



Turan, Kaya, 2025. "Interweaving the Aesthetic and the Infrastructural: Whitehead's Theory of Symbolic Reference in Leighton Pierce's Long-Exposure Films." *communication +1*, vol XI, iss I, pp. 1-26.
DOI: <https://doi.org/10.7275/cpo.2051>



Interweaving the Aesthetic and the Infrastructural: Whitehead's Theory of Symbolic Reference in Leighton Pierce's Long-Exposure Films

Kaya Turan, Stony Brook University, US, kaya.turan@stonybrook.edu

For works such as *Stone Moss* (2008), *WhiteAsh* (2014), and *Deck* (2018), avant-garde filmmaker Leighton Pierce shot thousands of handheld, long-exposure stills and then animated them in editing software by layering, merging, and fading between them – a method he calls “weaving.” Synthesizing fluid motion from still images, the filmmaker constructs intricate and impressionistic meditations on the sensation of time, in which each image lingers and blends in with the next to render the present spectral and multi-dimensional. Pierce’s films negotiate – or “weave” – between the opaque, sub-perceptual level of infrastructure and the phenomenal level of aesthetics – that is, between the underlying, distributed, and largely inaccessible operations of the technical and environmental substrate and the the higher-order activity of conscious perception and film form. I argue that by weaving the causal structure of perception into cinematic form, LeightonPierce’s long-exposure films enact what Alfred North Whitehead calls “symbolic reference” – the elucidation of the perceptual mode of durational “causal efficacy” by means of the instantaneous mode of “presentational immediacy” - between aesthetics and infrastructure. The final, continuously animated videos serve as the grounds for an embodied encounter with the processes of lower-order perception and digital capture and editing. I suggest that Pierce’s films accordingly inform an atmospheric ontology of media that both includes and exceeds embodied sensation.

Introduction

Leighton Pierce's 2018 film *Deck* opens with a long take – a one minute and twenty-three second 4K video – of a seaside sunset: the sun, intermittently veiled by calligraphic clouds, almost imperceptibly slopes in its westward arc. It casts a single, powerful ray on the scene below, illuminating the flowing tide and dark, dispersed islands (figure 1). With this romantic image, Pierce invokes the historical association, in avant-garde cinema, of sunsets and *duration* (both cinematic and ecological). Andy Warhol, Tacita Dean, James Benning, and Sharon Lockhart form a minor tradition of reflecting on the passage of time by capturing the drama of nightfall in its agonizing and meditative slowness.¹ This thematization of temporality, in Pierce's film, is further reinforced by the drifting sea, which gives symbolic and material expression to the “flow” of time. The image thus recalls, also, the proclamation of Alfred North Whitehead in his speculative opus *Process and Reality*: “That ‘all things flow’ is the first vague generalization which the unsystematized, barely analyzed, intuition of men has produced... The elucidation of meaning involved in the phrase ‘all things flow’ is one chief task of metaphysics.”²



Figure 1 – Opening sunset in *Deck*

¹ See: Warhol: *Empire* (1965), *Sunset* (1967), Tacita Dean: *The Green Ray* (2001), James Benning: *Nightfall* (2012), Sharon Lockhart: *Double Tide* (2009), *EVENTIDE* (2022).

² Alfred North Whitehead, *Process and Reality: An Essay in Cosmology*, ed. David Ray Griffin and Donald W. Sherburne (New York, NY: The Free Press, 1978), 208.

Then – with a flash of bright, streaking light trailed by several smaller illuminations, which are only later recognizable as the moon and the stars – this “opening calm” (as the video section is titled on Vimeo) is interrupted, as if the cosmos is being reconstituted. From here on, the form of the film is dramatically altered, as the 4K video is replaced by a fluid succession of still images wavering between abstraction and recognizable form. For *Deck*, Pierce shot thousands of handheld, long-exposure stills and then animated them in editing software by layering, merging, and fading between them – a method he calls “weaving.” Synthesizing continuous motion from still images, the filmmaker constructs an intricate and impressionistic meditation on the sensation of time, in which each image lingers and blends in with the next to render the “present” spectral and multidimensional. In transitioning from an archetypal image of duration to the excavation of its infrastructure, the film seems to answer Whitehead’s call to “systematize” or “elucidate” the flow of time.

Deck is the culmination of this unique cinematic method, which Pierce has since abandoned after his development of carpal tunnel syndrome, in part due to the intensive and embodied shooting and editing process involved in these works. The practice originated seventeen years earlier, when Pierce, after over twenty years of analog filmmaking, was experimenting with a digital camera on the backsteps of his home and accidentally captured a long-exposure image.³ Fascinated by the aesthetic qualities and philosophical implications of the resulting interplay of stasis and movement, this technique became the foundation of Pierce’s practice for the next two decades. In giving aesthetic form to temporality’s processual emergence, I understand Pierce’s long-exposure films as belonging to a photographic project and lineage of imaging that which is present but imperceptible to conscious experience, dating back to 19th century image-making practices such as spirit photography and Étienne-Jules Marey’s chronophotography.

Pierce’s films, accordingly, negotiate – or “weave” – between the opaque, subperceptual level of infrastructure and the phenomenal level of aesthetics – that is, between the underlying, distributed, and largely inaccessible operations of technical and environmental substrate and the higher-order activity of conscious perception and film form. Recent scholarship in digital and computational media differentiates between infrastructural processes (the imperceptible and discrete operations of computation) and aesthetic experiences (embodied and continuous sensation). This distinction is anticipated in the philosophy of Whitehead, for whom experience pervades all of the cosmos, but is distributed in two “pure” modes of perception: causal

³ This footage became the basis of the film *The Back Steps* (2001).

efficacy – non-cognitive experience – and presentational immediacy – sensory experience that arises only in the later stages of process.

Understanding all of experience as a continuum arising from the same datum, Whitehead also identifies the possibility of interplay between these two modes in his theory of “symbolic reference.” Symbolic reference describes the synthesis of two distinct modes of experience, in which the components of one mode elucidate those of another. I argue that by weaving the causal structure of perception into cinematic form, Leighton Pierce’s long-exposure films enact symbolic reference between the temporal structures of aesthetics and infrastructure. The final, continuously animated videos serve as the grounds for embodied encounters with computation’s subperceptual mediation of time. In what follows, I examine the ways in which Pierce’s weaving gives aesthetic form to the dimensional and spectral qualities of infrastructural time.

These films thus give rise to what I take to be the highest possibility of aesthetics in Whitehead’s philosophy: “the art of utilizing the perceptive mode of presentational immediacy as a means for understanding the world as a medium.”⁴ That is, using the immediacy of aesthetic experience to gain insight into the relational continuum that constitutes the cosmos. I suggest that Pierce’s films accordingly inform an atmospheric ontology of media that both includes and exceeds embodied sensation.

