Sensing the Virtual: Atmosphere and Somaesthetics in Virtual Reality

Jessica Fiala

Abstract: *This article examines somaesthetics in virtual reality via the spatial lens of atmosphere, adapting theories of atmosphere to virtual environments and advocating for VR as a distinctive terrain for somaesthetics. Building on Gernot Böhme's analyses of atmosphere, this exploration unpacks ways that artists have engaged the body and space in VR, from creative interface design to multisensory storytelling, and projects that blend physical and virtual environments. Having mapped the confluence of somaesthetics, atmosphere, and immersive virtual space, the paper concludes considering the practical need for cultivating atmospheric competence in VR.*

Keywords: *atmosphere, somaesthetics, virtual reality, embodiment, immersive technologies.*

"To sense oneself bodily is to sense concurrently one's being in an environment, one's feelings in this place."

– Gernot Böhme, *Atmospheric Architectures: The Aesthetics of Felt Spaces* (2017b, p. 21)

"Our new media and technologies…are dematerializing the traditional heaviness of the life world, so that the previously invisible atmospheric dimension of our environments…now emerges as powerfully real and essential."

– Richard Shusterman, Somaesthetics and Architecture: A Critical Option (2011, p. 294)

1. Introduction

Entwined with intersections of body and place, digital technologies present an ambivalent intimacy. Woven into daily life, they are carried, worn, and installed in spaces passed through and inhabited. They provide platforms for creativity and conflict. They rouse with alerts and prompts, tracking movements and actions, at times in the background, at times at the center of work and play. Yet these technologies do not merely enter into and inform everyday spaces

and routine habits. They also make possible immersive virtual worlds that one can step into, virtual environments where the body nevertheless remains a foundation for experience and performance.

Virtual reality (VR)[1] has been gaining attention in recent years, with headsets becoming more affordable and capable over the past decade and VR usage bolstered by COVID-19 lockdowns. Spending on VR headsets has increased globally, a variety of arts and cultural organizations have launched VR programming, and major corporations have announced significant investments in the metaverse.[2] Applications of VR already range from occupational training to gaming, architectural design, co-working environments, education, journalism and storytelling, mindfulness practices, arts and cultural programming, and more. Embodiment is an ongoing focus for VR research (Erkut & Dahl, 2019; Kilteni et al., 2012; Murray & Sixsmith, 1999; Shusterman, 2013b) and, despite barriers such as internet connectivity and the cost of hardware, speculations abound related to the future normalization of VR (Ovide, 2021).

While much remains to be seen regarding such predictions, as immersive virtual environments become more common, they present compelling areas of inquiry for researchers and practitioners examining both embodiment and spatial design. How can the body be fully engaged in the subtleties and sensations of (virtual) place, and yet simultaneously, be (physically) elsewhere? How can analyses of built environments enhance understandings of sensory and emotional experiences in virtual space? What distinctive layers of embodied awareness and practice can virtual environments make possible?

Advocating for the interdisciplinary field of somaesthetics, philosopher Richard Schusterman described its focus as "the critical study and meliorative cultivation of how we experience and use the living body (or soma) as a site of sensory appreciation (aesthesis) and creative self-fashioning." To this end, he underscored that somaesthetics encompasses "both theory and practice" (2011, p. 283), from activities and physical training directed at refining bodily awareness and abilities, to sociopolitical and physiological analyses (p. 285).[3] Connecting these approaches to the essential role of the body in architecture and spatial design, he described the body as a "point of origin" for experiencing, navigating, and interpreting the environments that surround us (2013a, p. 13).

Focusing on the centrality of the body within virtual environments, this paper draws on one spatial theory—atmosphere—to explore sensory and corporeal experiences of VR through the lens of somaesthetics. In so doing, I argue that VR offers rich ground for somaesthetics across dimensions of analysis and practice. Examples chosen highlight artistic projects that engage the body in VR through interface design, multisensory storytelling, and installations that span physical and virtual spaces. These examples skim the surface of a much larger arena of potential experimentation, providing touch points within a field of practice ripe for further examination.

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1 Immersive and virtual environments range from worlds navigable via web browsers to physical installations and spatial interventions relying on technologies such as sensors, projection mapping, live feeds, augmented reality apps, geolocation apps, and more. This paper focuses on virtual reality projects accessible via a head-mounted display.

2 Global spending on headsets, software, and services spanning VR and AR rose 50% in 2020, reaching $12 billion (Vardomatski, 2021). In the cultural arena, film festivals featuring immersive content, such as Tribeca and Sundance, have experimented with making VR projects available remotely. Facebook centered the metaverse in its 2021 name change to Meta and Microsoft announced investments in the metaverse in 2022.

3 Shusterman further proposed three dimensions of somaesthetics. Analytic somaesthetics encompasses embodied perception and the role of the body in "knowledge and construction of reality," including sociopolitical influences on behavior, interpretation, and practice, as well as analyses thereof (1999, p. 304). Pragmatic somaesthetics studies and compares methods of "somatic improvement" ranging from techniques of physical training to intentional habits and strategies for honing mindful awareness (pp. 304-5). Practical somaesthetics is the arena of praxis and action—the physical practice of "intelligently disciplined body work aimed at somatic self-improvement…Concerned not with saying but with *doing*" (p. 307).

Figure 1 *Char Davies. Forest Stream, Ephémère (1998). Digital still captured in real-time through HMD (head-mounted display) during live performance of interactive immersive virtual environment, Ephémère.*

2. Embodied Approaches to Atmosphere

The ambiance of a place can be connected to physical qualities and characteristics, but it reaches beyond them as well, hovering in the air, felt in the body. This confluence of sensation, place, and meaning—atmosphere—is comprised of both emotional and physical impressions that convey mood and set the stage for action to unfold (Böhme, 2017a and 2017b; Griffero, 2020; Pallasmaa, 2014; Schmitz, 2016). Philosopher Gernot Böhme described atmosphere as "*tuned space*" (2017a, p. 2), underscoring its interstitial nature, mediating between "objective factors" found in an environment and "aesthetic feelings" rooted in the embodied experiences of individuals (p. 1).

