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Trading Signals for Patterns and Ephemerality for Sensuality in Dance Studies

–– Jorge Poveda Yánez

(UNIVERSITY OF CALIFORNIA, RIVERSIDE).

ORCID: 0000-0002-5268-6206

–– Rory Fewer

(UNIVERSITY OF CALIFORNIA, RIVERSIDE)

ORCID: 0009-0007-2549-048X

In response to the redoubling effect of "ephemerality" in performance studies and "cloudiness" in discourses framing digital databases, this article proposes a materially-driven assessment of dance after its digitization. At the dawn of ubiquitous computing and increased avenues for the conversion of dance into computerized information, we propose a critical appraisal of the information-driven epistemology that champions the digitization of all aspects of life, including movement and creativity. As such, new technological affordances for the capture and reproduction of the dancing body are contrasted and contextualized with an emphasis on the series of re-materializations that digitization produces across bodies, devices, and choreography.

While this guiding premise of a materially-driven approach entails foregrounding the electric, mineral, hydraulic,

petrochemical, or otherwise material resources needed for the conversion of dance into data, this premise is also framed as an invitation to renew the sensorial and sensual study of data in and of itself. By epitomizing the "pattern" instead of the "signal", we suggest that sitting with the shape, contour, and trajectory of data points before trying to make sense of them could rekindle a sensual engagement with computers and their language. Capitalizing on this sensual detour for the examination of dance data is discussed as the fuel for any pivotal changes in the field, whereby simulation might cease to be the synonym for artificial and instead be recruited as the rehearsal of another real.

Keywords: Dance, Digitization, Screen Cultures, Datafication, New Materialism

The sensuality of the "body" and its alleged opposition to the intellectual life of the "mind" is a familiar argument that has shaped the field of dance studies time and again. Even though there is a long lineage of thinkers and philosophers that have displaced the world of ideas from that of embodiment since the first century BCE (Manning 188), René Descartes is recurrently blamed for splitting the mind and the body as the cardinal sin across the humanities. The pervasiveness of this alleged—while nonetheless effective—split similarly illuminates the common imaginaries surrounding digital dance as a ghostly immateriality. Against beliefs of embodiment as non-cognitive or thoughts as incorporeal, this special issue foregrounds digital dance as a form of information that can only exist thanks to its material basis. Upon being accused of having bifurcated mind and body, René Descartes himself refuted this charge in the mid-seventeenth century. Contrary to the canonical interpretations of his work, he claimed that mind and body were indeed two parts of a continuum, connected through the physiological locus of the pineal gland (Shapiro). Today, motion capture laboratories and other digitization tools can be thought of as the technological loci where dance (the "body") turns into information (the "mind"), and

to confine these two to completely different realms would thus reinstate a Cartesian split that may have never been there to begin with. Descartes lived through the emergent scientific revolution wherein "reason" was consolidated as the guiding light of the humanistic project, which in the twenty-first century has been replaced by "information". Despite these misunderstandings of Descartes or perhaps precisely because of them, contemporary scholarship from the so-called "hard" sciences as well as from the humanities agree that the production of thought is impossible without a body, and we would extend this claim to similarly argue that the circulation of digital dance is unviable without electric, chemical, and physical infrastructures. To unfold such a stance, we offer this special issue to reframe the alleged dematerialization of digital dance as a multivocal re-materialization of movement across bodies and devices. The conversion of the sensual and physical aspects of dance into information is met here through a renewal of the sensual perception of information.

The championing of "information" as the riveting engine of the "information society" serves as a Trojan horse whereby dance—as long as it is translatable into flows of data—has been reinserted into research agendas. In this way, dance triumphantly resurfaces as a fully-fledged academic subject, an ever-morphing aesthetic object, and a new commodity via its degree of transmutability into information. The re-inscription of dance in the form of data reinforces the circular epistemology of information as an overarching framework for our age, producing what it validates and validating what it produces. This risk of determinacy in the form of informational bias, however, is only the latest permutation in terms of how dance has been delimited as an epistemology. "Information", and its subsuming category of "knowledge", have circulated as value terms for years (Leach), and dance is likewise no stranger to their conceptual pull. There exists an abundance of accounts that have framed dance as "embodied knowledge", "tacit knowledge", "implicit knowledge", "know-how", or other similar formulations, even before dance met computerized environments (Barbour; Daniel; Mingon and Sutton; Pakes; Roberts; Sklar; Taylor). At the dawn of omnipresent computing and the internet-of-things, dance makes yet another schizoid-fracture as it becomes converted into data packages, ubiquitous across not only devices, avatars, robots, and flesh, but also spreadsheets, graphs, diagrams, and coded structures (Schafer).

While earlier debates contraposing the unmediated presence of a performer's body against its mediated recordings now appear tinted by a romantic fascination with the live and throbbing human presence, contemporaryscholars working at the intersection of dance and technology need to preemptively identify their own biases and fascinations. Scholars of this emerging field (or "nerds" as Sydney Skybetter puts it endearingly) possess the vigor to continue envisioning new and expansive deployments of the dancing body. Fueled by an infatuation with the malleability of the digital, one cannot deny the posthuman fantasies that have inspired their reimagining of the body—mutable and interchangeable identities, the perks and pleasures of telepresence, a world of infinite and decentralized nodes, etc. Looking retrospectively into the 1990s and early 2000s, dance and performance studies scholars became infatuated with the idea of "ephemerality", a certain alliteration around the poetics of disappearance that led to the framing of the performing arts as always at the cusp of vanishing (Schneider). Is there a way to preemptively identify the infatuations that guide contemporary scholars of dance and the digital, even in the moment we are embracing them? We may now ask a more generative question: what ideas can be put forth to foreshadow the future decades of dance's digitization?

The regurgitation of dance as information could indeed be thought of as a way for the dancing body to appeal to the dominant culture centered around information and knowledge. This operation, however, is an epistemological choice sustained by a towing infatuation. The trope of ephemerality has not effectively *disappeared*; rather, it has successfully recruited adepts from the field of information sciences too. Dance, or any other cultural practice for that matter, once turned into information is supposed to become only "a probability function with no dimensions, no materiality, and no necessary connection with meaning", a "pattern, not a presence" (Shannon qtd. in Hayles 18). The ostensible fleetingness of the informational pattern, however, remains a pervasive yet inaccurate trope of digital culture. Fantasies of organic life succinctly becoming evanescent zeros and ones that radiate across invisible waves reiterate, rather than debunk, the infatuation for ephemerality. Trusting in the digital as a funneled vision that turns bodies into immaterial patterns produces significant blind spots in the conversations surrounding the de/re-materialization of dance, and it also loses the conceptual

gravitas that the "pattern" in itself can offer as a *datum* always already material, embodied, and hence sensual.

To follow the trope of digital dematerialization is to center once more on the underlying mathematical logic or plasticity of data instead of the servers, hard drives, and hefty machinery that host it materially. Moreover, after its conversion into machine-readable data flows, dance only has the chance to circulate as such thanks to several other scaffolding systems and their very material constitution. We can think here of circuits, for instance, since "electricity is the medium of virtually all computational work today" (Pasek et al. 21). The networks that make it possible for dance-as-data to gain its expected schizoid-ubiquity are constituted of layers upon layers of new material configurations: fiber-optic cables, Ethernet copper wires, and various protocols in between (Hu xxv). Yet these mineral and petrochemical re-materializations are, more often than not, discursively displaced by the epitomized ephemerality of (dance) data. As either infatuations or metaphors, "ephemerality", "immateriality", and "cloudiness" have become potent tropes in the computer sciences and in how contemporary society organizes and understands itself (Hu xiii). Here, the (re)validation of dance through its datafication sits at the intersection of a double denial, namely that of (i) the more or less self-evident occlusion of the materiality of the fleshiness of the body, and (ii) the concurrent electric, mineral, and otherwise material infrastructures that operationalize its morphing and circulation in the form of data.

After performing an entire dance routine, a performer might be seen chugging down a glass of water. Once the underlying choreographic material of dance is transformed into data and hosted in one of the many rapidly growing data centers across the globe, it can require as many as five million gallons a day just to cool off (Hogan 3). Water sustains the body even after its digitization. Data centers like the Utah Data Center can store data at the rate of twenty terabytes—the equivalent of the entire Library of Congress—per minute (Carrol 2013 in Hogan 3) but then require staggering amounts of water for this allegedly "ephemeral", "immaterial", and "cloudy" data to remain operable. On user-facing interfaces, dance's contours and shapes are experienced as photons of light mobilized on the polished surface of screens. Through energy as an analytic, the body and its synaptic connections also emerge as a site that hosts

its own circuitry and flows of data. Manifesting as the long fibers attached to neurons called axons, the body relies on a constant flow of electrical impulses in order to control basic functions related to heartbeat, blood pressure, and breathing. Similar to how its digital instantiation is supported by software and hardware, the dancing body is also a medium whose movement is predicated on electrical flows. Viewed through the body as an electrical medium, the seeming ephemerality of data also shows its boundedness to the materiality of flesh and its circuitry.

A reversal of this double denial would be to reintegrate all of these very material aspects into the analysis of digital dance. Without rehashing the heated debate on whether or not telepresence is a form of presence (a debate productively intersected by Dann Strutt in his contribution to this special issue), what we hope to emphasize is how the apparent de-corporealizing abstraction of dance does not necessarily entail mutilation of the (human) sensorium as is commonly feared. New forms of interactivity afforded by devices and digital environments are but one example of how the sensing body continues to exist within emerging technologies. Even in the most unengaging of computational environments, these affordances can be unlocked if the informational pattern is taken as an opportunity for new sensorial experiences rather than the mere conveyor of an abstracted and immaterial message. Maybe the way computer scientists account for dance after its datafication—as volumes, densities, and patterns—can inform how analogic performances are currently being accounted for.

A pattern is an alluring form because it traces contours and shapes; it creates volumes, reiterates itself, and has a recursive impact across bodies and artifacts. Without reinvesting in a blunt positivism or reconstituted empiricism, we foreground the pattern here for it requires attention and care. There is an aesthetic appraisal due in order for the pattern to be traced. We can think here of patterns of weather, programs, water flows, dance-data, or circuits—they can all be traced and perceived. This "tracing" in itself requires a somatic mode of attention. As Thomas Csordas puts it, to trace something is to walk behind it; it requires us to squint our eyes to see where it is going, to hunch the back to closely examine its shape, or to circle around it to perceive its itinerary, as if courting it in a properly sensual way. We invoke this sensual mode of inquiry as both an

emerging affordance of the computational and a framework that can impact the field of dance at large.

Before the anthropomorphic figure is superimposed back onto data points (e.g. the ones produced through motion capture), there are opportunities for perceptual (re)formulations of what the body in movement looks like. In their contribution to this special issue, Hugh von Arnim, Tejaswinee Kelkar, and Live Noven develop at length how ableist predispositions of motion capture might surreptitiously reappear when mere patterns of the body are funneled into the signal of what a human figure should look like. This approach of sitting with the pattern and resisting the urge to turn it into a signal requires a commitment to seeing what is right in front of us and taking it for what it is without the compulsion to fit it into an ulterior, pre-established form. This stance is attuned to contemporary feminisms' recalibration of an excessively discursive and constructivist stance to a materially-driven investigation that welcomes back the sensual cue stemming from the body, including its composition and behaviors (Alaimo). Reinscribing the sensual mode of inquiry centered around the pattern in dance (in its unmediated or mediated form) implies delaying or displacing the preference to see the body as fugitive and always at the service of ulterior, yet pre-established, discursive formations. A neo-materialist recalibration of dance studies would entail spearheading the somatic, sensual, and tangible modes of inquiry that do not try to *see through* dance but see it directly in the eye. As Christopher Bryan suggests, if we keep trying to suspiciously *see through* things we will end up seeing nothing at all. This "seeing" is highlighted here not in the literal ocularcentric sense, but rather as a broader innuendo encouraging the appraisal of dance as a complete phenomenon in itself and not as a gestalt always in need of supplementation by a discursive appendix.