Dimensionality

The concluding sequence of *White Ash* (2014) returns us to the familiar motif of the sea. However, unlike *Deck’s* 4K video of the ocean, here the movements of crashing waves and flowing tides are re-constructed out of long-exposure photography. The images, taken at night but illuminated by long-duration shutter speed, render the painterly scene in subtly varying shades of grey, with the horizon line between sea and sky a sfumato gradation (figure 2). Rising waves gently approach from this boundary, eventually crashing on rocks strewn across the shore at the bottom of the frame. This motion is fluid but not quite naturalistic, proceeding by rhythmic shifts and undulations. The image is rendered thick with time, a complex tapestry of pasts and presents. Duration, like waves, emerges from the opaque depths, gaining momentum as it combines with new elements before crashing on the shores of the present.

⁴ Whitehead, *Process and Reality*, 127.



Figure 2 – Long-exposure ocean in *White Ash*

In forming duration from multiple, complexly layered images rather than a single long take, Pierce proposes an alternative ontology of time to the one that has dominated the avant-garde tradition of “slow cinema.” Temporality is figured not as a singular, unfolding present but as the intricate synthesis of overlapping and heterogenous timescales. The present maintains its unity, but is also revealed to be founded in a diversity of elements.

Pierce affords a *dimensionality* to duration that stems as much from the process of creating these images as it does from the images themselves. He begins by shooting hundreds of handheld stills, with a meditative, dancelike technique in which he captures many, repeated images of various “subjects” (which are just as likely to be trees or cups of tea as human figures) – as well as transitions between subjects – with the same bodily movement. Once the stills are collected, he imports them into digital editing software where he spatially aligns the images so that the subject occupies the same relative position in the frame. The initially jerky movement (due to slight variation in the images) is smoothed out by a process in which the same image is layered over itself several times, each offset by one frame to create a sense of motion. The opacities of the layers are adjusted, with the bottom layer having full opacity and each subsequent layer decreasing in opacity – in this way, without literally using the fade function in editing software, Pierce creates a smooth and dissolving movement between images.⁵ The resulting films index the plethora of durations involved in the laborious shooting and editing processes.

⁵ Zoom conversation with Leighton Pierce, 11 July 2023.

The interplay of image capture and image editing – of the initial still photographs and the final, animated video – accordingly forms the central problematic of these works. In creating video *out of photography*, Pierce demonstrates the ways in which fleeting impressions inform and are informed by causal processes that predate and outlive them. However, a strict demarcation between stasis and movement is complicated by the nature of long-exposure photography, which, with long-duration shutter speed, captures an image *over time*. The blurred, abstracted quality of the images (heightened by the handheld and kinetic act of capture) already contains the possibility of communication between the transitory and the causal. The duration immanent to the extra-photographic world lingers within the image, awaiting its revivification in Pierce’s “weaving.” The films are (literally) animated by Pierce’s editing practice, by which the discreet, still images are combined into continuous motion which obscures evidence of cuts. In digital editing software, Pierce delicately crafts the “warp and weft” of image to transform fixity into fluidity.⁶

Pierce’s films accordingly revive, in the digital age, structuralist cinema’s concern with the relationship between still and moving images. In his 1971 essay “For a Metahistory of Film,” photographer-turned-filmmaker Hollis Frampton questions the orthodox position in which cinema “somehow ‘accelerates’ still photographs into motion,’ and serves as a “special case of the catholic still photograph.”⁷ Reversing the primacy of stasis and duration, he posits the existence of an “infinite cinema” which predates the invention of photography and encompasses the totality of the world’s movement. In Frampton’s “metahistorical” account, “a still photograph is simply an isolated frame taken out of the infinite cinema.”⁸ Following Frampton, we can understand Pierce’s cinematic weaving as a taking apart and re-composing of the infinite cinema, rearranging its frames into new durational patterns.

Pierce writes that “time is, in fact, what I see as my main material.”⁹ Duration, rather than image, is figured as the fundamental element out of which and into which the films are shaped. Pierce makes time out of time: he combines variable and disjunctive temporalities into durational unity. He compares his work to “a mechanical clock with many different internal rhythms, all of which move the hands

⁶ Description of *White Ash*, Vimeo, Leighton Pierce, 2014, <https://vimeo.com/61583349>.

⁷ Hollis Frampton, “For a Metahistory of Film: Commonplace Notes and Hypothesis,” in *Film Manifestos and Global Cinema Cultures: A Critical Anthology*, ed. Scott MacKenzie (Berkeley, CA: University of California Press, 2014), 81.

⁸ Frampton, 81.

⁹ Description of *The Back Steps*, Vimeo, Leighton Pierce, 2001, <https://vimeo.com/8635630>.

steadily forward.”¹⁰ What appears on the surface as unified continuity, is internally constructed and enabled by the complex confluence of many subterranean parts.

This properly dimensional account of temporality reflects recent articulations of digital media, which draw attention to the temporal disparities at the heart of computation. As many scholars have noted, digital and computational media operate at speeds far beyond those available to perceptual consciousness – a development that coincides with “recent discoveries in neuroscience confirming the existence of nonconscious cognitive processes inaccessible to conscious introspection but nevertheless essential for consciousness to function.”¹¹ This condition entails a distribution of media into (at least) two levels: aesthetics and infrastructure, with aesthetics (understood in the broader sense of *aisthesis*) corresponding to sensory perception and the domain of the image, and infrastructure to the microtemporal, imperceptible operations that condition and give rise to sensation.¹² In other words, like the ocean in *White Ash*, computational time proceeds in heterogenous but mutually imbricated layers, as a current that flows from the bottom-up, from causal depths to transitory surfaces.

Pierce’s films, in layers of imagery wavering between the instantaneity of photography and the continuity of cinema, give visual form to this dimensional distribution of temporality. The layered quality of the films emerges directly from Pierce’s intimate and arduous engagement with the potentials of the digital editing software “timeline,” which allows for users to arrange an unlimited amount of video tracks both horizontally (temporally) and vertically (spatially) with a high degree of control (figure 3). For Pierce, the tendency to think dimensionally comes from his pre-digital experiences with sound mixing and multitrack audio recording: he describes layering as “the most exciting thing about digital,” in that it makes “picture editing more like sound editing and mixing.”¹³ The ability to mix many image tracks in real-

¹⁰ Description of *The Back Steps*, Vimeo, Leighton Pierce, 2001, <https://vimeo.com/8635630>

¹¹ N. Katherine Hayles, *Unthought: The Power of the Cognitive Nonconscious* (Chicago, IL: The University of Chicago Press, 2017), 1.