As the body navigates space and absorbs the nuances of place, experiences of atmosphere are informed by a range of characteristics and sensations, both overt and subtle. Elements such as bright lights or dim shadows, echoes of emptiness or the sounds of bustling activity, freedom or restriction of movement, heat or cool mixed with stillness or breeze, designs of sharp angles or organic curves, all comingle to inform atmosphere in a given moment and over time.

While atmosphere can allude to clear identifiable or tangible components, it also relates to a constellation of factors that can be subjective, multilayered, invisible, and contextual, coalescing in what Shusterman described as an "experienced quality of a situation" (2011, p. 296). Interpersonal and social dynamics, cultural competence and facility (Pallasmaa, 2014, p. 231; Griffero, 2014, pp. 200-201), and degrees of welcome, scrutiny, or safety, intersecting with differing treatment based on race, gender, ethnicity, economic class, and ability further inform encounters with atmosphere among individuals and within communities. Given such a spectrum of experiences, even within a shared situation, atmosphere can elude straightforward interpretation. Furthermore, Shusterman noted that the ability to assess atmosphere is

compromised by a lack of embodied awareness and aptitude in recognizing sensations that inform perception, undergirding a need for somaesthetics (2011, p. 296).[4]

Noting the many ways in which designing atmosphere has become a common part of contemporary life, from political events to spectacles launching new consumer products, Böhme encouraged the development of "atmospheric competence." In-line with somaesthetics, he rooted such competence in "bodily presence" (2017b, p. 119). Böhme further noted dual prongs of production and reception, proposing learning how atmospheres are created—physically and through actions and comportment—as well as the ability to better perceive them. In addition to critical faculties vital for confronting attempted manipulation, he aligned atmospheric competence with notions of fulfillment also foregrounded in discourses on somaesthetics, describing atmospheric competence as "a prerequisite for the experience of pleasure in life and the discovery of one's body as a medium of being" (p. 121). In the context of VR, atmospheric competence can be interpreted as cultivating an understanding of the sensory, relational, sociopolitical, and design factors that inform experiences of virtual environments, as well as related skills of somatic awareness to better perceive atmospheres and develop critical capacity to analyze their impact. On the production side, atmospheric competence in VR goes beyond design, also implying a sense of responsibility for actions within interactive or communal environments.

Reflecting on the elements that make up atmosphere, rather than an inward-facing "essence," Böhme emphasized the ways an element "steps out of itself," referring to this extension outward as "the ecstasies of the thing" (2017b, p. 22). Of particular relevance for virtual atmospheres, he differentiated between *material*, "the stuff of which things are made" (2017a, p. 142) and *materiality*, "pure outward form" (p. 143). Using the example of particle board, Böhme elaborated on the discrepancy between "essence and appearance" (p. 144) in long-running practices of fabricating a surface illusion on objects made from cheaper materials, common in contexts ranging from architecture to jewelry making. The "ecstasies of the thing" do not therefore rely solely on structural composition, but also impressions, which Böhme noted can be physical as well as mediated through description or pictorial representation (2017b, p. 54).

Through mediation, atmosphere can extend into situations wherein particular objects are physically absent.[5] Literature provides one example, producing atmosphere through conjuring imaginary spaces, while media such as films and television series at times engage the body on a visceral level, observable in bodily responses to cinematic atmospheres of suspense, humor, or sorrow (Pallasmaa, 2004; Ryynänen, 2022).[6]

Atmosphere within VR can, however, be differentiated from the phenomena outlined above. It is distinct from both the physical experience of being in the world and from embodied reactions to screen-based media external to the viewer. In VR, the body is fully surrounded by a virtual environment that can play on combinations of sensations, from ambiances evoked

4 Numerous scholars have examined atmosphere through the lens of somaesthetics, from embodied analyses of architecture (Shusterman, 2011 and 2012) to architecture's relationship with art and aesthetics (Veres, 2018), perspectives on architectural design (Dhillon, 2015), the dynamics of urban life (Shusterman, 2019), and site-based dance performance (Fiala & Banerjee, 2020).

5 Böhme highlighted the common presence of atmospheres through the example of the theatrical stage set (2013), involving the production of an atmosphere received by an audience. VR and AR are already being used to convey a sense of place to architectural clients (Degen et al., 2017) and gather community feedback on preliminary designs (Winger-Bearskin, 2018). Such uses couple the process of assessing design decisions with the atmospheric feelings related to how a new construction can function in situ and for a community.

6 Max Ryynänen has proposed the category of somatic film to describe "films that base their effectiveness on strong bodily reactions" (2022, p. 8). While the visual is prominent, atmosphere also relies on timing and soundscapes, as evidenced in the influence of cinematic soundtracks on the way that film shapes emotion (p. 13). Of further relevance is Ryynänen's writing on media-generated atmosphere in the context of the emotional and physical layers of rasa theory (2020).

through landscapes to moods kindled through storytelling. Coexisting with the space one occupies, atmosphere in VR is both enveloping and also known to be an illusion, a particular convergence of body and spatial design.

