Displays and Immersion

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What is Immersion?

Immersion is the sense of “being there.”

Most work on immersion has been game-centric.

Stages of Immersion

• According to gamers, immersion is used to describe the degree of involvement with a game.
• This involvement moves along the path of time and is controlled by barriers.
• Some barriers can only be removed by human activity, such as concentration
• Others can only be opened by the game itself, such as the game construction.
• Each level of involvement is only possible if the barriers to the level are removed.
• Removing these barriers, however, only allows for the experience and does not guarantee it

Stages of Immersion: Engagement

• To lower the barriers to enter this level, the gamer needs to invest time, effort, and attention.
• Accordingly, an initial barrier for engagement is access. This refers first to the gamers’ preference, if they do not like a certain style of game they will not even try to engage with it.
• “I don’t tend to play sport games, I don’t see the point really.”
• Secondly, access relates to game controls. The controls and feedback need to correspond in an appropriate manner so that the user can become expert, at least at the main controls.
• “You just press anything just to try and kick, you don’t really know what the controls are.”

Stages of Immersion: Engrossment

• The barrier to engrossment is game construction.
• This is when game features combine in such a way that the gamers’ emotions are directly affected by the game.
• Some game features mentioned by participants that form this quality were visuals, interesting tasks, and plot.
• The gamer is now less aware of their surrounding and less self-aware than previously.
Stages of Immersion: Total Immersion

- Total immersion is presence.
- Participants described being cut off from reality and detachment to such an extent that the game was all that mattered.
  - "You just forget about the things around you and you're focused on what you're doing in the game"
  - "You feel like you're there"
- The barriers to presence are empathy and atmosphere.
- Empathy is the growth of attachment.
- Empathy is distinct from attachment in that you feel attached to a main character or team but do not necessarily empathise with their situation. Gamers who did not feel total immersion talked of lack of empathy and the transfer of consciousness.
- Atmosphere: the development of game construction.
  - All but one game mentioned as totally immersive was a first person perspective game.

Types of Immersion

- In the game design community there has been work in categorizing immersion
- Staffan Björk and Jussi Holoainen divide immersion into the following categories:
  - Tactical immersion
  - Strategic immersion
  - Narrative immersion
  - Spatial immersion

Tactical Immersion

- Experienced when performing tactile operations that involve skill
- Players feel "in the zone" while perfecting actions that result in success

Strategic Immersion

- More cerebral
- Associated with mental challenge
- Chess players experience strategic immersion when choosing a correct solution among a broad array of possibilities

Narrative Immersion

- Occurs when players become invested in a story
- Similar to what is experienced while reading a book or watching a movie

Spatial Immersion

- Occurs when a player feels the simulated world is perceptually convincing
- The player feels that he or she is really "there" and that a simulated world looks and feels "real"
Presence

• The concept of spatial immersion is the category most addressed by new display devices
• The current trend of virtual reality glasses and head-mounted display can produce a visceral feeling of being in the virtual world
  • this is called Presence (a type of spatial immersion)
• According to a talk by Michael Abrash the VR research team at Valve identified aspects needed to establish Presence

Displays

• Display devices offer differing levels of spatial immersion based simply on their design
• The basic desktop monitor offers little immersion, a window into a world.

Presence

• A wide field of view (80 degrees or better)
• Adequate resolution (1080p or better)
• Low pixel persistence (3 ms or less)
• A high enough refresh rate (>60 Hz, 95 Hz is enough but less may be adequate)
• Global display where all pixels are illuminated simultaneously (rolling display may work with eye tracking.)
• Optics (at most two lenses per eye with trade-offs, ideal optics not practical using current technology)
• Optical calibration
• Rock-solid tracking - translation with millimeter accuracy or better, orientation with quarter degree accuracy or better, and volume of 1.5 meter or more on a side
• Low latency (20 ms motion to last photon, 25 ms may be good enough)

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Augmented Reality

- Augmented Reality/Mixed Reality has mixed challenges in terms of immersion
- There are added challenges such as tracking and rendering virtual objects consistently in a real world
- However, augmented reality has the benefit that the user will already be immersed as they are viewing the real world, not a purely virtual one.

Quantifying Immersion

- There have been multiple attempts at quantifying some aspect of immersion.
- 1997 - Randy Pausch, Dennis Proffitt, George Williams
  - Compared search tasks using a HMD compared to a desktop
  - Found that when the target was camouflaged there was no difference in performance
  - When the target did not exist, VR users were much better at determining when they had searched the whole space

Quantifying Immersion - 1997 - Randy Pausch, Dennis Proffitt, George Williams

- 1997 - Boyd
  - Compared three kinds of virtual environments
    - Head-tracked walking (HMD)
    - Subject holds a hand-tracking device to simulate holding a puppet or doll by the head to walk it around in a scaled-down virtual world
    - Flying (operates a metaphorical vehicle)
  - The task was to locate a virtual object that looked like a telescope, walk up to it and look through it
  - For all but two subjects, mean time was lower for the immersive design than for the other two designs, often by a large factor

Does immersion make a virtual environment more useful? Boyd, 1997