¹² Shane Denson describes this division in terms of technical substrate and experiential form, as the distinction between the cinematic apparatus and the cinematic image. M. Beatrice Fazi offers a similar account, explicating the orthodox Deleuzian perspective in which computation – as “informational, instrumental, operative, and technologically mediated” – and aesthetics – as “unmediated affective relations that possess ontological continuity with the matter-flow of the real” – stand in contradiction. See Shane Denson, *Discorrelated Images* (Durham, NC: Duke University Press, 2020), and M. Beatrice Fazi, *Contingent Computation: Abstraction, Experience, and Indeterminacy in Computational Aesthetics* (London, UK: Rowman & Littlefield International, 2018).

¹³ Laura Coombs, “50 Feet of String: Interview with Leighton Pierce,” *Millenium Film Journal* no. 45/46 (2006), <http://mfj-online.org/journalPages/MFJ45/Coombspage.html>.

time and with varying levels of opacity allows him “to see the image track as a flow rather than a sequence of shots.”¹⁴

It is this quality of durational flow – and its relation to stasis and immediacy – that principally concerns Pierce. In figuring cinematic time as the interplay of the instantaneous and the durational, Pierce’s films align with Whitehead’s “philosophy of organism.” Departing from the philosophical tradition that delimits experience to conscious perception (spanning from Descartes and Locke to Hume and Kant), Whitehead instead describes both an expansion and a division of experience. He writes that aside from experience, there is “nothing, nothing, nothing, bare nothingness.”¹⁵ This is not, however, a statement of pure subjectivism, but rather a radical revision of the category of the experiential to include the totality of the universe, from the microscopic to the macroscopic.

Neither is Whitehead’s position a monistic account; within this maximally expanded field of experience, he identifies two “pure” experiential modes. The first of the pure modes, presentational immediacy, names experience as we typically and historically understand it: “our perception of the contemporary world by means of the senses.”¹⁶ Presentational immediacy is conscious, sensory experience, and is exclusive to higher-grade organisms. Temporally, presentational immediacy is concerned only with the immediately at-hand, offering “no information as to the past or future.”¹⁷ It corresponds, accordingly, to the directly and perceptually accessible domain of *aisthesis*.

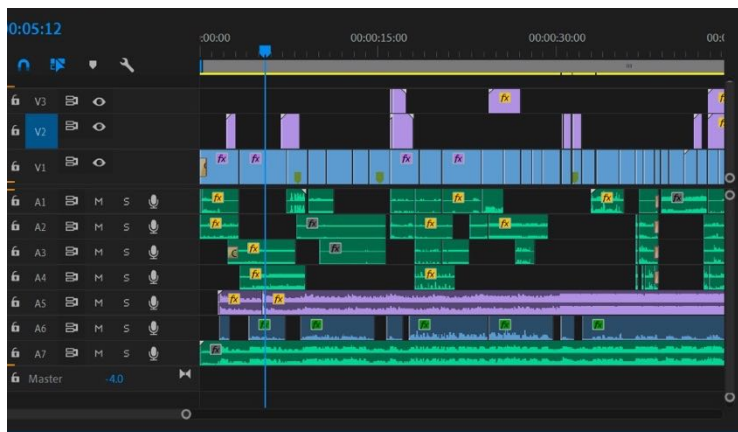


Figure 3 – Timeline in Adobe Premiere Pro

¹⁴ Coombs, “50 Feet of String.”

¹⁵ Whitehead, *Process and Reality*, 167.

¹⁶ Whitehead, 311.

¹⁷ Whitehead, 168.

However, Whitehead, borrowing from George Santayana, warns against falling into the “solipsism of the present moment.”¹⁸ In a reversal of both Humean skepticism and Kantian subjectivism – philosophies which relegate causality to a superficial (Hume) or secondary (Kant) status, as a “way of thinking or judging about” perceptual contents – Whitehead posits another, more fundamental mode of experience that underlies presentational immediacy.¹⁹ Causal efficacy, as Whitehead terms it, is “the hand of the settled past in the formation of the present.”²⁰ It is primary to sense perception, operating throughout the cosmos as the durational, relational, and infrastructural ground of experience that precedes and enables presentational immediacy.

Pierce’s films are ultimately founded not in the contrast between causality and immediacy, but in the union between these two modes. In a sequence of *Deck* titled “moonset sunrise 2,” Pierce constructs the transformation of dusk into dawn in a swirling abstraction of trees, clouds, stars, moons, and city lights. Within this “shot” (which is really a multiplicity of images stitched together as one), these various forms bleed into one another, each leaving behind a visual trace and overlapping with others as the “camera” (the movement really stems from the act of editing, and not capture) gyrosopically maneuvers about the scene (figure 4). Using only still images, Pierce investigates the alchemy of twilight, the transmutation of night into day. The synthetic act of weaving demonstrates the way in which time proceeds in layers, and *is*, properly, the synthesis of those layers.

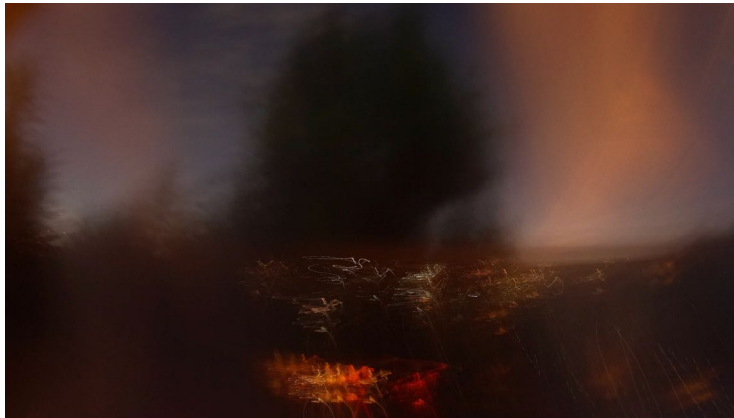


Figure 4 – Twilight in *Deck*

¹⁸ Whitehead, 81.

¹⁹ Alfred North Whitehead, *Symbolism: Its Meaning and Effect* (New York, NY: Capricorn Books, 1959), 39.

²⁰ Whitehead, *Symbolism*, 50.

By combining immediacy and duration within the frame, Pierce's weaving enacts an integration of infrastructural duration and aesthetic immediacy. The causal structures of computation and perception are woven into aesthetic phenomena that are available for sensory experience. The metaphor of "weaving" is apt for enacting such a relation, given the historical significance of sewing for both cinematic duration - the intermittent mechanism of 19th century sewing machines was adopted in the invention of cinema, as a means for advancing the film strip through the camera and projector - and computer programming - the Jacquard loom, with its translation of complex patterns into punched cards, was an early form of binary code that informed the development of computation. Pierce's method allows for the possibility of communication between the modes of causal efficacy and presentational immediacy.