Figure 2 *Design I/O, Raw Space (2017). Created in collaboration with Beatie Wolfe and Nokia Bell Labs. Design by Design I/O and Joshua Goodrich, VR drawings by James Paterson. VR experience driven by openFrameworks software augmenting a 360-degree live video stream with generative 3D visuals. Image courtesy of Design I/O.*

3. Crafting Embodied Experiences of Virtual Environments

Making a case for the relevance of somaesthetics in spatial design, Shusterman emphasized:

> *If architecture is the articulation of space for the purposes of enhancing our living, dwelling, and experience, then the soma provides the most basic tool for all spatial articulation by constituting the point of origin from which space can be seen and articulated.* (2013a, p. 13)

He elaborated that, as the reference point for spatial orientation and navigation, the body is rooted in physical experience—the "multisensorial feelings of moving through space" (2013a, p. 13).

This phrasing foregrounds two aspects useful for scrutinizing atmosphere as it pertains to virtual reality—multisensorial stimuli, coupled with action. On the one hand, atmosphere bleeds over lines between self and environment. Atmosphere "washes over" an individual. It is "poured out into the surrounding space" (Griffero, 2014, p. 194) and has been interpreted as both "something 'out there'" as well as "something which can come over us, into which we are drawn, which takes possession of us like an alien power" (Böhme, 2013, p. 2). And yet, despite this all-consuming sense of being engulfed by an environment, atmosphere does not stop at

external elements imposed upon a passive receiver.[7] Atmosphere also involves choices and limitations, raising questions related to what one can do in a particular place—the role(s) one is invited to take on, the degree (or lack) of agency to roam or act, and the behaviors expected or forbidden (by law or social convention). These dual aspects of physical atmosphere—action and immersion—have clear parallels in discourses on virtual reality.

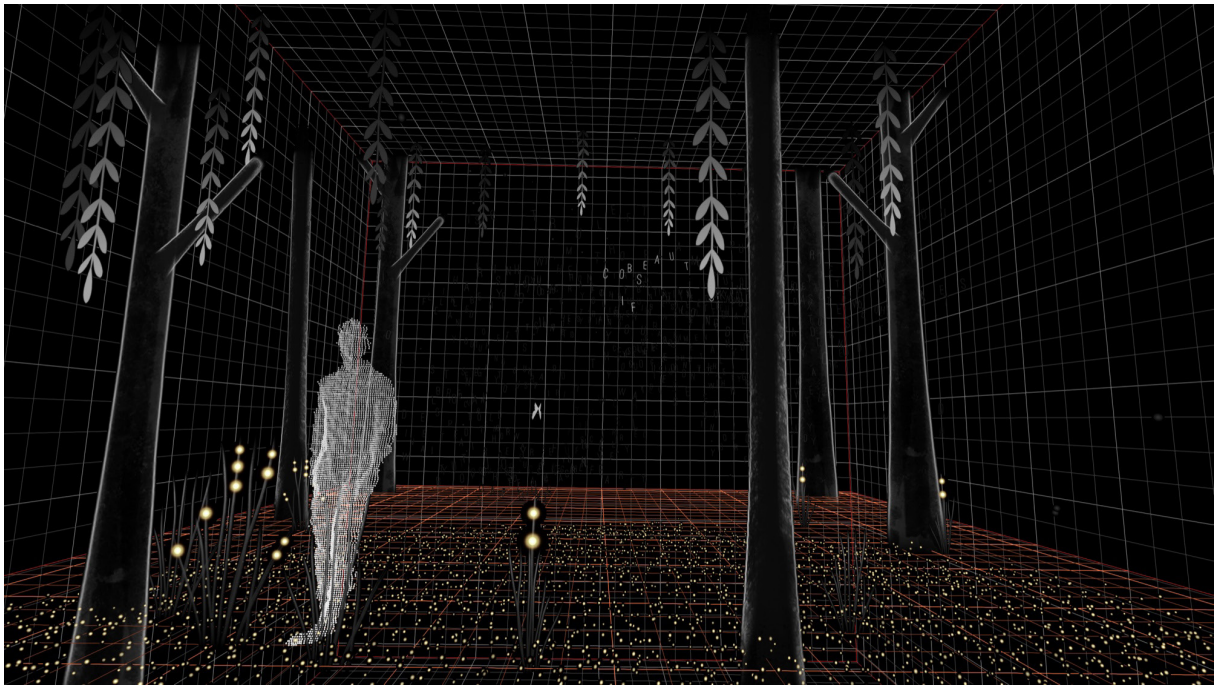

Figure 3 *Design I/O, Raw Space (2017). Created in collaboration with Beatie Wolfe and Nokia Bell Labs. Design by Design I/O and Joshua Goodrich, VR drawings by James Paterson. VR experience driven by openFrameworks software augmenting a 360-degree live video stream with generative 3D visuals. Image courtesy of Design I/O.*

Donning a head-mounted display, the body becomes the "point of origin" for exploring virtual space. Common sensorimotor actions such as turning one's head to change perspective form key technical capabilities that contribute to the "place illusion" of "being there," the feeling of being believably immersed within a surrounding world, however fantastical.

But what does such an illusion entail—on technical, experiential, and somatic levels? Terms and interpretations remain an ongoing debate,[8] however, VR researcher Mel Slater (2003) has differentiated technical elements, such as displays and body tracking delivered by devices and technologies, from a feeling of "presence," the subjective response to immersion. He further distinguished between presence (form) and the degree to which one is engaged (content) (p.2). Dissecting experiences of VR within this framework, a person could lack interest in the content unfolding even when illusions are successfully achieved—for example, "place illusion" or "plausibility," where events occur within understandable cause and effect sequences (Slater et al., 2022, pp. 2-3). Analyzing virtual atmosphere can therefore take one down paths that diverge and merge, studying technical methods of generating virtual environments, the audience responses these provoke, and methods of encouraging deeper interest or involvement.

