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# Ambiance In and Around the Virtual Reality Headset

**Abstract.** *Ambient perception in virtual reality is split between perceiving the virtual space inside the headset and perceiving the surrounding physical environment. While promises of VR “immersion” frequently ignore the surrounding space, an ambient perspective reveals how immersion in VR is always at least double: any immersion in virtual space comes nested within an immersion in the atmospheres already surrounding VR use. This essay seeks to understand how these two layers cohere both spatially and temporally across the interface of the VR headset. An ambient perspective on VR demonstrates how even the most immersive media must be understood as shaped by the spaces surrounding the interface itself.*

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## Introduction

Virtual reality researchers Maria Sanches-Vives and Mel Slater (2005, 332) note how “immersive virtual environments can break the deep, everyday connection between where our senses tell us we are and where we are actually located and whom we are with.” As with most VR research, Sanches-Vives and Slater’s paper quickly moves on from this observation to focus on how VR environments can substitute for this everyday sensory emplacement, producing feelings of immersion within virtual environments instead. Yet wearing a virtual reality headset not only provides access to virtual environments, it necessarily transforms a person’s relationship to the surrounding space as well.

Research on ambiance and atmosphere has begun attending to how media can alter a person’s emotional and affective relationship to their surroundings, including my own earlier work (Roquet, 2016). Most media aiming to intervene in the “tuning” of a space do so by attempting to blend in to existing environments, including everything from early background music on record players to more recent computational interfaces using algorithms driven by environmental sensors. Ambiance modulated via digital interfaces has become an increasingly common approach in the last few decades. Mark Weiser’s influential vision for ubiquitous computing in the 1990s imagined it as a “calm” technology that can “disappear into the background” (Weiser and Brown, 1997; Weiser, 1991, 98), an approach later described by Eli Zelkha and others as “ambient intelligence” (Wright et al., 2008, 24).

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While often forgotten today, Weiser (1991, 94-95) initially positioned ubiquitous computing in opposition to virtual reality, which at the time was at the peak of its first era of popular attention and hype. VR, Weiser (1991, 94) writes, “focuses an enormous apparatus on simulating the world rather than on invisibly enhancing the world that already exists.” This opposition continues to shape the understanding of virtual reality today both among VR researchers and in popular discourse surrounding the technology. While many consumer technologies today take up the ubiquitous computing call to blend into existing environments, VR’s primary aim appears to be the exact opposite: to perceptually bring a person elsewhere, allowing a VR user to transcend wherever they currently find themselves. Facebook’s inaugural campaign for their Oculus Go headset, for example, promised the device would allow a user to “go anywhere.”

In contrast, philosophical work attending to mood, ambiance, and atmosphere emphasizes how there is ultimately no getting away from the atmospheric determinants of an existing space. Martin Heidegger’s writing on *Stimmung* (2010, 132-33) is explicit on this point: “Mood has always already disclosed being-in-the-world as a whole [...] We never master a mood by being free of a mood, but always through a counter mood.” The most media can do in this understanding is to help reshape and remediate the current tuning of the environment. Media are better understood as tools to help remaster the given mood, rather than offering an opportunity to jettison it and start over from scratch. Departing from VR orthodoxy, I argue that this is even - and perhaps *especially* - true of “immersive” media like virtual reality.

From an ambient perspective, virtual reality is best understood not as a departure from the given environment, but as a computational space nested inside the atmosphere already surrounding the VR user. As Andreas Philippopoulos-Mihalopoulos describes (2015, 142), atmospheres are themselves already an immersive enclosure: “once inside the atmospheric interior, one cannot see outside.” Like VR space, the physical environment is perceptible in every direction. There is no turning away. The VR interface in this sense replicates the already-existing ambient enclosure of the everyday human-scale environment, but shrinks it down and straps it to an individual human head. VR leverages stereoscopic (3D) visuals, binaural (3D) audio, and a positionally-tracked headset and controllers to perceptually fix the VR user at the very center of a virtual environment. This virtual space is continuously re-rendered through screen and speakers in response to every shift in a user’s perspective, much like the external world continuously registers on human retinas and eardrums as a person moves through space. VR users thus find themselves within two immersions simultaneously, their attentions stretched across both a computer-driven ambiance and the given atmosphere of the surrounding world. The two spaces may complement one another, or they may be in tension. In either case, the VR user is tasked with being inside two places at once. The “break” Sanches-Vives and Slater describe is never absolute, but rather splits the immersion across the environments inside and outside of the headset. The rest of this essay seeks to begin thinking through how exactly VR splits ambiance across the interface, and what is at stake in bifurcating a person’s environmental situatedness in this way.