Whitehead names such an integration "symbolic reference," as the "synthetic activity" whereby the modes of causal efficacy and presentational immediacy are "fused into one perception."²¹ Symbolic reference takes up elements from one mode of experience in order to elucidate elements from the other. This operation requires a "shared locality" as well as a "common ground," which is satisfied in the case of presentational immediacy and causal efficacy by the fact that the two modes concern the same data in their mutual belonging to the domain of experience. The first set of elements, which are known "immediately and directly" are referred to as the "symbols," and the second, accessed "mediately and indirectly," as the "meaning."²²

Whitehead clarifies that symbolic reference primarily moves from top to bottom, from the epiphenomenal to the (more) fundamental. Symbolic reference is "chiefly to be thought of as the elucidation of perception in the mode of causal efficacy by the fleeting intervention of percepta in the mode of presentational immediacy."²³ In other words, symbolic reference typically elucidates infrastructural processes by means of aesthetic experience. The vivid and distinct perceptual contents of presentational immediacy, as symbols, discover - but don't create - the meanings of the vague, environmental, and causally efficacious processes that constitute them.

The metaphor of weaving figures the production of digital and cinematic time as an artisanal, embodied, and handmade practice. It references the laborious process through which Pierce painstakingly crafts temporal continuity in editing software. This active sense of the body's involvement in the emergence of temporality is

²¹ Whitehead, *Symbolism*, 18.

²² Alan B. Brinkley, "Whitehead on Symbolic Reference," *Studies in Whitehead's Philosophy* no. 10 (1961), 34.

²³ Whitehead, *Process and Reality*, 178.

reflected in the animated image, which impressionistically de- and re-constructs durational perception through camera and bodily movement. The ten-minute duration of *Stone Moss* (2018), for instance, recreates the uninterrupted first-person perspective of a figure traveling circuitously through a labyrinthine forest. The interwoven images, each taken from a kinetic, handheld perspective, offer a meditation on the experience of walking and demonstrate the ways in which memories of the immediate and distant past inhere and intermingle in each step: time, in addition to space, is afforded a labyrinthine structure. This film, itself resulting from a highly embodied creative process, demands corporeal engagement on behalf of the spectator. Pierce's layered and synthetic images "amplify and attenuate our sense of bodily time," lending themselves to introspection on the causal sources of temporal experience.²⁴

The simplest and most common form of symbolic reference identified by Whitehead is the recognition of the "withness of the body": the awareness that sense-data arise from bodily organs (we see *with* our eyes, we touch *with* our hands). The readily available, immediate information of sense experience acts as the symbol which discovers the meaning of the embodied causal operations from which they derive. Symbolic reference, in moving from presentational immediacy to causal efficacy, refers us to our *environment* – beginning with our most immediate environment, our bodies, and extending to the vague world beyond. Pierce enacts such a referral to the bodily sources of temporality by interweaving first-person perceptions to carefully reconstruct their dynamism and draw attention to the embodied movements that give rise to them.

A section of *Deck* titled "domestic space3" opens with a downward slanting camera movement which distorts the titular deck and its surrounding scenery into an azure field of abstraction populated by diaphanous lights and oblique shadows. Polychromatic stripes of light – the blurred trails of city lights captured over time – crisscross the frame to form a fluctuating grid. This image, far from a pure abstraction devoid of information, offers a kind of blueprint for Pierce's cinematic method: the interlacing lines reveal the cross-stitching that forms the fabric of duration. Time, in Pierce's films, advances in the intersection, the overlapping, of warp and weft.

Warp and weft name the vertical and horizontal threads, respectively, of a fabric (fig. 5). Patterns and compositions emerge via their intertwining, in which the weft is drawn sequentially over and under the warp. Warp and weft – which correspond to the two-dimensional structure of the digital timeline – form the

²⁴ Description of Pierce's films for a screening by the California Institute of the Arts, "Leighton Pierce: Deck," 5 December 2018, <https://art.calarts.edu/events/leighton-pierce-deck>.

underlying structure of Pierce's strange and fluid mode of montage. Their imbrication creates continuity out of discontinuity.

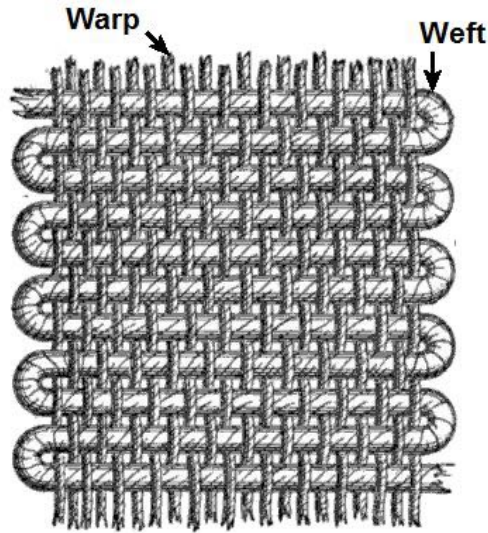


Figure 5 – Warp and weft

Despite its thorough engagement with and relevance to contemporary media technologies, Pierce's method returns us, also, to the problems and questions of early and pre-cinema. The late nineteenth and early twentieth centuries saw the proliferation of techniques for imaging the passage of time. Cinema, by capturing and projecting discreet frames in rapid succession, offered one solution to the problem of duration.

Étienne-Jules Marey's fixed-plate chronophotography offers an alternative method of photographing time that relies on a logic of *superimposition* rather than *succession*. Like cinema and the contemporary "motion studies" of Eadward Muybridge, chronophotography captures images of a body in motion sequentially and at high-speed – but instead of parsing these images as discrete frames, they are printed on a single photographic plate. Multiple images, taken just fractions of a second apart, are overlain, the same body layered over itself many times to image the total spectrum of its motion (fig. 6).

While Marey did experiment with film, he always preferred fixed plates to moving film. Mary Anne Doane offers an anecdote that epitomizes Marey's relationship to cinema:

In an extraordinary move, he would attempt to rearrange the images taken with moving film so that they embodied the characteristics of fixed-plate chronophotography. In other words, he would laboriously cut out the individual images from a strip of film, place them next to one another so that they slightly overlapped, and re-photograph them.²⁵

Through superimposition, Marey sought to overcome the intervals between frames, the lacunae that pervade and enable cinematic time. In other words, Marey shed light on cinema's blindness to causal efficacy – the relations *between* presentationally immediate instants (in this case, frames). Through this idiosyncratic practice, the immediacy of individual frames is fused with the causality of continuous duration into a single, horizontally extended image.



Figure 6 – Chronophotograph by Étienne-Jules Marey, *Cheval blanc monté*, 1886

Marey's filmstrips-turned-chronophotographs formally resemble Pierce's practice of weaving, in which temporal succession is accomplished *via* superimposition. In Pierce's films, each successive frame already exists within the previous ones, overlaid at a lower opacity that gradually increases (and subsequently decreases, as it is overtaken by others). Duration emerges from within this continual process of undulating opacity in which originally discrete and temporally disjunctive frames intertwine to form synthetic continuity. Like the warp and weft which interlace over (and under) and over again to form a unified composition, Pierce's images proceed by their ceaseless overlapping.

