch the situation (in order of importance):

- Camera* with positioning and compass
- Microphone with continuous recording capabilities†
- Accelerometer (and a vibration output channel)
- Brightness sensor

* A standardized interface should have the capabilities to request specifications of the camera such as auto-focus, optical zoom-range, aperture, flash, light range (eg. infra-red range?).

† We understand that continuously recording sensors are subject to privacy concerns. It is why we believe that an AR standard also requires rules for privacy settings and interaction metaphors to adjust them in an augmented reality context.

- Temperature

As stated before, the sensors might be installed in the environment or on a mobile device on the user directly. A standard should also cover how to access sensor sources which are available in proximity.

Types of augmented reality

In 1957, Morton Heilig created *Sensorama*², a first augmented reality simulator incorporating visuals, sound, vibration and smell. While this was a simulator, it shows us that perceived reality is multimedia-based and not only restricted to visuals. Fully immersive story telling (and gaming) makes heavy use of this where possible (cf. amusement parks, ghost train). Mobile augmented reality also increases the level of immersion.

It is why a standard for mobile AR systems should include guidelines and formats for:

- Visual augmentation
- Audio augmentation (eg. with surround sound headphones)
- Tangible augmentation (eg. vibration on events such as locking/selecting an object in visual AR)

Privacy and opt-in in AR

All this new information that is augmented to reality is challenging for the user of such a system. While we believe that successful applications and stories will try to filter and reduce complexity, we also encourage that an AR standard provides guide lines about how:

- A user is informed that it is currently exposed to an augmented reality service (similar to what browsers do with a yellow info bar when a page tries to access the location API).
- A user opts in to an augmented reality service (M. Langheinrich³ and A. Greenfield⁴ have suggested some solutions)

Usability in AR systems and interaction metaphors for it

Further, a standard should provide possibilities that an application can react on user commands (user input) such as:

- Gestures (eg. shaking and mimics of real movements such as fishing, bowling, etc.)
- Features and object recognition for tangible user interfaces (eg. Tangible Bits⁵, a MediaLab research program where physical objects were used to interact with digital information)
- Diagrammatic user interaction (eg. ZombieBoard⁶, a whiteboard scanner system from PARC that recognized user commands written on the whiteboard, such as scan now)
- Proximity to other objects (for instance, bonding objects by shaking them next to each other)

Conclusion

We have covered the requirements an AR standard should meet such as sensor support, types of augmentation, privacy mechanisms and usability metaphors.

¹ *Alternate reality game*, on Wikipedia, http://en.wikipedia.org/wiki/Alternate_reality_game (accessed in May 2010)

² *Sensorama*, on Wikipedia, <http://en.wikipedia.org/wiki/Sensorama> (accessed in May 2010)

³ *Privacy in Ubiquitous Computing*, by Marc Langheinrich, <http://www.inf.usi.ch/faculty/langheinrich/articles/papers/2009-ucbook-privacy.pdf> (accessed in May 2010)

⁴ *Everyware: The dawning age of ubiquitous computing*, by Adam Greenfield, <http://www.studies-observations.com/everyware/> (accessed in May 2010)

⁵ *Tangible Bits*, Tangible Media Group, <http://tangible.media.mit.edu/> (accessed in May 2010)

⁶ *ZombieBoard Whiteboard Scanner or Image Mosaicing and a Diagrammatic User Interface for an Office Whiteboard Scanner*, Eric Saund, Xerox Palo Alto Research Center, PARC, 1998, <http://www2.parc.com/isl/members/saund/zombieboard-public.html> (accessed in May 2010)