To focus on the pattern or the datum from a neo-materialist stance, however, can very quickly turn into universalist claims of "objectivity". Advocating for an "objective" take and the complete evacuation of the political from dance (if there even is such a thing), is an intent that continually reappears in technologically-driven fields. The seductive idea that engineers, with their pragmatic, matter-of-fact outlook, might be an omen for the "end of ideology" has circulated as a well-documented trope since the 1930s (Marx 1997, 572). Similarly, fantasies of "pure movement" uncontaminated by politics evidence

an untenable politics of decontextualizing pragmatism, also known as formalism in the field of aesthetics. And so, to maintain a sensual, materially-attuned approach to dance does not mean to advocate for an ahistorical (neo)materialism that epitomizes the immediacy of perceptual inquiry as absolute. Rather, what we want to hint at is the rediscovery of the *discovery*, as opposed to its simulation. Paul Ricœur's scholarship on the Hermeneutics of the idea of Revelation and the Hermeneutics of Suspicion is illustrative here. To follow the latter is to continue the great tradition of the masters of suspicion—Nietzsche, Marx, and Freud—in their quest to unmask *deeper* truths as always hidden behind *surface* phenomena. The resonances of such suspicion have been theorized as "paranoid readings" (Sedgwick) in critical theory and have also generated contraposing reactions, including "surface readings", in literary studies. Amidst this crossfire of readings, a question oscillates between dwelling too much on hidden social structures of domination or addressing them too little. In the aftermath, the stitching between *deep* and *surface* or macro and micro illustrates the complexities of turning a pattern into a signal.

Without falling for the low-hanging-fruit idea of the digital as the advent of a post-racial and post-gender world, we propose an approach that does not politicize dance but rather perceptually identifies the politics already enacted in its sensuous composition. Otherwise, when appraised from the hermeneutics of suspicion, dance becomes a medium that is always inscribing and inscribed by larger power forces that are suspected of invading it from the outside. This permanent suspicion of dance as a landmark of politics becomes an issue when its centering requires a suspension of sensual inquiry and a detour toward discourse. Identity, as a form of discourse mediated by language, is a recurring cornerstone in contemporary dance scholarship, centering representation as the battlefield where oppositional politics get to be played out between groups whose "interests are discreet and the[ir] difference is absolute" (Martin 10).

As opposed to an analysis that seeks for performance to be exogenously captured by the political, the sensual tracking of the pattern might render possible the imagining of another kind of politics within bodily mobilization itself (Martin 14). Here, then, politics would resurface as already in motion, not as something awaiting ignition (Martin 2) but as a force already there. If the meaning-mak-

ing potential of identity and representation relies on an immutable discreteness that is analytically "inadequate given the schizoid and intrinsically non-linear structure of advanced capitalism" (Braidotti 40), what is the import of approaching dance from the computer's eyes? A computational approach to dance allows one to visualize the political not as a *ghost* visiting the body or something that is done to bodies behind their backs (Martin 4), and thus serves as an untapped source for the emergence of new conclusions based on the body's own sensual mobilization. So far, the "ghost" and the "ghostly" have formed one of the quintessential imaginaries around technology (Chang; Kim; Warren-Crow); its always-incomplete presence mimics arguments of the body as permanently "haunted" by ideas of power as an exogenous force. Indeed, like a proper ghost, this take on power is one that never fully leaves and never fully appears, mirroring the formula of reading the dancing body as always both enacting and resisting the systems of oppression that haunt it.

We might be facing the moment to give up the ghost in the machine, and this possibility is opened up by the collapse of different temporalities afforded by new technology. Archival technologies like print, phonograph, photography, or video have advertently or inadvertently consolidated a deferral of time, a phenomenon particularly palpable in the cases of folklorism and heritage studies, whereby the subjects recorded not only feed the archive but also the melancholic economy of the past's romanticization. The crucial transformation of contemporary digitization technologies goes beyond their heightened precision for recording events—it relates to the disenchantment with the intent to capture as a form of deferral. Current motion capture (mocap), virtual reality (VR), and artificial intelligence (AI) installations and initiatives—such as those described in the contributions of this special issue—do not encapsulate the past, but rather channel its circulation into contemporary and contemporaneous expressions (Fabian qtd. in Kirshenblatt-Gimblett, "Folklore's Crisis", 283). Fundamentally, this aesthetics fulfills the collapsing of different temporalities at play, prioritizing the presentness of the (physical and digital) bodies. The mnemotechnic and capturing affordances of today, despite having more possibilities to *authentically* or richly capture the past (or maybe precisely because of this) are displacing the rubric of accuracy for those of interactivity and immersion. Perhaps we finally ran out of past (Kirshenblatt-Gimblett, "Intangible Heritage", 59), or if the past

has already caught up with us, wouldn't this then be an invitation to focus on disentangling the economic, ecological, artistic, biological, and computational dimensions of dancing in the present?

Authentically and impermeably conserving the past might be a receding project, but the sensual dimensions of digital dance are explored in **L. Archer Porter's** contribution to this issue as the affective charge of collecting and compiling NFTs (non-fungible tokens). Porter behaves like a chronologist harmonizing, on the one hand, the time of the gestures of dancers like the Chilean duo CryptoMoves and, on the other hand, the time of crypto technology. Dance here is imported into the shrine of collectability as not only a token of the commodification of an emergent economy but also as an aesthetic object of kinetic beauty sacralized by its technological stabilization. The digital dance artifact, defined by the sociality of collecting as a practice, is revealed to be grounded in the passions of collectors that undergird digital dance's circulation through processes of ownership and exchange. Porter effectively lays out the fundamentals of how the blockchain operates, what NFTs are, and how they intersect with ongoing processes of choreography gaining economic value—observations that are further problematized by the decisive and pivotal role of the collector as a tech-savvy taste-maker and value-giver for dance.

Porter's article dialogues with **Ania Catherine's** piece from the Portfolio section. Based on the artistic practice she has developed together with Dejha Ti in the artistic duo Operator, Catherine rehearses to its boiling point the surveillance we agree to be a part of as users of social media and digital technologies. The duo's work becomes a *tableau vivant* that testifies to the values and perspectives built and engrained in new digital technologies, as opposed to only relying on the mesmerizing value of the latest devices' affordances. While fleshing out the financialized ecology of rarified digital natives, the text trades the sanctity of cultural critique through its very rehearsal. The missing fleshiness of the dancing body across blockchain architectures is ushered back in by Operator in their work *Human Unreadable*, through a ping-pong of media-agnostic experimentations that jump scales from generative on-chain choreography into analog steps and back. In a second work titled *On View*, museum visitors are encouraged to take selfies next to art pieces, which sustain forms of social performativity until keeping a smile on one's face becomes

physically impossible. The invitation to endure this exaggerated version of a contemporary ritual for acquiring the cultural capital of art illustrates Operator's theatricalization and aestheticization of surveillance weaponized as a balancing maneuver—a kind of cultural homeostasis.

In his timely contribution, **Sydney Skybetter** tackles similar issues surrounding emerging technology and surveillance. He describes the inextricable links between choreography, robots, and violence, noting examples as early as ballet's use as a form of supplemental training for fencing in eighteenth-century France, and as recent as choreographic performances created for Boston Dynamics' robot police dog. Skybetter, reminding the reader that the root word of "robot" is in fact "slave", traces a pattern of how the technology fueling an ever-morphing landscape of robot dances exists alongside its military and police applications. In particular, he reveals the racist hierarchies embedded in such performances, which continually appropriate and decontextualize Black performance practices in efforts to showcase the very technologies that are weaponized as forms of anti-Black surveillance. The emerging technologies undergirding robot dances offer new instantiations within a long history of surveillance, extraction, and violence, as dance techniques, Skybetter writes, are "lifted out of cultural context and encoded at the level of software and *interface*". Such abstraction, however, often results in a loss of kinaesthetic empathy, precluding spectators from treating robots with the same level of significance they would a human body.

The choreographic interaction and potential gaps between digital technologies and human bodies are explored by **Diego Marín-Bucio** from the angle of AI. Marín-Bucio describes a performance piece in which he sought to develop a bodily-interactive AI that could collaborate with human dancers to produce performances in real time. The AI model, named Dancing Embryo, is trained on motion-capture recordings that comprise a "movement bank" from which the AI generates new movements. This contribution offers an artist's perspective on these evolving forms of collaboration, including factors such as an AI's possible level of participation, the primacy of visuality, and challenges to logical thinking presented by interacting with an AI-generated figure that may not necessarily conform to conventional gestural vocabularies. The author explores the barriers to entry in producing such work while offering a clarification

between the use of technology in performance as real co-creation versus mere high-tech puppetry. These accounts create critical distance with the widespread glamorization of new technological gadgets. Put differently, this is research and artistic experimentation that resists being mere PR for tech companies' gadgets. In this way, a double-sided distancing is played out between, on the one hand, a techno-optimism that renews the faith in a civilizatory project of modern technocracy and, on the other hand, the "classical gothic themes" that represent "technological artefact[s] as potentially threatening monstrous others" (Braidotti 3).

To reintegrate the foam from the top of the wave, bringing these opposing elements back into the same flow would imply alchemizing, for instance, the common angst about humans being replaced by machines with the issue of humans adopting the machinic. Scholar Jesse LeCavalier has described how in the context of Amazon and Walmart warehouses, for instance, humans are becoming the laboring force operationalizing robotic estimations and calculations, prompting us to consider how in daily life we are starting to process information like machines do. If the digital is characterized by thinking in fragments and chunks (Portanova 54), what do we make of the choppy, fragmented experience of doing any task these days? This special issue, which for the first time in more than forty years of *Documenta*'s history is being read completely digitally, might be competing for the attention of our readers as they are pulled in the direction of the many other banners, notifications, beeps, and vibrations generated by their multiple devices.

Another extrapolation of this techno-human enmeshment is offered in this special issue by **Nina Davies**, whose contribution, "Do you want to get hit by a car?", demonstrates that the machinic leaks into the human both cognitively and physically. From a productive redoubling of speculation and real jurisprudence, the contribution locates choreography as a defense mechanism against computer vision-infused cars. After making the reader feel at home through the familiar format of the podcast interview, Davies stitches up an eerie fictional lawsuit whose oddity resides precisely in how plausible it seems given current car automatization. Here, the fictitious car company Piasecki is being sued by the family of a victim who was hit by a self-driving car trained to identify people using data harvested from video games like *Grand Theft Auto*. In this speculative

landscape, failure to adopt the choppy and fragmented movements of a machine becomes a threat. Davies' fictional story, in which humans need to be read as a machine in order not to be hit by a car, could be summarized as the case of a signal deciding to relinquish its status to become a simple pattern. In the context of transitioning from peering technologies that look in on the body to screening technologies that try to turn the body inside out (Cherniavsky xxi), we can think of motion capture as a node where obfuscation and clarity of images recombine. If these advancements in computer vision are done without a poetic intent, the informational patterns they produce become readily available for cooptation by the very surveillance capitalism widely denounced as the force turning people into locatable data signals.