²⁵ Mary Anne Doane, *The Emergence of Cinematic Time: Modernity, Contingency, The Archive* (Cambridge, MA: Harvard University Press, 2002), 57.

Through their mutual interest in the relation between duration and superimposition, Pierce and Marey share the project of giving visible form to microtemporal causal relations. While Marey's stated primary concern, as a physiologist, was the movements of bodies (ranging from human beings to animals to fluids to machines), scholars have repeatedly emphasized the centrality of time in his project. Doane frames Marey's practice as an inheritance from Hermann von Helmholtz's studies of physiological time, in which Helmholtz measured the time between physical stimuli and muscular contractions. Of particular interest to Marey was Helmholtz's concept of "lost time": the imperceptible time between events. Doane understands Marey's life-long pursuit as a positivist "urge to make a 'lost time' visible and knowable."²⁶

A key distinction between Marey and Pierce is their perspective on the blurriness that results from layering images of the same form over itself. Unlike Marey, for whom "the confusion of images by superimposition constitutes the limit of fixed-plate chronophotography," this "confusion" is a desired effect for Pierce.²⁷ While Marey's dream was to objectively map and measure time, Pierce's is to meditatively observe it so that he might glimpse its mysterious origins and nature. Blurriness opens perception onto the realm of the symbolic, revealing its connection to its opaque sources. Whitehead describes perception in the mode of presentational immediacy as vivid and distinct, while perception in the mode of causal efficacy is vague and indistinct. In the philosophy of organism, "clearness in consciousness is no evidence for primitiveness in the genetic process: the opposite doctrine is more nearly true."²⁸ The obscurity of Pierce's images reveals an atmospheric, only indirectly and vaguely accessible realm of temporal experience that underlies our immediate perceptions of the world.

Marey's chronophotography and Pierce's weaving figure dimensionality as a technique for enacting symbolic reference between presentational immediacy and causal efficacy. These image-making practices combine temporally disparate images within and across frames as a means of revealing the continuities that underlie them. It is imperative that we recognize that the underlying sources of contemporary aesthetic experiences are machinic as well as embodied: the experience of time in Pierce's films issue not only from our bodily organs but also from microtemporal computational processes that do not belong to the human and precede embodied

²⁶ Doane, *The Emergence of Cinematic Time*, 47.

²⁷ Marey as cited in Georges Didi-Huberman, "The Dance of All Things," in *Movements of Air: The Photographs from Étienne-Jules Marey's Wind Tunnels*, ed. Florian Dombois and Christoph Oeschger (Zurich: Diaphenes, 2023), 206.

²⁸ Whitehead, *Process and Reality*, 173.

perception. The perceptible and bodily felt images that make up the films stand at the very end of a causal chain that begins before even the witness of the body. Causal efficacy stretches all the way down, to the “constitution of the datum.”²⁹

Media theorist Mark Hansen places Marey at the fore of a “minor tradition in media theory” that “conceptualizes the technical distribution of experience as a co-functioning of autonomous machinic and human elements, each possessing its own domain of sensation.”³⁰ The aim here is not to develop technological prostheses to supplement human perception, but to give indirect expression to the technical “distribution of sensibility beyond perception.”³¹ Pierce’s films follow in this tradition, giving visual and symbolic form to the variegated and synthetic structure of computational time.

From within the nebular abstraction of imagery that dominates the “domestic space?” section of *Deck*, the viewer occasionally finds some spatiotemporal grounding in brief glimpses of familiar elements of the scene, such as the windows of the house behind, or the branches of the trees in front. This oscillation between abstract flux and ordered composition reflects Shane Denson’s understanding of the relational configuration of technical substrate (infrastructure) and experiential form (aesthetics). Denson draws on Niklas Luhmann’s theory of “mediality” to figure the substrate/form relation as a dynamic interplay in which the disorganized and loose elements of substrate are transformed into the organized and tight elements of form.

The dynamic interplay between infrastructure and aesthetics is given temporal form in *Deck*, in which the synthetic animation of causal duration gives rise to provisionally stabilized perceptual images. Recognizable, organized forms, such as the windows and branches, “emerge from and return back into a substratal pool of disarticulation.”³² The substrate – or infrastructure – in question here is the opaque ground of causality, which remains only indirectly available to perceptual experience. In this way, the film parallels the emergence of on-screen images from distributed and microtemporal computational processes.

In his book *Feed-Forward: On the Future of Twenty-First Century Media*, Hansen seeks to develop a theorization of computational time “on the basis of Whitehead’s genuinely strange conviction that the metaphysical structure of reality has to remain

²⁹ Whitehead, 172.

³⁰ Mark B.N. Hansen, *Feed-Forward: On the Future of Twenty-First Century Media* (Chicago, IL: The University of Chicago Press, 2015), 53.

³¹ Hansen, *Feed-Forward*, 54.

³² Shane Denson, *Disrelated Images*, 66.

de jure inaccessible to direct experience.”³³ Here, Hansen is referring not to the distinction between presentational immediacy and causal efficacy, but to the broader, ontological division between the speculative and the experiential in Whitehead’s thought. While he takes all of the cosmos to be experiential, Whitehead also describes a process which remains outside of and prior to experience, temporality, and indeed the universe altogether: concrescence.³⁴ Before their admission into the “settled world” of experience, future elements of the universe undergo a process of becoming in which they “prehend” – or relate – to the totality of existing entities. Concrescence is the process by which these disjunctive entities are synthesized into a novel unity (an “actual entity”), which is introduced into the universe: “the many become one, and are increased by one.”³⁵

However, Hansen also admits that the microtemporal operations of twenty-first century media complicate a rigid separation of the metaphysical from the experiential. While computation remains squarely within the domain of experience, as Whitehead figures it, it also remains speculative to human cognition. Computation thus occupies a “third arena of process” which “operates at a ‘higher level’ than the microscopic [metaphysical] domain where actualities come into being, but at the same time at a ‘lower level’ than the macroscopic [experiential] processes of perception.”³⁶

On this account, contemporary media draw from and intervene in a vastly expanded and multi-temporal network of causal efficacy. Pierce’s weaving addresses this condition by creating a digital structuralist cinema that interrogates cinematic time’s emergence on the basis of a multiplicity of timescales. To return to an earlier claim, Pierce *makes time out of time*. He combines the originally divergent temporal structures of photography, cinema, perception, and computation into novel durational unity.³⁷

³³ Hansen, *Feed-Forward*, ix.