7 See Griffero (2014) for an extended analysis of the "authority" of atmospheres.

8 For discussions of key concepts and terminology, see Bye, 2015; Chalmers, 2017; Gigliotti, 1995; Lombard & Jones, 2015; Slater 2003; Slater et al., 2022; and Slater & Sanchez-Vivez, 2016.

Surrounded by illusions, the body provides localized orientation as well as the ground for both experience and action. Highly interactive projects relying on body tracking, haptic devices, or controllers allow one to impact or engage with an environment. Personal avatars offer a chosen representation, a platform for creative self-fashioning through the design and performance of a persona. Multi-person environments add social layers to representation, interactivity, and embodiment. In contrast, noninteractive scenarios may unfurl as if one is floating disembodied with a surrounding world, "virtually absent and proprioceptively present at the same time" (Popat, 2016, p. 371). Each use case presents different affordances, yet across this spectrum of possible activity, the soma remains a foundation for experiencing virtual space.[9]

Entering the virtual does not, however, erase personal history or larger sociocultural contexts. Writing on embodiment in VR, Craig Murray and Judith Sixsmith encouraged acknowledging "not simply that the experience of VR is an embodied one, but that it is simultaneously and inescapably a social, racial, ethnic, gendered, and cultural one" (1999, p. 322). Within the virtual, one remains informed by the legacies, constructs, and habits of the physical, which influence virtual spatial design as well as embodied performance and reception.[10]

Of relevance for both atmosphere and somaesthetics in VR, discussions of immersion play on dual connotations of the term itself. On the one hand, immersion suggests plunging into, a physical act or experience of all-surrounding sensation. On the other hand, immersion refers to "a mental state" the all-consuming experience of being engrossed in an activity (Ng, 2021, p. 110), which relates to both attention and emotional investment (Griffero, 2020, p. 128). Together somaesthetics and atmosphere therefore encompass physical stimuli, spatial design, and subjective response, each with corporeal layers of reception, interpretation, and action.

4. Creative Intersections of Somaesthetics and Atmosphere in VR

The artistic pallet behind virtual spaces that both surround the body and engage the soma ranges from designing virtual landscapes to establishing characters and methods of interaction. Although VR has developed within a common ocularcentrism that privileges both vision and hand-eye coordination (Davies, 2003; Dyson, 2009; Hillis, 1999; Murray & Sixsmith, 1999), artists are experimenting with alternative capabilities within the medium, producing projects of relevance for studies of both somaesthetics and atmosphere.

Blurring body & environment in virtual space

Atmospheres permeate space, wrapping around objects and bodies, felt physically and emotionally. However, the frequently invisible or taken-for-granted qualities of atmospheres may imply emptiness, ignorable expanses in-between the prominent characteristics that anchor a place. They unfurl across space, but atmospheres are not merely "out there." They extend toward and meet the soma, with visceral textures that hover close and brush against the body.

Artist Char Davies stressed such a reorientation, explaining that: "I have never thought of virtual space as empty. Nor as airy atmosphere. I have always thought of it as full, and sensuously enveloping, like the liquidity of oceanic space, pressing upon one's skin."[11] This meeting at the

9 See Kilteni et al. (2012) for a detailed breakdown of the "Sense of Embodiment" in VR as it relates to self-location, sense of agency, and sense of body ownership.

10 In his discussion of body/media, Shusterman noted tendencies, even when using advanced technologies, to repeat existing tropes, hierarchies, and power imbalances, lamenting that "even when we seem freest to dispense with old body identities we seem intent on reproducing them" (1997, p. 26).

11 T. Das Neves (personal communication, September 13, 2022), noting comments from Char Davies.

surface of the skin brings to the fore the porous and interconnected relationship of self and external environment. Davies' project *Osmose* (1995) centered this somatic intimacy, providing a starting point for considering somaesthetic experience in VR in the context of an atmosphere that facilitates a reconnection with the body and a refocus of attention inward.

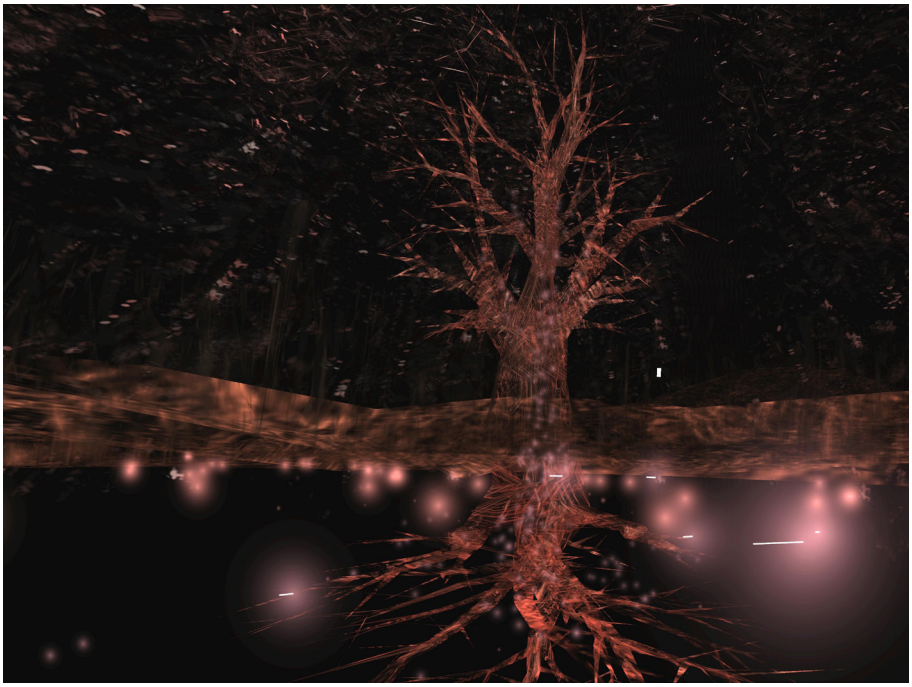

Figure 4 *Char Davies. Tree Pond, Osmose (1995). Digital Still captured in real-time through HMD (head-mounted display) during live performance of interactive immersive virtual environment, Osmose.*