## The Vacuum of Virtual Space

First, let’s consider what aspects of the ambiance of a physical environment can and cannot be currently reproduced within a VR headset. Virtual environments for VR are nowadays commonly constructed using game design software like Unity or Unreal Engine. The ambient quality of the space is directly affected by environmental design

choices like the use of light, shadow, polygon modeling, graphics shaders, and spatial audio, all of which may be limited by the processing power required. These areas are all sites of active research, and will likely come to more closely approximate perception of a non-virtual environment over time, if never matching it entirely. New approaches to rendering virtual light, for example, are shifting more and more towards replicating what James J. Gibson (1979, 65-92) called the “ambient optic array,” or how the angles of light rays reflecting off surfaces change in real time as a viewer shifts position in space. Of course, just because current VR environments have less detail than those of existing physical spaces doesn’t mean they have *less* ambiance, just a different kind. To the extent the computational origins of a virtual environment are perceptible within the space itself, this might even be considered a *computational* ambiance, with all the varied associations this might carry for a specific individual. As Lombard and Ditton (1997) suggest, a VR user with a background in programming and 3D design will likely be less inclined to understand a virtual environment as equivalent to an actual physical space, and more likely to perceive it as a set of computer-driven parameters. As with other forms of ambiance, a person’s past experiences and social positioning intersect with the forces shaping the environment itself, informing how and how much a person fits into the space - whether that space is actual or virtual.

Even taking this into account, however, many perceptual qualities shaping the ambiance of a non-virtual space are simply missing from most current VR interfaces. A virtual ambiance will thus necessarily be defined in part by what is missing: smell, for example, or gravity, including physical resistance from objects and surfaces. Perhaps the most important missing element of all is air, the literal atmosphere of a space. The lack of air also means a lack of temperature, humidity, and atmospheric pressure. The virtual space on the other side of the screen and speakers can only gesture towards these qualities indirectly. VR environments sometimes attempt to hint at the presence of air by using particle effects to give texture to the otherwise empty space between objects - randomly drifting polygons approximating dust or pollen reflecting the light. But (in my experience at least) this can easily backfire, drawing attention instead to the lack of oxygen in the vacuum of virtual space. The otherwise immersive qualities of the environment make these absences all the more noticeable.

If the virtual space itself lacks these properties, the existing atmosphere of the environment surrounding VR use will continue to provide them. In this way, the ambiance surrounding VR use will always necessarily be hybrid. Some aspects will be tied directly to the computational rendering inside the headset: visual elements coming within the headset’s field of view and sounds coming through the headphones, along with the small degree of haptic feedback available when the controllers vibrate in the hands. Simultaneously, ambient aspects falling outside the interface will continue to be drawn from the immediate surroundings: all the qualities of the surrounding air, the Earth’s gravity, the solidity of the ground and any other surfaces in the area, any sounds leaking in around the headphones, and any light peeking in through the nose bridge of the headset.

As Brendan Keogh (2018, 22) argues in relation to videogames, spatial mediation bridges actual and virtual worlds as a player’s attention flits back and forth between the screen and the surrounding environment. While “an experience of immersion by the player may very well be the *æsthetic* goal of many videogames, immersion as a critical and evaluative tool tends to obscure the full machinations of embodiment *across worlds* that videogame play constitutes” (Keogh, 2018, 35, emphasis in original). Any experience of mediated ambiance, likewise, is shaped not just through the virtual spaces produced by the interface, but how these spaces perceptually intersect with the actual environments they arrive nested within.