³⁴ Following Didier Debaise and Isabelle Stengers, Hansen critiques the French legacy of Whitehead scholarship which fails to faithfully uphold the speculative/experiential divide. He identifies the repetition of this historical error in most contemporary applications of Whitehead to media, in which theorists mistakenly attempt to describe computation in terms of concrescence or prehension.

³⁵ Whitehead, *Process and Reality*, 21.

³⁶ Hansen, *Feed-Forward*, 143.

³⁷ Recent accounts of cinematic spectatorship stress the ways in which the cinematic apparatus exceeds the boundaries of the screen to include architectural, social, and embodied structures that influence and inform the act of watching film – suggesting a number of additional dimensions and temporal dynamics at play in the viewing of Pierce’s films, whether screened at home or viewed in the movie theater. See Jean Ma, *At the Edges of Sleep: Moving Images and Somnolent Spectators*

This complex process of genuine temporal origination is conveyed by the title of Pierce's 2010 film *Retrograde Premonition*, which suggests a futural intuition founded in retrospective reflection. Pierce mines the rhythms of the past in order to anticipate and create new futures, stressing the fundamental interconnection of what has been, what is, and what will be. The film stitches together still images – their temporal heterogeneity indexed by disjunctions in perspective, which Pierce smoothly integrates with abstract and blurred flourishes – to compose an unbroken and fluid exploration of his apartment. Cinematic duration emerges here not as a given but as the dynamic synthesis of the temporalities proper to photography, editing software, and computation.

Pierce's films offer an account of temporality as the composite of many levels of process. The form of the films enacts symbolic references between the higher-level, aesthetic, and presentationally immediate dimension of perception and the lower-order, infrastructural, and causally efficacious continuum which underlies it. They lend themselves to the Whiteheadian conception of experience described by Hansen, for whom "every experience of a human being is actually the accomplishment of a very complex series of partially overlapping processes occurring at different scales and at different time frames."³⁸ Pierce's weaving dramatizes this complex process of overlapping, through which elements across ontological levels are synthesized into provisional temporal unities.

Spectrality

About seven minutes into *White Ash*, the screen is plunged into urban phantasmagoria. Ultramarine blue lights smear across the top half of the frame, obliquely illuminating the shadowy street below. Fluorescent streaks of white and yellow sporadically flash across the scene as vehicles speed by. Amidst this amorphous metropolitan glow, anonymous silhouettes make their way through the uncertain night. These faint forms, alone or in pairs, on foot or on bicycles, drift across the image, soon to be replaced by others. In long-exposure capture, their solid bodies lose their substantiality and become vaporous, diaphanous, hallucinatory (figure 7). These phantasmal figures recall the first human forms ever captured by a camera: the smudged contours of a shoeshiner and his customer, who alone stood still long enough on the crowded

(Oakland, CA: University of California Press, 2022), Jocelyn Szcapaniak-Gillece, *The Optical Vacuum: Spectatorship and Modernized American Theater Architecture* (New York, NY: Oxford University Press, 2018), and Meredith C. Ward, *Static in the System: Noise and the Soundscape of American Cinema Culture* (Oakland, CA: University of California Press, 2019).

³⁸ Hansen, *Feed-Forward*, 150.

Boulevard du Temple in 1838 to be captured by Louis Daguerre over a five-minute photographic exposure (figure 8).



Figure 7 – Spectral figures in *White Ash*



Figure 8 – Detail of Louis-Jacques Mandé Daguerre, *Boulevard du Temple*, 1838

The wandering spirits of *White Ash* thematize a spectrality that pervades Pierce's practice of weaving as a whole. By layering images in descending opacity – with each newly introduced still image beginning at full opacity and decreasing frame by frame – Pierce creates motion trails which give visible form to lingering of the past in the present. This effect appears to slow down the *passage* of time, extending the visible life of the present and exaggerating the subtle transitions between moments.

In *Barbara Hammer Lends a Hand* (2012), Pierce frames the hand of fellow avant-garde filmmaker Barbara Hammer in close-up(s), as she interacts with his installation “Threshold of Peripheral Induction” at the Ann Arbor Film Festival. Her hand, reaching out toward the faint emerald glow of a screen, is registered in all its wavering micro-movements. In so many fading layers, her outstretched palm becomes a phantom limb, a ghostly appendage that reaches from one frame to the next (figure 9). Hammer’s hand is the “settled hand of the past in the future” – the causally efficacious fabric that binds one instant to another.³⁹ Weaving together duration and instantaneity, Pierce creates spectral *images* of causal efficacy, symbolically referring to the insensible persistence of the past in the present.



Figure 9 - Hammer’s “phantom limb” in *Barbara Hammer Lends a Hand*

Pierce’s ghostly motion trails give symbolic form to what Hansen calls the “feed-forward” character of contemporary media: their operation at microtemporal speeds below the threshold of perception and intervention in the yet-to-come of conscious experience. Feed-forward names computation’s futural orientation and operation, its mediation of the sub-perceptual, infrastructural dimension of experience that is only later synthesized for consciousness. Accordingly, Hansen figures twenty-first century media as “directly contributing to the domain of causal efficacy.”⁴⁰ In Pierce’s films, the spectral temporal dynamics of the motion trail, by which the past inheres in and founds the present, becomes a way to elucidate computation’s active role in shaping the imminent future. Each image remains in the frame after its initial appearance, as a lingering impression that, along with others,

³⁹ Whitehead, *Symbolism*, 50.

⁴⁰ Hansen, *Feed-Forward*, 145.

constructs the composition of the new “frame”: the present is woven from the threads of the past. In this way, Pierce symbolizes Whitehead’s understanding of presentational immediacy as “an outgrowth from the complex datum implanted by causal efficacy.”⁴¹ The method of weaving fuses this complex datum into a perceptible image, demonstrating the continuity between causal efficacy and presentational immediacy.

The spectral, even alien dimension of causal efficacy is dramatized in *Sitting* (2010). Pierce photographs, and then stitches together, images of a nude woman (credited as Sarah R.) who is posing as a model for a painter (Prudence Whittlesey). The film opens with an image of the upper half of the model’s supine body, which is bisected by a curtain. This voyeuristic framing introduces the tense dynamic between the looker and the looked-at, the representer and the represented. This binary relation, however, is soon further complicated, as the camera “zooms” in on the figure, impossibly but fluidly shifting between perspectives to unveil the larger scene. Amidst the impressionistic flourishes of the camera, an additional, phantasmal and kinetic figure occasionally enters the frame: the faint, blurred form of the painter. The intersubjective structure of the film is revealed to be triadic, an organization which reflects the film’s triumvirate blending of the painterly, the photographic, and the cinematic.