In *Osmose*, Davies and her creative team invited immersants[12] to explore a 360-degree spherical virtual environment using balance and breath, made possible by a specially designed user interface, a vest, in addition to a head-mounted display. Soft, translucent imagery evoking the natural world—clearing, forest, tree, leaf, cloud, pond, subterranean earth, and abyss—blended at its periphery into text related to technology, the body, and nature, as well as the underlying code for the project software. Inspired by methods of breath use in diving, immersants could rise or sink through intentional inhalation and exhalation, shifting weight and modulating breath to hover or travel throughout the virtual space. This movement correlated to spatial audio that adjusted with location, direction, and speed.[13]

Through both form and content, *Osmose* points toward a number of possible avenues for considering embodied relationships with virtual atmosphere, in part through undermining the dominance of the visual. The project's soft graphics contrasted with common efforts in the medium at photo-realism or imagery with sharp clarity. When higher resolution technologies became available, the project team intentionally blurred graphics. This aesthetic choice had a functional component, described by Davies as shifting awareness from a "habitual reliance on sight" to "a more interior sense of embodiment." The interface design, relying on subtle movements of the body's core and eliminating hand-eye based controllers, joysticks, and gloves

12 Davies coined this term in 1995 (Davies, 2003).

13 For extended discussions of Davies' work, see Davies, 1998 and 2003; Dyson, 2009; Grau, 2003; and McRobert, 2007.

further reflected a prioritization on experiential exploration rather than goal-oriented action. Within this shift from an emphasis on "'doing' to one of 'being,'" Davies also noted a somatic paradox—"*grounding the experience in the flesh body itself*" while inducing a sensation of floating through reliance on breath and balance.[14]

Figures 5 and 6 *Char Davies. Left: Immersant wearing a stereoscopic HMD (head-mounted display) and breathing / balance interface vest (1995). Right: Roots, Rocks, and Particle Flow in the Under-Earth, Osmose (1995). Digital still captured in real-time through HMD during live performance of interactive immersive virtual environment Osmose.*

In addition to opening up questions regarding how VR might offer modes of combining somaesthetics and atmosphere to ground awareness in the body, *Osmose* also draws attention to the boundary of soma and atmosphere. Blurring lines between body and space, blending somaesthetics with atmosphere, provides a framework for delving into ways the "ecstasies of the thing"—such as designed imagery and audio—extend toward, meet, and mingle with immersants' bodies. Beyond aesthetic questions, focusing on meeting points of self and space offers practical questions for how these dynamics may be explored through mutually reinforcing designs of virtual environments and physical interfaces.

Examining interface design also reveals common modes of interacting with technologies, opening up opportunities for comparison and questions surrounding the design of alternatives. As Davies underscored:

> *The technology associated with this medium is not neutral—it has come out of the military/scientific/Western/industrial/patriarchal paradigm. And so, by default, the technology not only reflects but reinforces dominant values, unless deliberately subverted by the artist.* (McRobert, 2007, p. 14)

14 T. Das Neves (personal communication, September 13, 2022), noting comments from Char Davies.

Acknowledging the limitations and possibilities of different interfaces, and generating designs with varied affordances, opens the door for developing somaesthetic practices alongside such devices. Studying common practices and deviations within interface design further supports Böhme's atmospheric competence, aiding a critical view of what different designs make possible on the side of reception and encouraging creative production.

Crossmodal storytelling in VR

Taking a step back from the immediacy of breath and balance, analyses of atmosphere frequently foreground senses beyond the common five of sight, sound, taste, touch, and smell, in addition to stressing the synesthetic merging of sensations. Writing on atmosphere has drawn attention to proprioceptive, kinesthetic, and tactile senses (Shusterman, 2011, p. 297) while also highlighting elements such as orientation, balance, stability, duration, and scale (Pallasmaa, 2014, p. 231). While debates continue regarding what constitutes a "sense," current scientific research has identified up to 33 senses that contribute to perception, from sensations such as pain, balance, and temperature to nuanced abilities to distinguish details like light, color, and pressure on the skin (Fulkerson, 2014; Howes, 2013; and Macpherson, 2011). Even without consensus on a set of designated senses, the breadth of such sensations and stimuli adds layers to the embodied forms of awareness relevant to studies of both somaesthetics and atmosphere.

Drawing on research into the multiplicity of senses that comprise perception, as well as crossmodal studies of the ways in which senses cohere to inform experience, the multisensory immersive production studio The Feelies embarked on a 360 VR documentary, *Munduruku: The Fight to Defend the Heart of the Amazon* (2017). The project, a collaboration with the Indigenous Munduruku community based in the Amazon's Tapajós River basin in Brazil, as well as Greenpeace and Alchemy VR, told the story of the Munduruku's work to establish land rights and prevent local environmental destruction. Munduruku community members collaborated on the storyline and participated in filming, in addition to advising on sensory elements by sharing insights into the flora and fauna of the local ecosystem.

The final installation virtually transported audiences to the Amazon basin using specially designed modular pods along with VR headsets. Within each pod, controlled sensations of vibration, humidity, touch, temperature, and binaural audio added visceral components to the VR immersion. Scents created by perfumer Nadjib Achaibou established an olfactory storyline, adding to the feeling of being present within a multilayered biodiverse ecosystem while also, through contrast, conveying the stark difference between verdant forest and industrial threats.