Along these lines, **Hugh von Arnim**, **Tejaswinee Kelkar**, and **Live Noven** in their contribution present a model for how the point—as a form of pattern—is worthy of staying with, instead of the bone-based approximation of the human body that is recurrently used as a signal for motion capture. The usual business of importing and superimposing a humanoid skeleton onto the harvested data can be seen as a very practical form of ableist imposition. In both, its iconographic and disciplinarian value—the preference for an anthropomorphic figure of an able body to render motion capture data—reminds the reader of the early stages of any medium or discipline, whereby its validity is always measured in terms of its capability to accurately represent reality. Before merely leaving the reader yearning for a moment when motion capture frees itself from its representational—and verisimilar—self-impositions, the authors offer a rubric for how to use the point in their proposal of "motion pointillism". The text advocates for the obfuscation of anthropocentric predispositions in the quest to discover (rather than impose) the contours and shapes of dance as the scattering of cruxes and specks wandering from bodies to screens.

This occlusion of the superimposed ableist body model and the preference for the free-standing and non-anthropomorphic point/pattern opens up the possibility for alternative forms of embodiment. **Dan Strutt's** contribution conceptualizes this as a form of "Alien Embodiment". Digital avatars that do not necessarily correlate to our actual anatomical articulations advance the premise of mocap liberating itself from its representational burden to instead boost

dance's inherent propensity for kinaesthetic metaphorism. Instead of feeding the techno-political forces of capture and control that demand accuracy, locatability and identification, Strutt focuses on how alien embodiments, on top of drifting away from those logics, allow for sensual philosophical exploration—that is, philosophy as a form of thought production rooted in the body. This article maps how in the very estrangement of alien embodiment there is leeway for bodily sensations to turn into precepts that, in turn, form the raw material for conceptual elaborations. Parallel to motion pointillism's avoidance of superimposing an anthropomorphic figure onto data points, Strutt eludes the reduction of these altered embodied experiences to previously known thoughts.

Ioulia Merouda, **Adriana Parente La Selva**, and **Pieter-Jan Maes** offer a contribution detailing their experience with digitizing the training techniques of the Odin Teatret, in which digital spaces are reframed for embodied experimentation as Deleuzian planes of immanence. Their emphasis on the *event(ness)* of virtual reality directly intersects the discussion previously introduced on the rediscovery of *discovery*, as a way to avoid merely replicating knowledge and instead investing in its reactivation through latitudes, longitudes, speeds, and affects. The possibility opened up by the authors and artists behind the project explored is to allow for the collapse of past and present temporalities into one vivid event where users get to sweat along/through the knowledge of the Odin Teatret as a self-actualizing plane of immanence. The contribution outlines the opportunities and perils of the transdisciplinary entanglement of the computational, design, and theatrical while steering dance into its digital double.

In a similar vein, **Laura Karreman** and **Nanna Verhoeff** explore the extensions of embodiment afforded by *Acts of Holding Dance*, a an art series created by Wendy Yu that features several projected figures breakdancing. Treating this work as a choreographic object to be thought through, the authors offer the three concepts of *capturing*, *tracing*, and *figuring* in exploring the reorientations it provides to spectators. The authors identify new forms of relationality, added kinaesthetic and interpretive layers, and disorienting bodily representations, while also noting the risk this performance runs in potentially losing legible elements of breakdance as it becomes abstracted from its original context and into digital form. What stands

out from this contribution is its generative method that combines thinking *about* dance and technology and thinking *with* dance and technology. In this way, the argumentation jumps scales between dance, projection, architecture, discourse, and public space, tracing conceptual interconnections throughout. The editors of this special issue interpret these argumentative leaps as a form of transpositions that can lead to alternative ways of knowing. According to author Rosi Braidotti, "transposition" is a theory that "offers a contemplative and creative stance that respects the visible and hidden complexities of the very phenomena it attempts to study" (6).

Another transposition traced across not only design, the computational, and the theatrical, but also the financial, appears in a contribution from **Jorge Poveda Yánez**. In this contribution, "liquidity" is taken as a token to trace the several transformations and transactions that dance movements suffer while they migrate across devices, bodies, and wallets. By zigzagging between the (very) analog liquids intervening in the performance of dance—like synovial fluid, sweat, and endocrine secretions—and the digital circulation of dance data as it generates unparalleled income for video game companies, the essay ponders the analytical traction of "liquidity" to approach dances on the screen. Taken as an analytic device, "liquidity" allows here to account for the several layers of de/re-materialization that dance undergoes as motion capture data, video game emotes, and a theatricality that accompanies the ultimate transformation of dance-data as liquid income.

In her contribution, **María Firmino-Castillo** highlights the artistic, philosophical, and ethical labor of *muxe* ("feminine man") and *Binnizá* (*binni*, people; *zá,* cloud)[1] artist Lukas Avendaño to reveal how the oft-assumed preeminence of "stable" databases over "compostable" bodies is neither self-evident nor pragmatically real when it comes to the sustainment of memory. The only real chance for the autopoietic endurance of memory, according to the author, resides in the trans-corporeal transmission between and across multiple bodies. The notion of the "ouroboric" discussed in this paper consolidates the conundrum of the self-consuming and self-birthing nature of matter as a sequencing of contradicting and iterative enfoldings and unfoldings. As the dialogic format of this contribution discloses, oscillation is offered as a device that troubles the false dichotomy between the virtual and real, causing the reader to likewise oscillate

between conventional understandings of analog/digital technology and alternate ontologies exemplified by a self-replicating *ouroboros* and multiplicitous *muxeidad*.

The real and the unreal (fictional but not necessarily digital) give birth to each other in intricate, ouroboric, and paradoxical ways. However interconnected, the digital and the analog operate in different registers. As Firmino-Castillo aptly reminds us, the digital needs the analog to exist but the analog exists independently. The digital has the potential for expansion, exaggeration, and generative duplicity, but it is only in its return to the analog that a different rubric might emerge for the "real" as the result of the friction between the two and not the substitution of one for the other. The disorientation of dancing with dimensionless *points,* the uncanniness of *alien embodiments*, and the perplexity of dance-data adopting the *liquid* circulation of currency are all offered here not as challenges to be overcome, but rather as the field for something different to appear—that is, for the appraisal of what difference *difference* can make, in the double sense of that which deviates from what is dominant and the expansive multiplicity of human expression that demands adjudication and decision (Martin 2). If the plasticity of computer-generated environments and settings is not fetishized as ulterior, teleological, and discontinuous, but rather as that which is expected to recur and return, then *simulation* might cease to be the synonym for "artificial" and instead be recruited as the rehearsal of another real. Homing and nesting this current segment of technology as it continues to take its own course, we hug it sensually, waiting to host it again sometime in its newly reconstituted material forms.

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Notes

1 Binnizá is the language and self-ascribed name of a community in the Isthmus of Tehuantepec, Oaxaca, Mexico otherwise known as Zapotec.

Sitting Here, Collecting Dance. Choreography's affect and value in the Crypto Landscape

–– L. Archer Porter

(UNIVERSITY OF NEBRASKA, LINCOLN)

ORCID ID: 0009-0002-4145-5266

This essay explores the emerging phenomenon of dance as a collectible within the crypto landscape, exploring how blockchain technology is reshaping the way dance is valued and experienced. Through the lens of non-fungible tokens (NFTs), the essay examines how dance is being transformed into a collectible object, complicating conventional paradigms of commodification. Focusing on the work of the Chilean dance duo CryptoMoves and the practices of collectors like Anna Condo, the essay highlights how the blockchain not only enables the commodification of dance but also introduces new affective dimensions and knowledge production avenues. By tracing the historical context of dance as both commodity and gift, the essay argues that the NFT marketplace catalyzes a new paradigm where the role of the collector becomes central in defining the cultural and economic value of dance in the 21st century. This shift, as the essay suggests, has profound implications for the future of dance, its cultural identity, and its place within the broader digital economy.

Keywords: blockchain and performance; dance NFTs; digital choreography; dance collectibles; media and embodiment

In your home is a shelf, a shelf where some of your favorite knick-knacks, keepsakes, souvenirs, and trinkets reside: perhaps a photo of a loved one that somehow perfectly epitomizes their character, a tchotchke that reminds you of your youth, an heirloom from a family member who has now passed. Adorned amidst these objects of fancy and nostalgia is a frame that plays your favorite short-form dance over and over, perhaps a work by Chilean dance duo CryptoMoves. Every now and then, you glance toward that video and cannot believe you were able to purchase it, own it, call it your own.

This scenario —while it may not be commonplace, or even imaginable in present circumstances— is made possible by blockchain technology, as well as products like *Infinite Object*, a photo frame that ceaselessly displays a non-fungible token (NFT) from your collection. Through these technologies, an individual can purchase a dance NFT, perhaps on a platform like OpenSea, objkt.com, Foundation, or SuperRare, and then load it onto this new frame to hang on their wall or place on their shelf. While the more common mode of displaying and appreciating an NFT is on an online platform (i.e. on a digital shelf), the scenario above makes tangible the idea of dance as a *collectible*. It captures the affective dimension of not just owning a dance, but feeling towards it the way one might feel toward any other keepsake or personal belonging. Through such an experience, individuals may come to know dance differently, come to assign it value in a way that has not been previously feasible, and come to cultivate a new life for it next to other objects of preference, fancy, and longing.

This affective dimension of the dance NFT is often disguised by the more overtly transactional nature of NFT trading. The experience of buying and selling a dance, in other words, often commands the narrative around the dance NFT, obscuring both the collector's sentiments towards the NFT and the relational dynamics between artist and collector. The NFT marketplace is, after all, how a collector would come to acquire a dance, and how a dance artist would come to list their work. While the meaning of the point-of-sale of a dance NFT, the use of cryptocurrency to both create and purchase it,[1] and the wallet addresses used to acquire it certainly underscore the commodification of dance, these apparent novelties have historical corollaries that portray dance as a commodity. The *experiences* of dance that these technologies enable, however, are remarkably novel and continue to expand as more dance artists enter the NFT space

and explore new modalities, media, and technologies.[2] Focusing on how the blockchain enables dance to become a collectible captures its unique contribution to the historical trajectory of dance.

Indeed, conceptualizing dance in the twenty-first century, as well as understanding how new technologies map onto the history of dance, requires a reframing of dances as not just ownable but also *collectable*. This essay considers the significance of dance as a collectible in order to unpack the meaning of dance and performance on the blockchain. In it, I trace the genealogy of dance as both commodity and gift, drawing comparisons and identifying contrasts with the dance NFT collectible. I then place dance in a wider discourse on collecting, wherein I tease out how collecting NFTs and collecting dance extend and depart from aspects of collecting in general. Through a historical perspective on commodities, gifts, and collectibles, I argue that the notion of collecting dance not only launches a new paradigm but also informs a new affective dimension and a new mode of knowledge production for dance at large. Certainly, dance already taps into the pleasures and conceits of being exchanged as both commodity and gift, as well as being turned into an object via digital technologies. Yet, the blockchain's catalyzing forces for the future of dance and performance are grounded in its ability to create and track the social, cultural, and economic life of dance as a collectible. The figure of the collector moves to the foreground in this process. That is to say, the aesthetic, intellectual, and curatorial perspective of the collector of dance NFTs—as opposed to that of the dancer, the choreographer, the audience member, or any other previous meaning-maker of dance—will shape the meaning and value of dance in the twenty-first century.