The relation between looker, looked-at, and looked-at-looker (which is even further complicated by the viewer of the film, who watches watching being watched) crystallizes in a composition in which the model is framed from behind, sitting up to examine the abstract paintings of her form as the painter faces her and the camera (figure 10). The camera, and Pierce behind it, form the infrastructural and invisible background which organizes and captures this scene. The machinic cinematic image sees both original and copy, looker and looked-at, as a foreign invader in the realm of subjectivity.

The relation between interior and exterior that is visualized in *Sitting* images feed-forward temporal dynamics, by which “the technically accessed data of sensibility enters into futural moments of conscious as radical intrusions from the outside.”⁴² For Hansen, contemporary consciousness is shaped by forces beyond its purview, outside of the temporal scope of perception. In Pierce’s films, this “intrusion from the outside” is figured through the aesthetic conventions of phantasmagoria, suggesting temporal alterity via visual confusion and the presence of forms from the past and from beyond the frame. These visual clues foreground the fact that time itself emerges from the

⁴¹ Whitehead, *Process and Reality*, 172.

⁴² Hansen, *Feed-Forward*, 30.

outside in Pierce's films: duration is not to be found in the original stills, but is externally introduced by the act of weaving which binds the images together.



Figure 10 – Looker, looked-at, and looked-at looker in *Sitting*

A key distinction between presentational immediacy and causal efficacy, for Whitehead, is that while presentational immediacy arises “from within us,” the “bonds of causal efficacy arise from without us,” disclosing “the character of the world from which we issue, an inescapable condition round which we shape ourselves.”⁴³ Underlying and informing presentational immediacy, or aesthetic experience, causal efficacy is the “vague, haunting, and unmanageable” substrate out of which the subject emerges.⁴⁴ This relation between causal efficacy and presentational immediacy informs Whitehead’s central project of reversing Kantian subjectivism: “for Kant, the world emerges from the subject; for the philosophy of organism, the subject emerges from the world.”⁴⁵

In *Sitting*, various selves (the model, the painter, the first-person visual field of the camera) are constructed in processes of formation that arise from relational configurations with the exterior (the other, the machine, cinematic editing). Pierce’s weaving creates, from an abstract and blurry mass of images, provisionally stabilized perceptions through which one can begin to differentiate self from other and figure from ground. In this way, the film reveals, symbolically, that “the perceptive mode of causal efficacy is to be traced to the constitution of the datum, by reason of which there is a concrete percipient entity.”⁴⁶ In other words, causal efficacy *founds* the

⁴³ Whitehead, *Symbolism*, 58.

⁴⁴ Whitehead, *Symbolism*, 43.

⁴⁵ Whitehead, *Process and Reality*, 88.

⁴⁶ Whitehead, 172.

subject. Aesthetic, bodily perception is not (as Kant would have it) primary, but instead a late-phase integration of diverse and inhuman causally efficacious sources. The task of symbolic reference is to take up the perceptually available contents of aesthetic experience, and, by demonstrating their continuity with the forces that precede them, refer back to the insensible domain of infrastructure.

Demonstrating continuities between aesthetics and infrastructure, however, becomes more difficult in a computational media regime. The introduction of alien elements and timescales into the production of sensibility deepens the chasm between the infrastructural and the aesthetic, resulting in what Bernard Geoghegan calls the “infrastructural uncanny.” The infrastructural uncanny describes a “range of unsettling phenomena that tend to emerge in periods of rapid expansion in the means of technological conveyance,” relating especially to “the incomplete and partial features of communication – its gaps and its delays.”⁴⁷ In computational media, the aesthetic/infrastructural divide is premised on precisely such a gap, which Hansen figures as an exteriorization, outside of the brain, of what neuroscientist Benjamin Libet calls the “missing half-second,” the “temporal gap between brain activation and awareness.”⁴⁸ This gap – microtemporal but profound – strains the possibility of symbolic reference by emphasizing an opaque discontinuity between causal efficacy and presentational immediacy.

Geoghegan examines nineteenth century spiritualism, and its aesthetic manifestations as spirit photography and spirit rapping, as a technology for *bridging the gaps* of the infrastructural uncanny. Contesting the conventional understanding of spiritualism as an imitation of new communication technologies, he instead positions it as offering “a means to scale the gaps in these emerging technical forms,” founded in its “ability to interconnect... heterogenous elements.”⁴⁹ Spiritualism, in other words, is a technique for synthesis.

Spirit photography, an early photographic genre pioneered by William and Hannah Mumler in the 1860s, utilized double exposure to bring the translucent bodies of the deceased into spatiotemporal coincidence with their living relatives. In combining portraits necessarily captured at different times within the frame, spirit photographs seek to reconcile the ontological gulf between the living and the dead. These images rely on the supposed integrity of the snapshot and perspectival congruity to signify temporal unity. In William Mumler’s famous portrait of Abe and Mary Todd

⁴⁷ Bernard Dionysus Geoghegan, “Mind the Gap: Spiritualism and the Infrastructural Uncanny,” *Critical Inquiry* no. 42 (2016), 900.

⁴⁸ Hansen, *Feed-Forward*, 190.

⁴⁹ Geoghegan, “Mind the Gap,” 902.

Lincoln, the faint figure of the assassinated president stands behind his widow, the right side of his torso obscured by her form and his spectral hands draped over her shoulders (figure 11). This crude spatial integration suggests that the persistence and coincidence of the past in the present.



Figure 11 – William H. Mumler, *Mary Todd Lincoln*, circa 1870

The strange temporal ontology proper to spirit photographs is expressed in the opening lines of Mumler’s memoir, *The Personal Experiences of W.H. Mumler in Spirit-Photography*:

In these days of earnest inquiry for spiritual truths, I feel that it is incumbent upon me to contribute what evidences of a future existence I may have obtained in my fourteen years’ experience in Spirit Photography.⁵⁰

Paradoxically, Mumler figures spirit photographs as *evidence* of the *future*. He harnesses photography’s (already disputed, in the nineteenth century) claim to documentary in order to glimpse what lies ahead. Erica Fretwell draws attention to the Civil War context of Mumler’s practice, positioning spirit photography as a counter to the brute realism of medical photography. She writes that in giving material and visual form to the grief of - overwhelmingly white and bourgeois - civilians, the images “reopened

⁵⁰ William Mumler. *The Personal Experiences of W.H. Mumler in Spirit Photography* (Boston, MA: Colby and Rich, 1875), 3.

time by putting the past in the present.”⁵¹ The real work of spirit photography, then, was to comfort the widowed and the orphaned, to offer them a “future existence” unburdened by loss.

Spirit photography is accordingly less a reflection on the indexicality of the photographic medium, and more an attempt to mend the ontological disparities introduced into the realm of the visible by photography and history. By combining the corporeal and the spectral on a single photographic plate, spirit photography addresses the disjunction between past and present, and between human and machinic vision. The ghosts of spirit photography, which resemble the figures that haunt Pierce’s films in their gauzy faintness, symbolize the imbrication of the photographic with nonhuman, foreign forces that reach beyond and before the domain of embodiment.