Multisensory components can be interpreted as both a means of knowing—gathering and processing information about an environment—as well as an approach to forming connections with community and with place. Grace Boyle, founder and director of The Feelies, emphasized this communal orientation, with technologies engaging the senses serving as tools to "build bridges through sensory immersion between people in different places" (2017). Situated at the intersection of embodied knowledge and social bonds, this approach to multisensory VR storytelling merges the place illusion of "being there" with an emotional affinity of "being with." The Feelies' work to create stories not just consumed, but felt, through a holistic arc that weaves together narrative, sensory stimuli, a keen attention to place, and a deliberate excavation of the ways these components resonate with interpersonal and emotional layers, presents a number of avenues for analyzing the overlay of somaesthetics and atmosphere in VR.

Figure 7 *Installation view of Munduruku: The Fight to Defend the Heart of the Amazon featuring multisensory immersive pods combining 360 VR film, binaural sound, scent, vibration, humidity, touch, and temperature changes. Image courtesy of The Feelies.*

Through a somaesthetic lens, the orchestration of sensory cues can be viewed as part of a larger interconnection between building embodied awareness and philosophy as an "art of living" (Shusterman, 1999). At the level of praxis, exposure to multisensory storytelling is one path for cultivating awareness of the many senses that inform perception, with deepened awareness opening up nuanced facets of experience and analysis. Going a step further, Böhme connected emotion with a receptiveness to the sensations of atmosphere:

> *To perceive atmospheres means to open oneself emotionally…Getting involved in atmospheres is tantamount to wanting to participate and to expose oneself to impressions—a prerequisite for the experience of pleasure in life and the discovery of one's body as a medium of being.* (2017b, 121)

Beyond the pleasure of appreciation, the interplay of the physical and emotional offers a foundation for the critical analysis of interrelations among physical sensations, designed environments, emotional experiences, and sociocultural dynamics.

In addition to being both physical and emotional, atmosphere is also durational. Comparing atmosphere to the swell of emotions incited by music, architect and scholar Juhani Pallasmaa characterized atmosphere as "a sustained being in a situation," an experience that builds and develops over time, "rather than a singular moment of perception" (2014, p. 235). The Feelies' multisensory storytelling in VR therefore reveals dual aspects of the medium: comingling layered sensory elements to produce immersive scenes and adjusting stimuli over time to form an intentional sensory arc enmeshed with a storyline and emotional trajectory. Multisensory and temporal aspects work hand-in-hand in the context of somaesthetic efforts to cultivate bodily awareness as well as Böhme's proposal of atmospheric competence in terms of both reception and production.

Bridging virtual and physical spaces

In addition to examining embodied experiences of atmosphere from a vantage point within VR, spanning virtual and physical spaces offers another framework for analysis. On one level, such bridging can entail physical installations coupled with VR environments (or VR projects brought to specific locations), with the pathway into or out of VR functioning as part of a blended experience. At another level, researchers are studying whether VR can serve as a means of combating prejudice or grappling with embodied responses to trauma, asking if VR can produce effects that thereafter inform visceral responses in physical environments (Tassinari et al., 2022; Waldrop, 2017).

The transmedia project *NeuroSpeculative AfroFeminism* (2017) involved multiple forms of creative and spatial design including a physical installation, speculative consumer products, a VR experience, and cognitive-impact research. Developed by members of Hyphen-Labs, a multidisciplinary international collective of women of color, project team members Ashley Baccus-Clark, Ece Tankal, Nitzan Bartov, and Carmen Aguilar y Wedge brought expertise to the project ranging from architecture to molecular biology and structural engineering. Audiences for *NeuroSpeculative AfroFeminism* began in a physical installation modeled after hair salons and featuring imagined consumer products designed for women of color.[15] From this installation, individuals entered a similar environment in VR, a "neurocosmetology lab," where they embodied an avatar representing a young Black woman. This futuristic virtual salon transitioned to a virtual dimension of inspiration featuring Black women pioneering technologies of brain optimization and cognitive enhancement.

Describing *NeuroSpeculative AfroFeminism*'s spatial grounding, Baccus-Clark connected the project's virtual realms of empowerment to existing spaces of community. She noted that "salons for Black women have been the site of political activism, community building and creative endeavors," drawing an analogy between this generative momentum and scientific innovation. Observing anticipated trajectories of VR to become a widespread storytelling medium that also offers a platform to question existing structures and envision possible futures, Baccus-Clark underscored the importance of featuring perspectives from and stories by women of color from the outset (Helm, 2017; Mercer, 2018). Through transmedia installations, *NeuroSpeculative AfroFeminism* presents a form of storytelling that is both symbolic and palpable, establishing an experiential cycle from physical through virtual and back to physical again.

This format opens up questions for somaesthetics and atmospheric competence regarding how to draw on tools and opportunities specific to virtual or physical environments, as well as how to develop practices that blur the boundaries and extend one type of experience into another. In outlining methods of strengthening atmospheric competence, philosopher Tonino Griffero emphasized attention to processes of "immersion and emersion" (2020, p. 165).[16] Focusing on the discrete phases and experiential arc of entry into, time within, and transition out of virtual environments can here be applied as a framework for critical reflection as well as creativity and enhanced embodied awareness.[17]

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15 Examples of speculative products include a scarf that undermines facial recognition software; transparent sunscreen that does not discolor skin; "Octavia electrodes," transcranial stimulation devices named for Afrofuturist author Octavia Butler; a visor that blocks microaggressions and reflects them back at the viewer; and earrings with hidden cameras and microphones for recording police actions (Ding, 2017; Helm, 2017).