Considering the work of CryptoMoves, and a particular collector of their work, Anna Condo, becomes incredibly instructive to this argument. Not only is CryptoMoves creating work that may be collected, but they are also shaping their oeuvre by describing the work on the NFT platform, social media sites, and other outlets of communication as a way to initiate the dance NFT's journey toward knowledge production and meaning-making. And then, once it is collected—by Condo, for instance—the dance NFT takes on a new meaning and life. Both sides of this meaning-making endeavor thus demonstrate how the nature of collecting, as opposed to experiencing dance as an audience member, comes to define the digital dance artifact.

This treatise on dance as a collectible is part of a larger project, grounded in a digital ethnography of performance on the blockchain (not just dance, but also performance art, works of theater, and other art that centers choreography and/or the moving body). In this project, which began in 2021, I participate in the creation and exchange of NFTs, engage in dialogue with other dance and performance artists on X and Discord, and interview curators and artists affiliated with NFT platforms like Foundation, SuperRare, and TEIA (previously Hic Et Nunc). One of the major themes of my conversations with interlocutors is how the blockchain opens up opportunities for dance artists that the offline dance market does not (and cannot) afford.[3] At the same time, there are obvious limitations and drawbacks to NFT culture, such as scams that might occur, the high volume of bots involved in both discourse and transactions and the existence of a "casino culture" surrounding cryptocurrency markets (Dixon). This dimension of the NFT not only shapes the experience of dance artists creating NFTs, but also leads to a wider public distaste for the blockchain and its NFT. The arguments presented in this essay present a particular, yet integral slice of my larger project as a way to move toward a critical rendering of NFT culture, from the perspective of dance artists and collectors of dance NFTs.

The Blockchain

Central to dance's new life as a collectible is the advent of the blockchain. This technology represents an ever-expanding, shared ledger that is distributed across locales of activity called "blocks". These blocks are linked together, forming a "chain", which builds in a way such that each block contains data from a previous block. This constant referral to previous blocks means that the data on the blockchain are unalterable and the transactions are irreversible. The data that are recorded and continually referred to include timestamps of transactions as well as the address data of the sender and recipient.

The blockchain was developed in 2008 as a way to record the movement of digital currency ("cryptocurrencies") across digital spaces. Because of this origin, the technology is often conflated with currencies like Bitcoin or Ethereum. Indeed, the birth of the blockchain as a currency ledger is undeniable; however, it is important to acknowledge the ways in which the blockchain became a technology

to also authorize and trace the circulation of digital objects. It was not long after the creation of the blockchain that this new way of record-keeping began to be used to create, or "mint", digital artifacts, which later became known as NFTs. An NFT is, in essence, a record of a unique digital asset, whether it be an image, video, audio, or text file, to name a few. Since the NFT is created through the intricate ledger system of the blockchain, it can be authenticated and verified, giving it its unique, or "non-fungible", status. The first work of digital art minted on the blockchain in 2014 thus launched a new paradigm of digital objects that would be created, authorized, and traded on the blockchain (Wu and Wu).[4] This paradigm of decentralized digital objects is part of a wider movement referred to as Web 3.0, which includes blockchain activity as well as artificial intelligence, augmented reality, and virtual reality.

The blockchain's ability to create ledgers for NFT creation and trading has led to transactions that are not financial in nature. For instance, NFTs may be transferred between accounts without any exchange of currency. It is fairly common in the NFT space for artworks to appear in a user's "wallet" (again, the financial origins are unavoidable) without any exchange of currency or factual communication between involved parties. These objects may take the form of unwanted spam or welcomed gifts, depending on the context. In other situations, an artist might send an NFT to a recipient who is expecting the artwork based on a communicated agreement. For whatever reasons an NFT may appear in an account, the movement of these digital art objects is constantly being recorded on the ledger, a fact that highlights a different, non-financial sensibility to the blockchain than its original impetus as a record for exchange through currency.

While the blockchain is culturally and historically associated with cryptocurrencies, they are separate innovations with distinct functionalities and thus have very different logics to them. This point is primary in understanding the technical foundations of NFT culture: a space that is shaped not only by commodity systems of exchange but also by gift systems of exchange. It also grounds a scene in which dance NFTs acquire an affective sensibility that is not solely defined by the buying and selling of dance.

Dance and Value

Dance has a long history of commodification that predates the advent of the blockchain (Dodds; Dunagan; Foster; Kraut; Weisbrod). Thus, in order to understand how the blockchain extends, complicates, or departs from that history, it is critical to consider the role of the marketplace in the circulation of dance prior to the advent of the blockchain. Indeed, dance has already been price-tagged and transacted through many other avenues prior to the first dance NFT: through ticket prices at concerts and other performances; funding schemes for artist grants, residencies, and fellowships; technique classes at a studio; awards at dance competitions, not to mention the cost of any dancer entering a competition (a much higher price than any trophy or prize money for placing at the top); the cost of dance in advertisements; tuition for university training; and the role of dance in film and television (including dance competition reality shows), among many other modes of transaction.[5] Through such means of exchange, dance, choreography, and the dancing body become lines on a balance sheet, oftentimes quantified with actual dollar amounts.

The above list of historical modes of price-tagging dance captures a breadth with which dance may be part of monetary transactions, thereby demonstrating how the form is no stranger to financial marketplaces. In fact, it may be argued that the dance NFT simply makes *overt* what has previously been covert about the circulation of dance through systems of commodity exchange. While some instances of dance reflected in that list may evade the grasp of the capitalistic marketplace, their mere incorporation into a system of a monetary value, likely on some spreadsheet noting the costs of immaterial labor, underscores how dance has operated, and continues to operate as a commodity in a capitalistic marketplace.

Although dance has a vitality that may seemingly exclude it from many markets of commodity exchange, it nonetheless circulates through and is exchanged within those systems, as Susan Foster articulates in *Valuing Dance* (1-8). At the same time, dance also circulates through gift economies, wherein its transaction does not prompt an immediate reciprocation, but instead establishes a social relationship for any gifts that may be reciprocated at a later time. This distinction between dance as a gift and commodity articulates two

modalities through which dance may be exchanged. However, objects of exchange are inherently mutable and may oscillate between commodities and gifts, and back again to commodities. To demonstrate this point, Foster draws upon Anna Tsing's study of the matsutake mushroom circulating through both gift and commodity systems, as well as Jean Baudrillard's example of how a singular system of exchange hosts the transactions of both gifts and commodities (14). Through this work, Foster unpacks how dance circulates through distinct systems of commodity and gift exchange, while also gesturing toward the slipperiness of these categories altogether.

Central to Foster's discussion of dance as both a commodity and gift is the alignment to paradigms of scarcity and abundance, respectively. That is to say, dance's incorporation into commodity exchanges primarily revolves around its perception and utilization as a resource of scarcity. "According to the scarcity paradigm", Foster writes, "dance's energy is never the product of fun, nor is it enjoyed without benefit or profit. In many contexts, dancing becomes a form of work with clear goals, measurable benchmarks, and short and long-term strategies for improvement, all based in notions of energy control" (78). Dance's abundance, on the other hand, operates on an energy that is "plentiful", "always available, … widely given and reciprocated", so that dance gifts may be given without suggesting a resulting lack of energy in the giver (21).

Under Foster's terms, dance on the blockchain overtly operates within a paradigm of scarcity. This paradigm is grounded in the notion of the edition. When minting a dance NFT, the artist determines the number of copies they would like to create for any given piece. Some dance NFTs are minted as a one-of-one, meaning that there is only one authorized copy of that work that may live in one wallet. The artist may instead decide to create multiple editions of the same dance NFT so that more collectors might acquire it. An edition of 500, for example, may be acquired by up to 500 collectors (though the same collector might acquire multiple editions of the same work). Structured much like screen-print or photography editions, the quantity of the NFT edition is often proportional to the value of that NFT (Whitaker). Theoretically, the smaller the edition is, the more valuable the NFT. So, in the example above, a one-of-one would be more valuable than a single piece from an edition of 500 (Belk, "Art Collecting").

The structure of the NFT edition may seem like rudimentary economics, yet a review of it indicates how the blockchain both extends and departs from dance's previous, pre-blockchain paradigm of scarcity. Specifically, the minting of dance as an NFT meets several of the characteristics Foster outlines for dance's paradigm of scarcity: it accentuates work with clear goals; it opens the dance out to measurable benchmarks, emphasized through the market for NFTs and curation sites; and it facilitates strategies for improvements, via the metrics on the platform, dialogue on social media sites, and the mere indication of whether it sells, or how quickly it is sold. In many ways, the blockchain does not just extend but *exaggerates* dance's paradigm of scarcity found in other modalities of its commodity exchange (ticketed performances, dance in commercial advertising, and dance's role in "influencer" economies on social media, for instance).[6]

The blockchain, with its focus on editions, unavoidably places dance within an economy of scarcity. At the same time, this technology introduces dance to a new language and technique for regulating value. Not only does the ledger track edition sizes, sequence order, and transactions across time—so as to authorize the existence and trace the circulation of a piece—but it also gives the artist an instrument through which to control the relative abundance or scarcity of their work. As in the example above, a dance artist might choose to mint a certain number of editions, or they may decide to create an "open edition" that has no limits to the number of authorized copies that might exist. While this way of moderating value through editions is distinct from Foster's discussion of dance's energy and how it circulates through systems of exchange, the comparison nonetheless helps conceptualize the blockchain's impact on the commodification of dance.

It may be premature to debate whether the blockchain is refashioning an existing system of capitalistic exchange, or perhaps cultivating a new way of commodifying dance. Less overt and perhaps more critical is how the blockchain might extend and modify the movement of dance in and out of commodity status, vacillating between commodity and gift, and back to commodity. The logic of the ledger as a record-keeping mechanism for the sending and receiving of NFTs, without any payment associated with them, is already part of the fabric of NFT culture. NFT gifts come in the form of tokens

of appreciation for existing collectors, art delivered to admired artists, "swaps" of work between artists who relate to one another, and sometimes even NFTs sent in an anonymized, random fashion.[7] This dimension of NFT culture reveals how NFTs can acquire value in a way that is linked just as much to sociality and relationality as to investment and profit. For the dance NFT, in particular, the blockchain is able to contour in unforeseen ways the gift-giving logic that is already inscribed in dance's energy, as detailed by Foster.

The logic of dance as both a commodity and gift sets the stage for its new life as a collectible, which is distinct from but overlaps in many ways with commodities and gifts. Discourses on collecting demonstrate how the collectible cuts through the logic of both gift and commodity. Russell Belk makes this perspective clear:

> Both collecting and gift-giving elevate the importance of selected goods and make them objects of heightened attention as vessels of special symbolic meanings that transcend their normal functional meanings outside of ritual contexts…In these processes, they are decommoditised, sacralised, and invested with extraordinary meaning. But in a money economy, these ritual possessions never entirely erase market value from these objects and in certain ways even seem to celebrate their monetary meanings above all moral meanings (Cheal 1988, Gregory 1982). Thus, every Christmas season there are perceptions of numerous excesses in gift-giving and gift-seeking, giving rise to cries of rampant materialism and greed (Belk 1993). Similarly, in collecting, there are frequent popular, metaphoric, and literary references to rapid acquisitiveness, possessiveness, and selfishness of collectors (Belk 1997; Danet and Katriel 1994; Olmstead 1996; Rogan 1997). Collections and collected objects are evaluated in both esteem and monetary value by virtue of their rarity and perceived quality. But the high price paid for certain collected objects like Van Gogh's "Sunflowers", is itself seen by many as the reason for revering the object. Collectors compete with one another for these prizes as avidly as any business rivals and often even more intensely. It seems therefore that collecting, like gift-giving, has a double nature: both sacred and profane; both

> opposing and celebrating the market; both materialistic and anti-materialistic. ("The Double Nature of Collecting" 7-8)

Through this comparison, Belk emphasizes that both the collectible and the gift share an "uneasy relationship with money and monetary value" (8). Although he does not mention the commodity or systems of commodity exchange, such notions are suggested in the reference to money and consumption. Thus, the uneasiness that Belk points out articulates a cozy adjacency to systems of commodity exchange, thereby underscoring how the collectible, like the gift, oscillates between different systems of exchange and spheres of value.