I understand Pierce’s weaving as a kind of twenty-first century spiritualism, a technique for bridging the gap between causal efficacy and presentational immediacy, infrastructure and aesthetics. In stitching together disparate timescales - ranging from the inhuman speeds of computational processes to the frozen eternities of photography - into cohesive and durational images, the method of weaving provisionally crystallizes heterogenous elements into perceptually accessible forms. Effacing any visible evidence of montage, Pierce transforms the discontinuities between still images into fluid continuity, such that the films unfold as if they are made up of a single, metamorphic long take.

The films accordingly give expression to Whitehead’s idea that “every actual thing is synthetic,” and that “symbolic reference is one primitive form of synthetic activity whereby what is actual arises from its given phases.”⁵² Symbolic reference, as the fusing of the perceptive modes of causal efficacy and presentational immediacy, is one iteration, within the domain of perception, of the composite and relational structure of the cosmos at large. After their initial formation in the metaphysical, speculative process of concrescence – in which an actuality-in-attainment prehends the entirety of the universe – actual entities merge with others to form “societies,” or composite sets of actual entities. Societies are “experiential entities that arise at scales from the nano to the cosmological,” shaping experience from the bottom-up and

⁵¹ Erica Fretwell. *Sensory Experiments: Psychophysics, Race, and the Aesthetics of Feeling* (Durham, NC: Duke University Press, 2020) 55.

⁵² Whitehead, *Symbolism*, 21.

enabling the temporal syntheses that define (but are not exclusive to) human perception.⁵³

Whitehead uses the term “cosmic epoch” to describe the “widest society of actual entities whose immediate relevance to ourselves is traceable.”⁵⁴ In 1929, he christened his own time as the “electronic cosmic epoch,” as a “society of electromagnetic occasions.”⁵⁵ Already, nearly a century ago, human experience was traceable to pre- and in-human elements that intervene in and give rise to perceptual processes. The feed-forward operation of contemporary media radicalizes this insight, demonstrating the ways in which human perception does not, properly, *belong* to the human, but is instead the synthetic product of forces from the outside and the past. Pierce’s long-exposure films offer profound, symbolic insight into the spectral production of subjectivity, using aesthetic experience to demonstrate the way in which causality emerges from without.

Conclusion: The World as a Medium

The ending of *Deck* returns us to the oceanic scene and 4K video of the opening image. Time has passed, either hours or days, as evidenced by the dark and dense blanket of clouds which have accumulated to obscure the sun, leaving only a thin strip of ambient and rain-filled light at the distant boundary of sea and sky. The sense of temporal difference that this image is imbued with, however, is not only quantitative (the intervallic and standardized progression of metric time), but qualitative. Between the film’s “opening calm” and “closing calm,” duration itself has been transformed through Pierce’s long-exposure weaving, revealing its foundation in the complex interplay of the perceptible and the imperceptible, the human and the non-human, the infrastructural and the aesthetic. This final image appears as the profound accomplishment – the *synthesis* – of these diverse elements, which have been interwoven into durational form.

In creating aesthetic, perceptible images which elucidate the durational infrastructures that found them, Pierce realizes the ultimate ambition of symbolic reference: “the art of using the perceptive mode of presentational immediacy as a means for understanding the world as a medium.”⁵⁶ The practice of weaving discovers the real continuity between the aesthetic and the infrastructural, and between causal

⁵³ Hansen, *Feed-Forward*, 120.

⁵⁴ Whitehead, *Process and Reality*, 91.

⁵⁵ Whitehead, *Process and Reality*, 92.

⁵⁶ Whitehead, *Process and Reality*, 127.

efficacy and presentational immediacy. It reveals the world itself as an ongoing process of synthesis. Whitehead's peculiar characterization of the world as a "medium" corresponds to recent theorizations of atmospheric or climatic media, which take an environmental perspective on media rather than a content or object-oriented one. Media are here understood as pre-reflexive – or causally efficacious – milieus from which distinct individuals, such as subjects, objects, and images, emerge.

Pierce's long-exposure films aestheticize the temporal structure of atmospheric mediation, through which imperceptible, distributed, and micro-temporal processes are transformed into macro-temporal forms available for embodied perception. His digital weaving combines the various temporalities involved in this process to figure mediation as a relational continuum. Embodied sensation is included within this continuum, but is not its origin. The final lesson of weaving is that the aesthetic should be neither discarded nor taken to be all-encompassing: it should be understood as the pivotal site of symbolic access to the atmospheric substrate in which we are immersed.

Bibliography

- Brinkley, Alan B. "Whitehead on Symbolic Reference." *Studies in Whitehead's Philosophy* no. 10 (1961): 31-47.
- Coombs, Laura. "50 Feet of String: Interview with Leighton Pierce." *Millenium Film Journal* no. 45/46 (2006), <http://mfj-online.org/journalPages/MFJ45/Coombspage.html>.
- Denson, Shane. *Discorrelated Images*. Durham, NC: Duke University Press, 2020.
- Didi-Huberman, Georges. "The Dance of All Things." In *Movements of Air: The Photographs from Étienne-Jules Marey's Wind Tunnels*, ed. Florian Dombos and Christoph Oeschger, 157-278. Zurich: Diaphenes, 2023.
- Doane, Mary Anne. *The Emergence of Cinematic Time: Modernity, Contingency, The Archive*. Cambridge, MA: Harvard University Press, 2002.
- Frampton, Hollis. "For a Metahistory of Film: Commonplace Notes and Hypothesis." In *Film Manifestos and Global Cinema Cultures: A Critical Anthology*, edited by, 78-85. Berkeley, CA: University of California Press, 2014.
- Fretwell, Erica. *Sensory Experiments: Psychophysics, Race, and the Aesthetics of Feeling*. Durham, NC: Duke University Press, 2020.
- Geoghegan, Bernard Dionysus. "Mind the Gap: Spiritualism and the Infrastructural Uncanny." *Critical Inquiry* no. 42 (2016): 899-922.
- Hansen, Mark B.N. *Feed-Forward: On the Future of Twenty-First Century Media*. Chicago, IL: The University of Chicago Press, 2015.
- Hayles, N. Katherine. *Unthought: The Power of the Cognitive Nonconscious*. Chicago, IL: The University of Chicago Press, 2017.
- Mumler, William. *The Personal Experiences of W.H. Mumler in Spirit Photography*. Boston, MA: Colby and Rich, 1875.
- Whitehead, Alfred North. *Process and Reality: An Essay in Cosmology*, ed. David Ray Griffin and Donald W. Sherburne. New York, NY: The Free Press, 1978.
- Whitehead, Alfred North. *Symbolism: Its Meaning and Effect*. New York, NY: Capricorn Books, 1959.