

Enhancing Spatial Presence to Enable N&V decisions



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The **experience** of being transported to an elaborately simulated place is **pleasurable** in itself, regardless of the fantasy content. We refer to this experience as immersion. Immersion is a metaphorical term derived from the physical experience of being submerged in water. We seek the same feeling from a **psychologically immersive experience** that we do from a plunge in the ocean or swimming pool: the sensation of being surrounded by a completely other reality, as different as water is from air, that takes all of our attention, our whole perceptual apparatus. (Murray 98)



The simulation can be perfectly accurate, but still not believed. A story...

Typical Simulator Project:

- Requested to evaluate a mechanical sound enhancer for an existing program midcycle enhancement
- Created a highly detailed drivable model of target vehicle (all gears, loads, road conditions)
- Physics of sound enhancer fully quantified, was able to change center frequency, level, and roll off
 - It was one of the best simulator models I made
- Had demonstration with chief engineer:
 - *"I don't feel like I am in the car"*
 - A new challenge to the N&V team
 - Not a sound concern
 - Not a vibration concern
 - It was....immersion? That's a new problem.



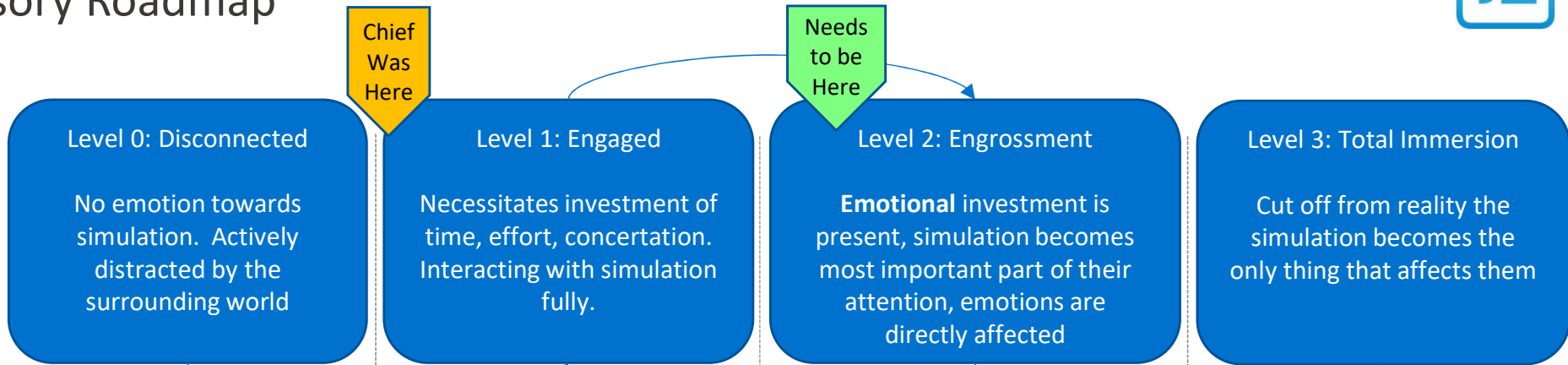
Definitions:

- **Spatial Presence**
 - A state of consciousness that gives the impression of being physically present in a mediated world
- **Sensory Presence**
 - A variant of immersion within a virtual environment in which all the person's senses are immersed into that environment, with each one, as much as possible, reporting back data from that environment.

*See reference page for in-depth reading

Moving towards total immersion

Sensory Roadmap



Sound	Generic	Accurate SPL & Content	Accurate SPL / Content / Direction	
Feel	None	Generic / Contextual	Accurate & key touch points	Accurate, key touch points + DC motion
Sight	Generic	Familiar Roads	Familiar Roads with proper art	Roads + Art + VR
Taste Smell	None			
	Aromatizer			

Sensory Presence - Creating Immersive Visuals

Overview of map building process



Source Data Collection

Map Building

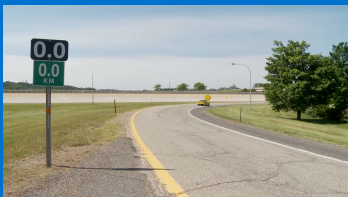
Final Touches

Driving!

USGS Provides road outline & Topo



Camera/Video
Provides context for "road decorations"



Road Scans



Road Runner



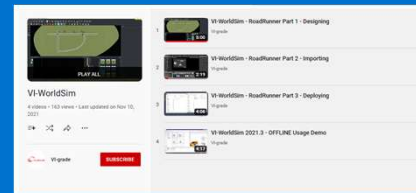
WoldSim Studio



N&V Simulator



VI-grade Training Videos



Sensory Presence - Creating Immersive Visuals

Project Results



Wins

- Achieved project goals that were initially laid out
 - Use integrated solution
 - Used in-house talent, software, and process
- Verified software tool chain works: collect data, build maps, run
- Source data collection is free (USGS)
- Map creation relatively quick “trace and go”

Opportunities

- Import/export process can be refined
- Final touches are required in WorldSIM
- Missing the artistic “wow” factor
 - All about the details, varied textures/objects

Outlook

- Will require additional licensing
- Great option for “quick” maps
- Need to balance in-house vs. external



What's Next?

Sensory Presence - Creating Immersive Audio



A simulation must “feel right” to decide to spend money to fix an issue.

Examples:

- Rear bias road noise
- Mirror whistle
- Sound staging for sound enhancement

Binaural playback provides a surround effect but falls short of true immersive audio.

Object based audio (OBA) formats such as Atmos or MPEG-H provide a framework for simulating sounds in a 3 dimensional space.

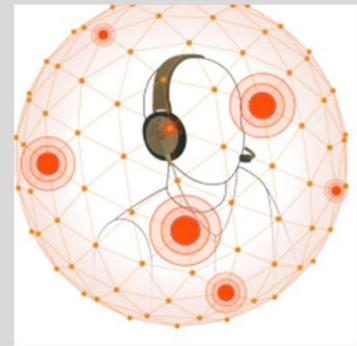
Localized sounds can then be rendered to headsets with tracking or to speaker arrays.

Integrating analytical models with object based audio and vibration in a free driving simulator enables realistic demonstrations

general motors



Sound with a location relative to head



e.g. Atmos, MPEG-H, ...



Conclusion & Thank You

Taking sensory presence into account during virtual vehicle evaluation can “elevate the experience”

There is no one solution to increase spatial presence, multiple solutions need to be brainstormed and tailored to the needs of the organization.

Utilizing RoadRunner and WorldSIM is an effective means for map creation.

Integrating object-based audio provides directionality thus adding an additional level of immersion

References

Warnders, Bernd. (2014). The Emotion of Horror in Fiction: Towards an Integrated Understanding of Emotional Responses in Mediated Contexts. 10.13140/RG.2.2.24663.21921.

- Immersion is a frequently mentioned factor that presumably determines a narrative's and its medium's attractiveness and success when it comes to involving consumers emotionally. the findings discussed throughout this thesis can be used as guidance/reference not only in analyzing elements of game design, but also to develop new approaches

Arsenault, Dominic. (2005). Dark waters: Spotlight on immersion.

- This paper combines several empirical studies and some theoretical research to shed some light on the dark, undefined waters in which we plunge when we are "immersed". Immersion, across all media, comes in three different types and in three different degrees, and can be hindered by barriers, such as inaccessibility, or favored by fuel, such as using one's imagination. The resulting model of immersion can be applied to experiences formed by any type of media object, but is particularly relevant to video games.