Igor Kopytoff aptly captures a similar uneasiness of the collectible when describing "future collectibles", such as "leather-bound editions of Emerson, bas-relief renditions of Norman Rockwell's paintings on sculptured plates, or silver medals commemorating unmemorable events" (81). The advertising rhetoric of these objects, Kopytoff elaborates, demonstrates how such collectibles blur categories of value and principles of exchange. "The appeal to greed in [the advertising of future collectibles] is complex: buy this plate now while it is still a commodity because later it will become a singular 'collectible' whose very singularity will make it a higher-priced commodity" (81). Like Russell's discussion of the competitive nature of collecting, Kopytoff's future collectible highlights the slippery nature of the collectible, revealing the life of the collectible as an investment and underscoring its status as both gift and commodity.

Under these terms, the meaning of the dance NFT's value as a commodity may be complicated as it is drawn into a discourse on the gift-commodity relationship, and the dynamic nature of the collectible. Nonetheless, with the emerging possibility of this new life, dance gains a new affective register via its status and life as a collectible. To call a dance an heirloom, knick-knack, treasured artifact, or keepsake prompts a shift in how we might frame this ephemeral art form, how one might *feel* toward it, and how it may be valued in the wider public consciousness. Before turning to illustrations of the dance collectible on NFT platforms, however, it is critical to review dance's relationship to objecthood, as the notion of a dance NFT relies on a conceptualization of dance as a *thing*.

Dance and Objecthood

Indeed, the blockchain did not initiate the commodification of dance, nor its exchange as a gift; however, the discourse on dance as both gift and commodity helps shape an understanding of the form as a collectible. What the blockchain *is* responsible for is instantiating the conditions through which dance may be collected, in effect creating somewhat of a cross-section of its life as both commodity and gift. In this way, Web 3.0 paves a path for dance to more readily enter into the sphere of objecthood.

Undergirding any discussion of dance as a collectible, or consideration of it as adjacent to tangible culture, is the notion of dance as a *thing*: something that not only accrues value through economies of exchange, but also circulates through pathways of exposure and gains a social life, and even metaphysical existence as an object. Over the last few decades, amid advancements in digital technologies, as well as the conceptualization of theories like object-oriented ontology, dance has garnered greater consideration as an object.[8] Notably, James Leach, Sarah Whatley, and Scott deLahunta coin the notion of a *choreographic object*, examining how digital technologies have, according to Hetty Blades and Scott deLahunta, the capacity to "make explicit aspects of choreographic practice for others to access" (34). Leach (2009; 2018) extrapolates this notion to posit how digital creations position dance at large as a knowledge-producing endeavor. Information and communication technologies in particular, Leach argues, enable dance to enter into "new relational forms", including "experiments in building new groups, new constituencies and new audiences" (460). Leach, Whatley, and deLahunta draw on the work of choreographer William Forsythe, among other choreographers, to illustrate how, in Leach's words, "there is knowledge and intelligence inherent in choreographic practice and appropriate ways of recording, visualising, and teaching dance that make [the desire to preserve dance] apparent" (463). The choreographic object, then, eases the gap between, on the one hand, the rich processual experience of choreographic praxis and, on the other hand, viewers who might not otherwise experience dance through a choreographer's lens.

Distinct from choreographic objects, Harmony Bench proposes the concept of the *embodied object* as a way to capture both the common and corporeal dimensions of dance and choreography. Defined as

"nonmaterial, corporeal objects that assume a bodily shape or sequence and are transferable across the bodies that are their primary medium" (*Perpetual Motion* 161), embodied objects emphasize how dance might move from body to body. Bench elaborates: "Gestures, steps, moves, movement phrases, dance routines, somatic practices, choreographic scores: all of these exist as movement ideas that take shape through corporeal instantiation and interpretation. They travel contagiously and accrue affective weight and meaning as they travel across the bodies that come to perform them" (161). In this way, the embodied object highlights the threads of movement that link bodies together.

If the choreographic object emphasizes knowledge production, the embodied object underscores how that knowledge is transmitted across bodies, perhaps cultivating some sense of *common knowledge*. While distinct in their characterizations of the object, both of these theories offer a clear distinction between the dance and the object: the latter being a representation of the former. Without rehearsing any debates on the ontology of performance, via its relationship to documentation, recording, or other modes of transmission (evident in the distinct positions of Peggy Phelan and Philip Auslander[9]), the fact of dance as an object becomes evident through an understanding of NFT culture and the wider Web 3.0 lexicon. The term "NFT" is often used interchangeably with "token", which references a physical object and thus establishes a likeness between the digital artwork and a material thing. "Object" is also the namesake of a widely-used NFT platform, objkt.com, further embedding the notion into the NFT vocabulary. This sense of the NFT as an object highlights a genealogical linkage between the blockchain and the Digital Object Identifier (DOI) system, an international protocol for providing unique identifiers for digital materials like eBooks, journal articles, reports, data sets, and government information. The extent to which the DOI influenced NFT vocabulary remains to be seen. Nonetheless, the fact that objecthood is embedded in this culture directly relates to the name, frame, and concept of the *non-fungible dance object*. Born from the logic of the digital object, the non-fungible dance object continues to be conceptualized and exchanged as a thing, without hesitation or debate regarding the status of its objecthood.

Aside from the relationship between the dance and the object, there are other important distinctions between, on the one hand, the

non-fungible dance object and, on the other hand, the choreographic object and embodied object. First of all, the non-fungible dance object suggests a separation of ownership and intellectual property. The NFT artist mints their work, and through the technology of the blockchain, they create their signature of authenticity that verifies the origin and authorship of the art object (Whitaker 33). However, once the object is collected, it is then *owned* by another individual or entity. That collector may choose to keep it "on display", or perhaps resell it at a later date, thereby relinquishing ownership to someone else. The discourse on dance objecthood, however, suggests that even though dance may be transmitted via some object, both its authorship and ownership still reside with the creator. This distinction gestures toward the already-complex nature of the intellectual property of choreography (Kraut; Waelde and Whatley), as well as the nuances of dance's digital transmission across time and space (Bleeker; Bench, "Dancing in Digital Archives"; Bench, *Perpetual Motion*). Complicating this discourse, the non-fungible dance object effectively cleaves ownership from authorship, propelling it into a distinct logic of copyright.

Second of all, the ways in which this object engages with knowledge production both extend and depart from the aforementioned notions of dance objecthood, i.e. those of the choreographic object and the embodied object. As described, the dance NFT does not offer much distinction between the dance and the object, and thus does not inherently promote a means through which the audience might interpret or come to know the dance. Once the non-fungible dance object becomes *collected*, however, it re-enters into a sphere of knowledge production. The discourse on collecting demonstrates how knowledge is embedded in the act of collecting, as well as the resulting collection of objects themselves. Literature on the history of collecting often defines the phenomenon as a mode of capturing, extending, and preserving human systems of knowledge (Elsner and Cardinal; Pearce; Geraghty). Susan Stewart, in *On Longing: Narratives of the Miniature, the Gigantic, the Souvenir, the Collection*, aptly expresses this thrust of the collection when writing:

> One cannot know everything about the world, but one can at least approach closed knowledge through the collection. Although transcendent and comprehensive in regard to its own context, such knowledge is both eclectic and

> eccentric. Thus, the ahistoricism of such knowledge makes it particularistic and consequently random. In writing of collecting, one constantly finds discussion of the collection as a mode of knowledge. (161)

Whether historic or ahistoric in its posturing toward temporality, collecting, according to Stewart's discussion of it, is characterized by a sense of order and a thrust toward knowledge, yet in a way that is "eclectic and eccentric".

Stewart's notion of collecting as an eccentric act of knowledge production shapes the meaning of the collected non-fungible dance object by imbuing it with an intelligibility that might not be embedded in other instances of dance. Evident in my use of the *collected* non-fungible dance object (rather than simply the uncollected object), however, is the sense that it is not the *creator* of the object that imbues the object with knowledge, but instead the *collector*. Once the dance NFT is in the collection of the person who acquired the work, the object may become available to forms of categorization based on genre or other systematic orderings. At the same time, the collector operates on taste and subjectivity, commanded by desire, and determined by experience and previous exposure. Thus, the meaning of the dance NFT may be derived from the collector's narrative around what it is, what other objects reside in their collection, and what "shelf" (digital or otherwise) it might sit on. These two affective sensibilities—on the one hand, objective categorification and, on the other hand, subjective desire and fancy—shape the ways in which the collected non-fungible dance object might be involved in knowledge production.

Of course, it is worth noting that the acquisition of the dance NFT takes place on the Internet, and thus results in a different social life than the collectibles Stewart discusses. While the intellectual history of modern collecting certainly positions the collectible in a constellation of knowledge and preservation, the act of collecting in the age of the Internet has a different affective and economic tinge to it. Pre-Internet collecting often takes on a linear view of the collection, pointing specifically to the proposition that nineteenth-century collections were instruments of *conservation* (Blom; Elsner and Cardinal). Collecting online, however, reshapes this dynamic by allowing the collected objects to continue to circulate (Koppelman

and Franks). This pivotal distinction means that a collectible in the age of the Internet is no longer an intimate thing that is taken out of circulation and brought into interiority (Dilworth). Instead, collectibles on the Internet, including digital objects like NFTs, may still be experienced by others whilst residing in a collection. Even with sites like eBay, collectors can access records of collectibles and images of the object, creating somewhat of a public log of various transactions for a given collectible (Trodd; Cahill). Collecting on the Internet, however, goes beyond auction sites like eBay, and expands into digital ephemera and the sharing of collections via images (Smith Feranec). Internet collecting is also impacted by the discourses around objects that tend to take place online (Geraghty). Once acquired, the collector might thus tap into what Koppelman and Franks discuss as the Internet's ability to "[provide] the most amazing display cabinet" (5). Displaying and/or exhibiting one's NFT collection online may take the form of social media posts about the merits of an object, or group of objects, which has become a common avenue of discourse for collectors; exhibitions on the sites on which NFT collectibles may be acquired, like the NFT platforms of OpenSea, objkt.com, or Foundation; virtual 3D galleries like OnCyber, or 2D galleries like Deca.Art; and display on whatever other image repositories or forums the collector might initiate or take part in. Collecting in the age of the Internet, regardless of how or where the work is displayed, not only acquires a character of *exploration* rather than conservation but also cultivates a historical record that might point to the economic and social history of a collectible.

As suggested through this review, the nature of collecting on the Internet indicates how a collector might possess a different affective sensibility toward their online collectible, possibly acquiring things with greater abandon or speculation, than they might do in pre-Internet times. This characteristic is especially the case for the NFT collector. They might find themselves instinctively drawn to a particular work of digital art—perhaps due to its aesthetics, or maybe its technical virtuosity—and purchase it on a whim, swept up in the energy of an auction. Alternatively, they might keep the tab open in the browser for several weeks, returning to it periodically to imagine how the work might add to their collection, while also researching the artist's oeuvre. These experiences may be defined by a range of emotions. On the one hand, the collector may find pleasure and delight in either the energy of the auction or the slow

and methodological process of determining if an NFT is "worth it", while on the other hand, the collector might find themselves struck with "buyer's remorse", wherein they purchased an NFT but regret doing so and cannot return their item. The ease with which one might click a few buttons to purchase a work of digital art, alongside the nature of Internet research helps shroud the act of collecting on the Internet in an affect of exploration, speculation, and eccentricity.