16 Griffero further discussed atmospheric competence in relation to the abilities to discern toxic and benign atmospheres and to learn from exposure to an array of atmospheres (2020, pp. 164-165).

17 Nurturing such critical faculties also builds on existing structures and capabilities. The current necessity of donning a VR headset can be approached as a form of framing device (Ng, 2021; Pinotti 2020) and while atmospheres may "wash over" an individual, as noted previously,

Figures 8 and 9 *Hyphen-Labs, NeuroSpeculative AfroFeminism (2017). Virtual reality scene and project installation from the Tribeca Film Festival. Images courtesy of Hyphen-Labs.*

Beyond the installation, the VR experience of *NeuroSpeculative AfroFeminism* has been connected with cognitive research into the aftereffects of virtual representations. Partnering with university researchers and scientists, Hyphen-Labs investigated how VR projects centering positive portrayals of Black women might play a role in decreasing prejudice and bias, particularly among individuals removed from these identities. Connecting the experience of stepping into and embodying an avatar of a Black woman in VR with cognitive physiological processing, Baccus-Clark posed the core question: "If you are immersed in this content, is it actually having an impact on the way your brain is firing?" (Bye, 2017).

While *NeuroSpeculative AfroFeminism* offers an example of crossing physical and virtual environments through speculative product design, spatial design, and cognitive research, the project *SPACED OUT* (2019) by artist Pierre Friquet (Pyaré) provides an example of a

engulfment does not guarantee enchantment. Audiences surrounded by a VR representation may identify or interpret in unexpected ways (Pinotti, 2017, p. 3; Polansky, 2019) and interfaces play an ever-present role (Murray & Sixsmith, 1999, p. 324), with each instance of stimuli and device interaction offering a moment that could jar an individual out of experiential flow.

transmedia pathway to recenter the body through both physical and virtual immersion. The VR experience itself transported audiences to a surreal moon landscape, inspired by the imagery of George Méliès' 1902 film *A Trip to the Moon*. In *SPACED OUT*, audiences explored this virtual world while submerged in a swimming pool, floating face down with a snorkel and wearing an underwater VR headset, DIVR, designed by Ballast VR.

The title *SPACED OUT* thematically referenced voyages to outer space as well as dissociation, a form of disconnection from one's surroundings and even one's own body associated with post-traumatic stress disorder, which can be physical, perceptual, and emotional. In addition to his work as an artist, Pyaré is an advocate for victims of childhood trauma and sexual violence, working with the French organization Association Parler. Describing the impetus for the project and confluence of themes, Pyaré emphasized that the virtual journey to the moon is also a journey inward, an opportunity to reconnect with the body both during the experience of immersion in VR, buoyed by weightlessness in water, and in the return to gravity afterwards (Bye, 2020). Reflecting on the broader implications of such projects, he asked, "Beyond trauma and pathology, as [a] human species, aren't we 'spaced out'?" In-line with analyses of somaesthetics in VR, he noted that journeys into "cybernetic sensuality" may offer routes toward an embodied reconnection with the "here and now" (Friquet, 2020). Ballast VR co-founder Ando Shah similarly connected physiological and emotional responses during the face down submersion used with DIVR to the mammalian dive reflex, associating phenomena such as a slowed heart rate with calming effects like reduced "mental chatter" (Bye, 2020).[18]

Alongside coupling virtual immersion with engulfing physical sensations, *SPACED OUT* offers a means of examining movement in VR. Technologies can enable movement within virtual space (or across a virtual map), however, physical roaming while in VR often bumps up against safety and spatial limitations. A flexible tether enabled audiences of *SPACED OUT* to experience a sense of motion while restricting mobility within the pool, a specific solution that points toward a larger challenge facing embodied experiences of atmosphere in VR.

While VR relies on habitual somatic movements around one's self to undergird verisimilitude, experiences of physical place are in part informed by locomotion—wandering up and over or through, circumnavigating, or approaching from afar—enhanced by momentum, distance, and feelings such as hard, soft, or unstable ground. The view from atop a mountain summit in VR involves notable somatic differences from its physical counterpart, both in the journey of arrival and the ability to maneuver and meander once there. Such differences can lead to hierarchically judging VR as "lesser" than parallel in-person experiences.[19] However, this paper presents virtual atmosphere as not simply mimicry of physical space but rather a medium that opens up distinct somaesthetic possibilities. Constraints and opportunities for action within VR are in part designed elements (Shusterman, 1997, p. 41), the result of decisions and common practices that artists help to identify, interrogate, and subvert.

5. Cultivating Atmospheric Competence in Virtual Environments

VR can take audiences to far-flung locations and imagined places, establishing a sense of "being there" in part through the technological and creative crafting of atmosphere. However, this ability to generate an immediate, intimate experience also gives rise to a need for awareness of

18 Researchers are also studying ways the physical submersion of underwater VR might undercut cybersickness, a phenomenon akin to motion sickness (Bye 2020; Carey, 2021; Fauville et al., 2021).

19 For a critique of such hierarchies, see Chalmers (2017).

how the senses and emotions are being deployed.

Despite its reliance on advanced technologies, scholars have noted that VR can generate an impression of an unmediated experience, placing audiences inside a representation wherein the space of representation coincides with the surrounding physical space. Rather than externally *observing* a work of art, audiences are positioned to directly *experience* an environment (Pinotti, 2020, p. 595), with the compressed distance between audience and artwork sparking concerns that the medium may hinder "critical detachment" (Grau, 2003, p. 201). Within designed environments known to be virtual but apparently "real," the constructed may seem "natural" or feel personal, lacking the bounded frames of other media and platforms such as screens, canvases, and stages (Grau, 2003, pp. 200-204; Ng, 2021, p. 115; Pinotti, 2020, p. 594).[20] While eliminating distance provokes questions related to how VR can be used for manipulation, being engulfed in an environment is also part of what gives the medium potential as a meaningful space for artistic experimentation and somaesthetic exploration.