## Felt Time Between the Sun and the Sky Box

Just as spatial experience is shaped by the confluence of actual and virtual ambience, so too is the experience of time. The discourse of virtual “immersion” tends to assume a VR user will forget the passage of time outside of the virtual experience, implying virtual time has no relation to the time of the outside world. However, much like space, the felt time of a VR experience necessarily intersects with and further mediates the temporality of the surrounding environment. Here too past experiences play an important role. While popular VR discourse often focuses on the awe and wonder often felt by a first time VR user, the experiential quality of VR is very different for someone frequently returning to VR over a sustained period, whether for work or entertainment. Virtual perception is shaped by practice and familiarity over time, weaving the perception and navigation of virtual space into embodied habits. As Kiri Miller (2017, 22-23) succinctly describes, “practice is how you get from virtual to visceral [...] repetition and structuring practice gradually change the quality of experience.”

The importance of practice in shaping experience is particularly clear in the case of VR developers, who are currently the population most likely to spend many hours a day inside a headset. Here the possible asymmetries between actual and virtual time may even start to interfere with individual biorhythms. American VR artist Danny Bittman (2018) speaks of the unsettling experience of taking off the VR headset after spending all afternoon working inside the *Tilt Brush* VR painting program. While the virtual sun of the software’s “sky box” stays bright in the sky throughout, Bittman describes feeling depressed when taking off the headset after a long shift and realizing the actual sun had already set long ago. This disconnect in experiential time - the direct result of a mismatch between the ambient light inside and outside the headset - forces VR users to stretch their bodies across multiple temporalities at once. While this anecdote may at first appear to provide evidence of how fully “immersive” VR can become, Bittman’s strategy for overcoming the alienation of VR’s mismatched temporality runs in precisely the opposite direction: he recommends taking frequent breaks from the headset to reconnect with the surrounding environment and “ground” perception back in the real world.

Other contexts, such as VR software for relaxation or virtual travel, may call for a more deliberate “counter mood,” replacing the ambient conditioning of the immediate environment with a markedly different virtual space and slowing down or speeding up the experience of time accordingly. But here as well, the virtual ambience will be deeply shaped by how it intersects with the broader environment around the VR user, including the experiential time immediately prior and immediately following the period spent inside the headset. The relationship between these spaces has emerged as a key theme in location-based VR installations, including theme parks and film festivals, where participant ‘on-boarding’ and ‘off-boarding’ rituals and carefully staged physical environments can be designed to enhance rather than conflict with the in-headset ambience - a conjoining of actual and virtual Saker and Frith (2020) describe as “coextensive space.” ‘Deeper’ immersion here emerges not from virtual space alone, but through a careful syncing of ambience across actual and virtual environments.

This ambient overlap becomes especially complex in the case of multi-user VR experiences where users are not co-located in the same physical space. In these contexts the ambience can spread across not only the user’s actual and virtual surroundings, but across the network into the physical spaces surrounding other VR users accessing the same virtual environment. When I play player-vs-player in *Eleven: Table Tennis*

VR, for example, I can not only listen to my networked opponent speak during our match, but also hear occasional background sounds leaking into their headset microphone from their local environment, such as noises from kids or other family members. Stretching ambiance across a network like this is nothing new in itself: the telepresent sounds on the other end of the telephone line have long offered clues to a caller's local environment. Networked VR raises the complexity level, however, weaving this network of background physical atmospheres into the shared perceptual volume of a VR space, which itself often serves as an ambient background for a foreground virtual activity (in this case, ping pong). None of these layers fully replace the others; rather, the overall ambiance is established by how they do or do not come together.

Will this convolution of different ambient layers enhance the experience, as in the most immersive location-based VR installations? Or will it further break the connection between actual and virtual space, leading to the kinds of alienated feelings Bittman describes? In either case, an ambient perspective on VR highlights the importance of how atmosphere spreads across a media interface, bringing actual and virtual spaces into both conflict and cohesion. In using any medium, some aspects of the actual environment will be supplanted by the virtual space provided by the device, while other aspects of the existing atmosphere will persist in conditioning the virtual experience. VR is especially helpful for thinking this process through, because despite the frequent promises of complete virtual immersion, it remains an interface deeply determined by the actual spaces surrounding the headset itself.

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