NFT Platforms, broadly

The notion of the collectible is tightly linked to that of the "collection", a term that is widely used in the NFT landscape. Among the many NFT platforms that facilitate minting, selling, buying, and curation of NFTs exist two uses of the collection, and thus two ways of conceiving the collectible. The first use refers to a series of works that an artist creates, which may coalesce into a shared aesthetic, theme, or concept. This use may be seen on sites like Foundation and Objkt.com. The second use refers to an assortment of NFTs that have been acquired through a singular wallet address, evident on platforms like SuperRare and fx(hash). The former centers on the experience of the artist, whereas the latter centers on the experience of the collector.

This difference in meaning demonstrates how NFT culture as a whole is still negotiating a lexicon for a new paradigm of digital art collection. It also represents the convergence of different subsets of the art market into the same space: museums negotiating the meaning of preservation in Web 3.0, blue chip galleries looking to capitalize on emerging digital artists, smaller galleries aiming to stay current, curators looking to tell a different story, venture capitalists taking advantage of a new modality of investment, and artist collectives aiming to blaze their own trail. These various factions not only occupy different orientations toward the collectible/collection, but also harbor divergent interests, are patterned through different ways of working, and in some cases also possess contradicting worldviews. With such distinct histories, affiliations, and codes of conduct, these factions independently navigate a new terrain while writing a new playbook, even as the blockchain itself undergoes updates. Amid shifts, collaborations and coalitions certainly form amongst individuals representing different factions. The result is the emergence

of numerous platforms devoted to the buying and selling of NFTs, each with its own flair, mission, and market leanings.

The ways in which a platform orients itself toward the wider art market impact its conception and framing of a collection. For example, a platform founded by individuals connected to a blue-chip gallery, or a premiere art auction house would have different affiliations and economic sensibilities than a platform founded by artists, art curators, or other individuals connected to the sphere of art-making. A *collection* in the case of the former might focus on the experience of the collector, whereas a collection in the case of the latter might focus on the experience of the artist. While affiliations to certain industries, conventions, donors, and other aspects related to the buying and selling of art are not foregrounded on a platform's webpage, these covert ways of operating manifest in how a platform relates to artists, both emerging and established, as well as how they define and mobilize a "collection".

Competing sensibilities toward what a collection is and who owns it also inform platform orientations toward dance and performance. Many of the positionalities and scenarios for NFT platform affiliations mentioned above do not include a framework for dance and performance. This is not surprising, considering how the notion of the dance collectible is historically novel. After all, dance and choreography have seldom, if ever, appeared up-for-auction at auction houses like Christie's or Sotheby's, as opposed to countless paintings, sculptures, photographs, and other works of visual art. NFT platforms thus have nothing to inherit, culturally and economically speaking, when it comes to the buying and selling of dance, even though the field of screendance has established a discipline and discourse for video-based choreography and movement art. As a result, platforms may not have a particular position on the prospect of hosting dance and performance NFTs, or including choreographers, dance artists, and performance artists in prominent curations on their sites (such as featured works on the homepage). Dance, in this way, is often omitted from the prospect of being collected.

Despite the uncertainty around the dance NFT, dance artists, as well as curators on NFT platforms, are adapting to an emerging system with values and affiliations largely inherited from a market that has historically accommodated *visual art*, as opposed to *performance*.

Dance artists, for instance, may select a platform based on how amenable it is to performance, specifically through the technical support for video formats. Similarly, curators and other affiliates for certain platforms may decide to promote more performance NFTs, recruit more dance and performance artists to their site, and tune their servers to be more video-friendly. These subtle, yet critical positionalities inform not only how dance is valued in NFT spaces, but also the diversity of genre and form that a platform might have for the NFTs on its site.

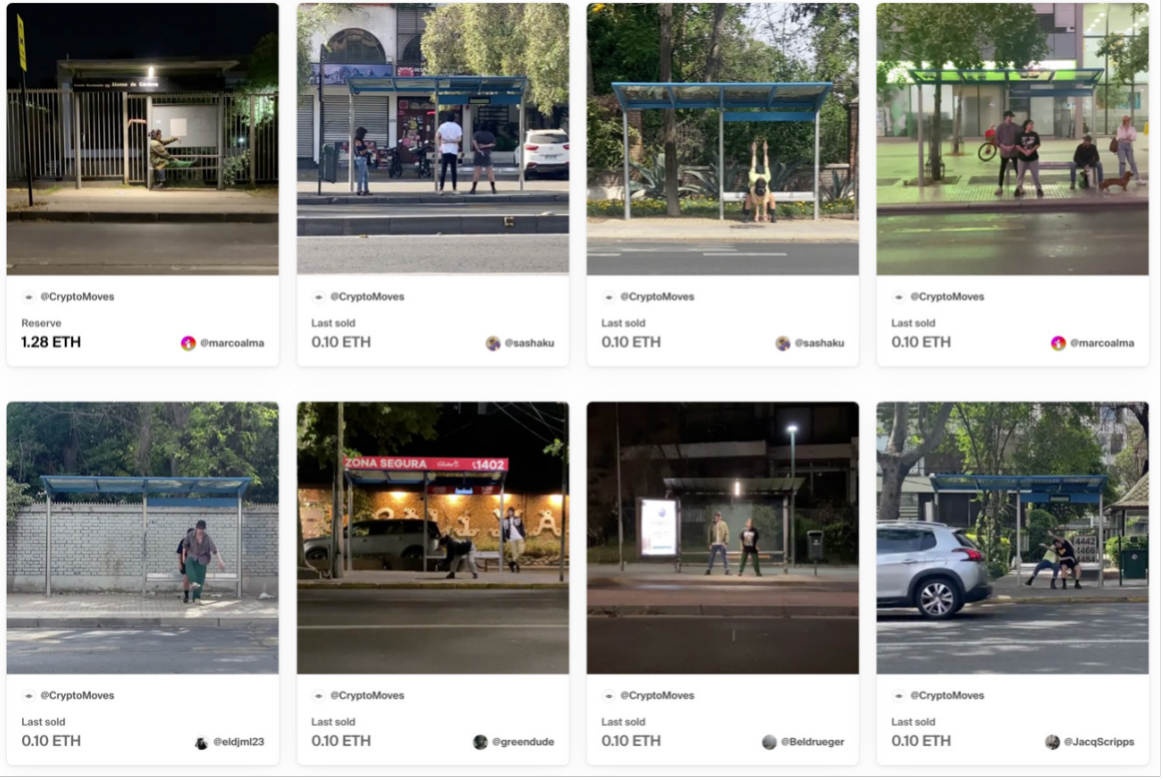
Dance Collectibles

Indeed, platform orientations toward dance impact the ways in which dance NFTs can even become available on the market, not to mention how collectors acquire them. Together, dance artists and platform decision-makers determine what our new dance collectible is, what it looks like, and how it might act in a market that is largely shaped by the economics of visual art. It is most helpful in these regards to consider how the dance collectible manifests for the artist, as well as for the collector. In this endeavor, I turn to the work of CryptoMoves, the moniker for the work of Chilean artists, Beatriz Castañeda and Nicolás Gatica. Castañeda and Gatica have been active in the NFT space since 2021, and have minted dance NFTs on both Foundation and SuperRare. An analysis of their work on Foundation will demonstrate what the non-fungible dance object is, how it circulates, and how it might come to live on the shelf of the collector.

On the profile page of their Foundation site, the bio CryptoMoves reads: "Award winning dancers based in Santiago, Chile. Our movement explores concepts like human connections, minimalism and geometry. We are from the first wave of dancers in the NFT space". Just below their bio is the number of collectors who own their work, as well as several tabs to view the various NFTs in their repertoire: curated "worlds" they have created, individual pieces they have minted, works by others that they now own, pieces they have collaborated with others on, collections they have created, and NFTs that they have acquired from other artists. At the time of writing this essay, CryptoMoves has sixty-one NFTs on the site, eight collections through which they package a series of NFTs, twenty-two collectors of their work, and four NFTs by other artists that *they* have collected.

When drilling down into the collections of their work, you see the eight series of NFTs that they created, each with a different theme and aesthetic. The collection "Connections" consists of thirty works and is described on the page as "a raw production about minimalistic movements and social connections through public transport". All of the NFTs in this collection are set in a different bus stop—presumably in or around Santiago, Chile, where CryptoMoves is based. Filmed in a continuous wide-angle shot, the two dancers perform in the small covering of the bus stop, moving arms and heads in a geometric fashion while cars and buses cross the frame (see Figure 1). Another one of their collections, "Conversations Through Alter Ego", has a different aesthetic and semiotic sensibility. The three NFTs in this collection utilize a similar video technique in which

Figure 1. Screenshot of CryptoMoves' collection, "Connections" (2023)



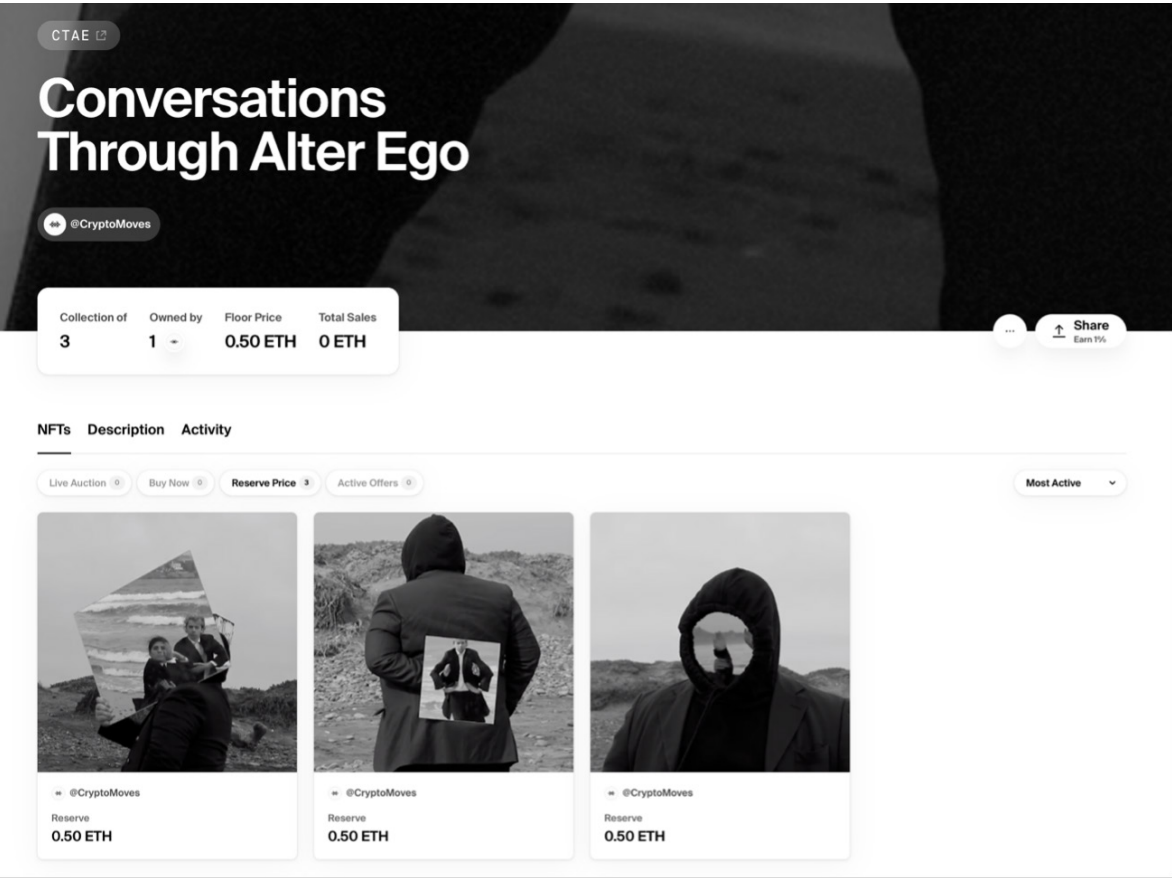


Figure 2. Screenshot of CryptoMoves' collection, "Conversations Through Alter Ego" (2023)

the moving image of the dancers sits within a still image (Figure 2). The effect is that it appears that a human figure in the still image is carrying, holding, and otherwise framing the dance piece.