In one example of this tension, VR has been both touted and critiqued as an "empathy machine."[21] Proponents note VR's ability to center underrepresented perspectives by transporting audiences into situations with individuals they may never normally face and offering an acute tool for journalism, advocacy, education, and nonfiction storytelling. But how do the entwined emotional, psychological, and physical aspects of a relational concept such as empathy (Torchin, 2019) translate into media stimuli and somatic response? When does "being there" in VR result in human connection or bearing witness, even inspiring action outside of VR, and when does it become mired in the relational dynamics of "experience tourism" or "tragedy porn"? While many artists and storytellers methodically work to empower communities in telling their own stories, as with other VR applications, concerns surrounding the financial motivations underpinning uses of "empathy" abound, which can range from aid organization donation drives to corporate initiatives to humanize brands (Farmer, 2019; Kang, 2017; Yang, 2017).

Just as Böhme saw a need for atmospheric competence to discern the use of physical atmospheres for political or commercial ends, so too, such an awareness is necessary in virtual environments. In addition to aesthetic appreciation, atmospheric competence supports charting one's own path through virtual spaces by better recognizing the roles one is invited to step into, the communities fostered and underlying interests at play, and the values and power dynamics inherent in both platforms and representations. However, nuanced approaches are necessary to respond to the particular qualities of the medium. Considering atmospheric competence in VR through the lens of somaesthetics offers an array of practical areas for creative expression and critical reflection—constraints and opportunities inherent in interface design, properties of all-surrounding representations, methods of engaging the senses, modes and degrees of interactivity, and overlays of the physical and virtual. While meaningful on their own, all such elements also contribute to holistic experiences of the specific VR content encountered.

Shusterman emphasized the practical application of somaesthetics through meliorative efforts aimed at training capacity and embodied awareness. VR offers an expanded ground for engaging the body—an inventive space to reorient and reengage, to reflect and experience

20 Approaching VR as a form that situates audiences inside representations, Andrea Pinotti advocated for transdisciplinary explorations of the foundations of such representations as well as *gradations* of designed components such as immersion and interactivity (2017, p. 3-4). Noting that VR representations do not simply *replace* the physical with a virtual world, but rather coincide with the physical in complex negotiations, Jenna Ng proposed analyses of *re-placement*—ways that the physical re-emerges with new dynamics, awareness, and interpretations alongside virtual experiences (2021, p. 132).

21 See, for example, Benjamin, 2019, pp. 169-173; Bollmer, 2017; Eveleth, 2018; Farmer, 2019; Kang 2017; Milk, 2015; Polansky 2019; and Yang, 2017.

relationships between self, space, and community anew. Within the medium, the body and the space it occupies intimately mingle with representation, making somaesthetic awareness, together with atmospheric competence, particularly relevant as VR's popularity grows.

6. Concluding Considerations

Entering VR, the body is both present and elsewhere. One can traverse landscapes impossible in the physical world and experience modes of embodiment and interaction that can only be realized through technologies. By offering extra-ordinary ways of being in, perceiving through, and understanding one's own embodiment, VR provides opportunities for grounding in the soma and considering the body's relationship to atmosphere through a new lens. Yet these excursions into the virtual also hold the potential to heighten a return. Early VR pioneer Jaron Lanier described the unparalleled and renewed sensory experience of the physical having passed through the virtual:

> *I saw a way to finally appreciate how wonderous our given reality is by having a point of comparison…if you've spent some time in virtual reality and then you go into a real forest, I think you're able to love that forest in a more visceral way than is readily apparent otherwise…just looking at someone else's face is astonishing after you've been in virtual reality for a while…However fantastical it might be, the best moment is the moment you take off the headset and you can see the world with freshened senses.* (Swisher, 2021)

As online and virtual spaces become more and more enmeshed with daily life as forms of entertainment, methods of communication, and strategies of self-presentation, the soma's experience both within VR and moving between virtual and physical spaces becomes a ripe expansion for the field of somaesthetics. Unconventional interface design, multisensory storytelling, and overlays of physical and virtual environments offer just a few examples of ways that artists are experimenting at the intersection of somaesthetics and atmosphere in VR. Immersive virtual environments further offer rich ground for somaesthetics and atmospheric competence in analyzing sociopolitical questions of representation, interaction, and influence.

VR is a tool that can be viewed with both optimism and skepticism, as well as adapted in ever-new ways across fields of practice. As technologies such as VR evolve and become more accessible, questions will continue to arise regarding how virtual spaces are designed and what actions they make possible. Within this ever-shifting terrain, the body remains central. It is the foundation for perceiving the self in technological dreamscapes, a visceral processor through which virtual voyages are felt and navigated, and the heart of experience to which one returns. Just as somaesthetics provides a framework for approaching the physical spaces one inhabits and passes through, so too, it offers a lens for examining dynamic, enveloping encounters with the carefully crafted atmospheres of virtual space.

Acknowledgements

I am deeply grateful to anonymous reviewers for their comments and recommendations for revisions, to Char Davies and Grace Boyle for sharing notes on discussions of their work, and to Suparna Banerjee, Kay Fiala, and Caitlin Hammel for providing feedback on draft versions of this article. Many thanks are further due to Carmen Aguilar y Wedge of Hyphen-Labs, Grace Boyle of The Feelies, Tanya Das Neves of Char Davies' Immersence Inc., and Theodore Watson and Emily Gobeille of Design I/O for sharing the images included above, and to the *Journal of Somaesthetics* editorial team for their support throughout this process.

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