These two collections, along with the others in the duo's oeuvre on Foundation, enable CryptoMoves to curate their non-fungible dance objects and better frame their work for audiences and collectors. The fact that they have eight collections with distinct aesthetic and semiotic sensibilities articulates how this feature is an instrument for the dance artist to shape the meaning of their work—to produce knowledge around it—before the collector acquires it.

This element of the NFT scene tests the ways in which a non-fungible dance object might produce knowledge, and how its meaning is constructed. As articulated in previous sections of this essay, however, much of the social, cultural, and economic life of the dance collectible takes place in the hands and on the shelf of the collector. So, while CryptoMoves is able to shape the meaning of their work through their collections and descriptions of their collections on and off the platform, the meaning of the dance collectible is also shaped by the collector. Delving into the collection of a particular collector of their work, Anna Condo, will illuminate the new life of the dance object on the blockchain.

The Foundation collections of Anna Condo are separated into two accounts (or "wallets"): ACECollections-1, which contains 592 objects, and ACECollections-2, which contains 479 objects. First, I focus on ACECollection-1, since that is the wallet with the dance NFTs. Indeed, while this collection consists of pieces representing a wide range of art genres and forms, from photography to mixed media collage to performance art, the number of dance NFTs stands out. That is, within the repository of ACECollection-1 are thirteen NFTs created by CryptoMoves, along with several works by other dance artists (three works by dancevatar, one by Cesar Saavedra Nande, one by Irin Angles, one by befe, three by Marco Alma, and two by shu). Evident in this collection, Condo appears to be one of the most avid collectors of dance NFTs. From what can be seen of her ledgers, Condo does not "flip" the NFTs she acquires.[10] Instead, she holds onto her acquisitions, growing her collection over time, and therefore articulating her preference for these objects.

With such a large collection, it is difficult to identify a particular theme or conceptual leaning among her objects in ACECollections-1. However, evident in the apparent lack of animation NFTs in this wallet, as well as the prominence of the human body throughout the collection, is an apparent interest in the corporeal. Indeed, across the various genres represented in this group of collectibles, is the centrality of the human figure. Even in pieces where that figure is absent, its life is suggested by the objects or spaces within the frame (Figure 2). Perhaps Condo's interest in dance NFTs revolves around the ways in which dance foregrounds the body, movement, and even the imbrication of the human in the ordinary facets of existence. In this way, Condo is producing a particular strand of knowledge

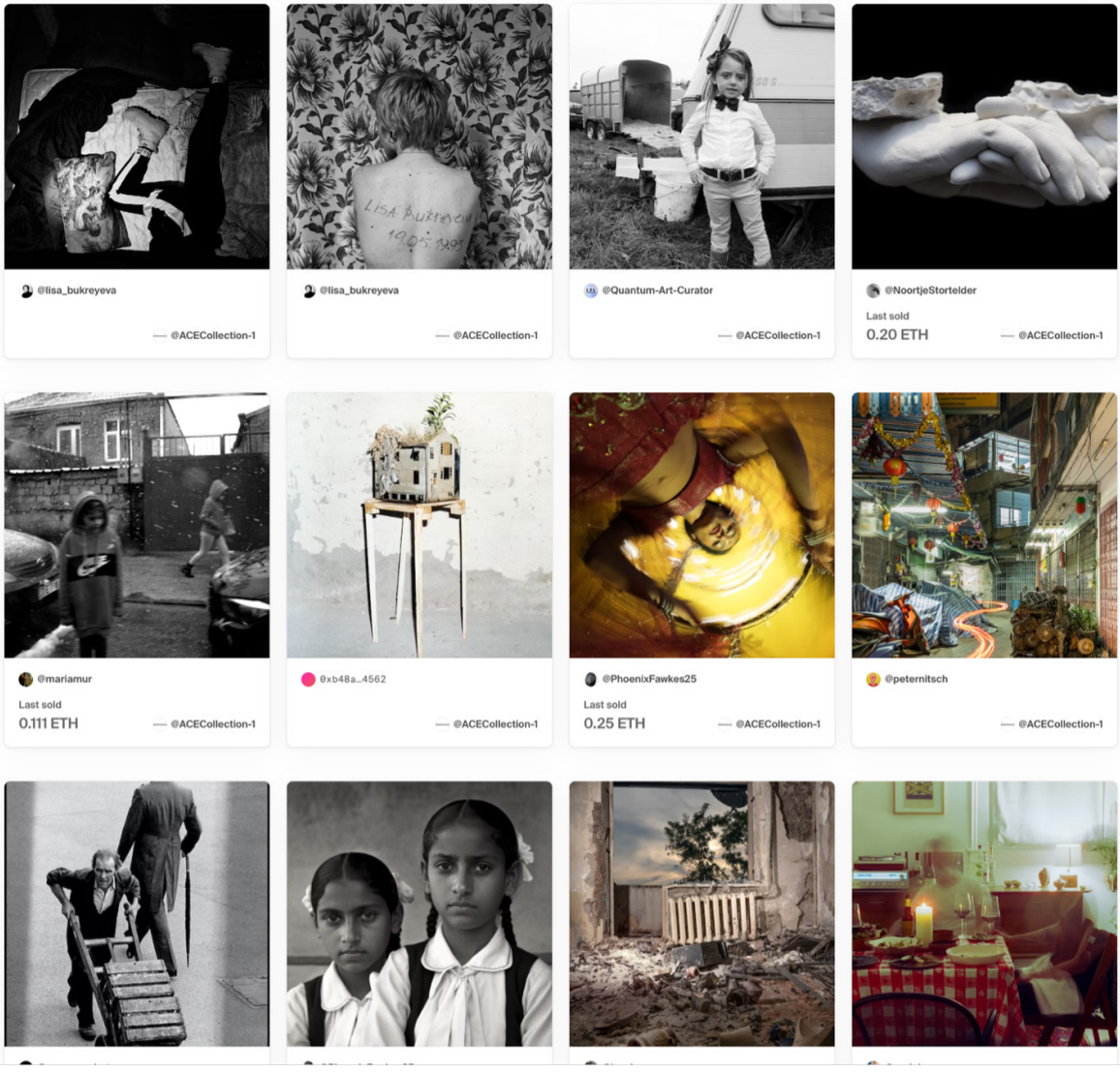


Figure 3. A screenshot of a small sliver of Anna Condo's collection in the ACECollections-1 wallet (2023)

or an argument about NFTs and NFT culture: in a space where the human image and human touch are becoming less visible in digital art, evident in how animations, AI creations, and code-based generative art tend to dominate the landscape, art that renders the human form highlights the embodied, corporeal dimensions of the world in which the art was created. Thus, by accumulating such a body-centric collection, Condo is not only suggesting a value for the human and the "organic" (a term used by one of the artists whose work lives in Condo's collection) but also exhibiting to the world what it means to have and to hold such a display case for an eclectic mix of remarkable objects.

This argument offered through Condo's collection of dance NFTs and other body-centric tokens is further supported by the aesthetic and conceptual sensibility of her second collection, ACECollections-2. Interestingly, ACECollections-2 consists of images that foreground, or otherwise suggest the *non-human*. Animation and AI seem to be two techniques or genres that can be found across the NFTs in this collection. As if the two collections are separate display cases that operate on a different logic, purpose, and meaning, Anna Condo is producing knowledge and meaning about the NFTs she collects.[11] Individuals who come across her collections may then think differently about the objects in them.

Through the lens of CryptoMoves and the collecting pursuits of individuals like Anna Condo, we see the emergence of a new custodian of dance: the collector. As collectors like Condo demonstrate, the act of acquiring dance NFTs involves more than just owning a work of art. It may involve crafting a narrative that gives life and context to the art. It may involve building a personal relationship with the digital object, one that approximates the relationship they might have with a physical object. It may also involve entering into a personal, collegial relationship with the artist over a shared interest in the work of art—an experience that many interlocuters described as personally meaningful. Through the role of the collector, then, the traditional dynamics of dance appreciation are being recalibrated in a system where dance is not just experienced but collected, narrativized, treasured, and perhaps also passed down as digital heirloom.

The implications of this shift are as profound as they are intricate. As dance enters the digital ledger, it does not merely become part

of a sphere of collectability, but it adopts a new cultural identity. No longer is dance solely framed through the performance *event*, which characterizes in-person performances as well as dancefilm festivals and screenings, or through its *transmission*, which characterizes the movement of dance across media platforms of Web 2.0—but by its *provenance*.[12] Provenance on the blockchain reveals the historical life of the dance NFT, telling a story of its collectability throughout its digital lifetime. It, for instance, weaves a narrative that can include collectors alongside the institutions that exhibit the work, the audiences who interact with it, and the cultural moments it signifies. The singular collector, with their curated digital shelves, functions as the conduit through which dance enters a wider narrative of its digital life.

The imprint of the collector, and the provenance that they activate, will continue to morph and expand in volume as more collectors enter into the market for dance collectibles, and those collectors assert their preference for a particular *kind* of dance object. These collectors may or may not be guided by the historical significance of bidding on and acquiring a non-fungible dance object, yet the fact of such a feat speaks to the dynamic shifts that screendance, and the field of dance more broadly, will undergo. Of course, many aspects of this future remain to be seen. The trajectory of Web 3.0, and the corollary dance NFT, hinges on the global geopolitical climate, the state of financial markets, international law, and legislation from independent nation-states. Thus, as political and economic changes take effect, the NFT landscape, and dance artists operating within that landscape, will respond in unforeseen ways.

While there are many unknown aspects of the future of the blockchain, its forces have already prompted a seismic shift in how dance may be conceptualized. The NFT wave that was born from blockchain technology may exaggerate the ways in which dance operates as a commodity, introduce new facets of dance's life as a gift, is transmitted digitally, and transacted in a marketplace. However, the more unsuspecting—and as I have argued, critical—contribution of the blockchain to the history of dance is its induction into the world of collecting. The notion of dance as a collectible *is* and *will continue to be* socially, culturally, and economically pivotal. Its operations of value will shift. Its relationship to audiences will change. Its capacities for meaning-making and knowledge production will transform. Yes, the new paradigm of dance is with the collector—and it is on display.

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Notes

1 Beyond the common understanding of how NFTs are traded using cryptocurrency, the creation of an NFT also requires cryptocurrency, particularly through a "gas fee" that is incurred at the time of minting. Gas fees relate to server costs and other overhead that is often required to sustain the technology of the blockchain. Gas fees, like petrol prices, are contingent upon a wide range of economic (and technological) factors and thus vary over time, but are often linked to the size of a file and the amount of transactional traffic occurring at a given moment.

2 My reference to new modalities and media references 3D and immersive experiences of dance. While NFTs of this nature exist on blockchain, they are mostly created by artists who are not involved in the world of dance or choreography (like the classic meme of the "dancing baby" by Michael Girard, which now is in NFT form). Exceptions to this trend include the work of Diego Mac.

3 The technological barriers of entry for blockchain activity tend to be high for many users. Interlocuters describe how their NFT journeys often began with the help of a friend or colleague who had aided

in their "onboarding" process. This process entailed the creation of a wallet; access to NFT platforms, some of which are (or were at the time) invite-only; the minting of their first NFT, etc. Users thus often need social, cultural, and economic capital to enter the NFT market.

4 The first NFT minted on the blockchain is a piece called *Quantum*, created by Kevin McCoy and Anil Dash in May 2014 on a platform called Namecoin.

5 Of course, Susan Foster notes via Pierre Bourdieu and Jean Baudrillard that the commodification of dance in capitalist marketplaces does not solely revolve around the exchange of financial capital, but also involves other modes of capital, namely cultural and social capital (7).

6 For a study on dance's role in commercial advertising, see Dunagan (2018). For an instance of dance's role in influencer economies on social media, see Porter (2020).

7 "Swap" is a term used on the now-defunct NFT platform, HEN, to describe the buying of an NFT. Interestingly, during its short life as a trading space for NFTs, HEN was an incubator for artists to experiment, play, and coalesce around the production and circulation of their art objects. The use of the term "swap" emphasizes the artist-centric, gift-giving potential of the NFT culture and NFT communities. The fall of HEN was a convoluted process that some interlocutors attribute to the technological insufficiencies of the platform (e.g., slow loading speeds due to a lack of necessary platform maintenance), and others attribute to the colonialist takeover of the blockchain (since HEN was founded by a Brazilian artist and was ultimately bought by an American hedge-fund-backed group). These dynamics of one particular NFT marketplace capture the competing interests and tensions at play in the early life of NFT culture.

8 As conceptualized by Graham Harmon, object-oriented ontology is a theory of object relationality through a phenomenological lens. For more information, see *Object-Oriented Ontology: A New Theory of Everything* (2018).

9 Peggy Phelan (1993) notoriously argued that the fundamental character of performance is its disappearance. According to Phelan, a digitized performance is no longer "performance". Philip Auslander (1999), on the other hand, challenges the assumption that live performance holds a unique authenticity or immediacy that mediated forms lack. In particular, Auslander argues that live and mediated performances have become interdependent and that the experience and meaning of liveness are deeply influenced by media technologies.

10 The notion of flipping – which borrows from a vocabulary of buying and selling other objects, including houses and cars – refers to the act of selling an NFT for more than it was purchased. The collector thereby makes a profit from the mere exchange of a digital object.

11 It must be noted in this regard that Anna Condo is an artist in her own right. Many artists in the NFT space indeed become collectors, as they come to admire the work of their colleagues and peers.

12 In the world of fine arts, provenance is the chronicle of ownership for a work of art, which not only establishes its authenticity but also its history through various owners and collections.

Motion Pointillism: The (Re/De)Construction of the Normative Body through Motion Capture

–– Hugh Alexander von Arnim
(UNIVERSITY OF OSLO)
ORCID: 0009-0005-7511-9019

–– Tejaswinee Kelkar
(UNIVERSITY OF OSLO)
ORCID: 0000-0002-2324-6850

–– Live Noven (INDEPENDENT ARTIST)

Marker-based, optical motion capture systems make use of reflective markers, interpreting them as clusters of dimensionless points in space. Before labeling and arranging these markers, potentially to fit a model of a kinematic chain, these markers possess little referentiality to objects in physical space. However, the construction of a kinematic model of the human body requires making several assumptions about the body and its affordances. In this article, we problematize the use of the kinematic model in dance performance that employs motion capture, placing focus on the referentiality of visual representations derived from markers and models while examining how motion capture contributes to the construction of the body through the embedding of assumptions and values about what a body is and can do

within the technology. Through the design and conceptualization of two interactive dance performances titled *Reconfigurations* and *The Shapeshifter,* we develop an approach to working with motion capture that we term *motion pointillism*, which aims to resist the systemic assumptions embedded in the modeling process. This approach conceptualizes the emergence of the dimensionless points' referentiality to a human body as a collaborative component of system development and performance, which occurs both in the design of visual representations as well as in the viewers' perception.

Keywords: Motion Capture, Modelling, Body, Dance, Normative

Over recent decades, motion capture (hereafter also mocap) has become popular in contexts such as stage-setting, popular music concerts and film. The technology's use in dance and various types of staging has been relevant for both the artistic as well as the popular stage. In this article, we problematize several assumptions made by these technologies about bodies, and how potentials for dance exploration and creative possibilities are co-created by these technologies. We present two of our own dance works that employ optical, marker-based mocap. These works were developed through our research-creation practices, with each consisting of an interactive system used in a performance. Through these projects, we developed an approach towards the use of marker-based mocap that we term *motion pointillism*. We contextualize this approach in relation to works that employ the technology as a method to model the skeletal structure and kinematics of the body.

One of the most recent large-scale appearances of mocap in popular media is connected to the band ABBA. In 2022, ABBA began their first concert series in 42 years in support of their new album *Voyage*. The show, which is currently scheduled to last until 2025, consists of the members of ABBA performing their greatest hits along with accompanying dance routines in a dedicated arena in the Queen

Elizabeth Olympic Park. However, it is not the members of ABBA who are physically performing the show. Instead, animations of the band as they looked in the 1970s perform a routine captured from the band[1] using an optical, marker-based mocap system. Despite some issues relating to the use of the technology as well as several initial technical setbacks, the show was received positively by audiences and critics, and has sold over one million tickets to date (Matthews and Nairn 298).

The show is among the most high-profile productions at the intersection of marker-based mocap and choreography, using a form of mocap in live performance that had previously mostly been associated with film and video games. However, dance works involving this technology date back to the 1990s, while the technology itself was formed through its initial application for medical biomechanical analysis in the 1980s (Downie 306). In the following section, we introduce some fundamental characteristics of optical, marker-based mocap and describe how the technology functions.

Optical Marker-Based Motion Capture

The term motion capture covers a wide range of technologies and techniques, with Kristian Nymoen defining motion capture at a fundamental level as "the use of a sensing technology to track and store movement" (13).[2] The technique central to our work and this article is "optical marker-based motion capture", which concisely sums up how it works and what is involved, describing both the sensor and what is sensed. Optical refers to the use of cameras as the sensing technology, with these consisting of cameras that operate within the Infra-Red (IR) range of the electromagnetic spectrum. Marker-based refers to what is sensed by the cameras, namely some physical object placed within the environment or upon the human body for which the position is tracked by the camera system. Optical markers are generally small, spherical balls that are coated with a highly IR reflective surface with an adhesive on one side. There are two main types of markers: active and passive. Active markers emit their own IR light and require a separate power supply, while passive markers reflect IR light emitted from IR light emitters usually mounted on the cameras themselves.

A typical marker-based system uses multiple cameras. Once the camera system is set up, the capture volume, which is the physical space in which motion is to be captured, is calibrated using fixed marker distances, so that new objects can be accurately tracked. If the IR light that is either reflected (by passive markers) or emitted (by active markers) is captured by at least two cameras, the position of the marker can be calculated through triangulation. The position of the marker takes the form of a three-dimensional point within a Cartesian coordinate system, expressed as distance relative to a user-defined origin representing a point in the capture space. There are several considerations that must be kept in mind when using a marker-based system. Firstly, if a marker is occluded or hidden from the cameras' view in a way that makes it visible to fewer than two cameras, the marker can no longer be registered by the system. This means that the physical properties of the capture volume must be considered to ensure that the cameras provide adequate coverage. The body of the performer can also cause occlusions, so even if an area is clear of objects there might be limitations placed upon motions that the performer can carry out. An example of this is floor work in dance, where any markers on the side of the performer's body that is against the floor may not be captured. Secondly, if several markers come into close proximity with one another, the system might be more imprecise. This is due to the system being unable to distinguish between the markers, especially if they come within the deviance of error of the system. Thirdly, any object that reflects or emits IR light will be registered as a marker by the system. In locations that contain many of either of these (for example spaces exposed to sunlight), this can add a lot of noise to a capture. This noise can be in the form of missing data or hallucinated data points (usually called ghost markers), or marker jumping, for example.

When passive markers are used, individual markers do not possess a distinct identifier. In the case of non-real-time use, once a recording has been completed markers can be labeled and any gaps in the capture can be filled. Depending upon the amount of noise in the capture, this can be quite a long and arduous process. If it is important that individual markers are consistently identifiable during the capture session (for example, in interactive performances that map a specific marker to a specific parameter), a method must be developed with which its identity can be preserved across any gaps. In a sense, all passive markers are calibrated and occasionally imagined by the system (Karreman).

A defining property of an optical, marker-based system is that the position of each marker is projected within a coordinate system.[3] This means that the position of each marker is not calculated in relation to the position of other markers, but rather in relation to an origin that is defined during calibration of the capture volume. As a result, there is no inherent relationship recognized by the system between the motion of each individual marker that it captures. Instead, markers can be placed anywhere within the capture volume, and the relationship between the markers must be defined by a method chosen by the system designer or user. An advantage of this is that it is possible to capture a human body interacting with an inanimate object or multiple human bodies within a single capture, and the spatial relationship is preserved. The most common method of determining the relationships between these objects is through the definition of rigid bodies and the modeling of the human skeleton as a kinematic chain.

Rigid Bodies and Kinematic Modeling

Mocap has used an approximation of the human body in the skeletal form since its inception. These types of representation rely on bone-based approximations of the body, from a surface level of capture. Since markers are dimensionless points within the capture volume, a few steps need to be performed to obtain higher-order properties. To obtain the spatial dimensions and rotation of an object, a constellation of markers can be defined as a *rigid body*. A rigid body is constructed with the assumption that the physical object that it represents is non-deformable, meaning that it does not change in shape, size, or internal structure when subject to external force. This implies that to define a rigid body the constellation of markers must be in fixed positions, with the relative position and angles between each of the markers remaining consistent for the duration of the capture.

To model more complex objects, a series of rigid bodies can be joined together to form a *kinematic chain*, which mathematically represents this series as connected to one another by joints that have predetermined degrees of rotational and transformational freedom. These are often organized hierarchically, with one rigid body serving as the root to which all other rigid bodies are chained. The modeling

of kinematic chains can quickly become quite complex. A full discussion of this is beyond the scope of this article, however, and we refer to Müller for a more thorough description of this process in relation to the human body.[4]

A common procedure is to define the hips as the root rigid body of the kinematic chain, with the two upper legs and the lower spine functioning as separate stems extending from the root. These models are often extremely simplified. For example, the spine is commonly modeled as consisting of either two or three connected rigid bodies in contrast to the 33 vertebrae commonly found in the human spine.

This representation of the body in its skeletal form is used by most markerless mocap technologies as well. Among others, pose estimation algorithms such as OpenPose use one approximation of the skeleton derived through training a machine learning model with a dataset of images of the human body with the labeled position of 135 keypoints (Martinez et al. 5), and the Microsoft Kinect skeleton tracker uses a skeletal model defined through the position and orientation of twenty joints extending from the hips in relation to the position of the device itself (Le et al. 341). It is hard to trace the exact origins of the skeletal structure that remains in a variety of these algorithms, but for example, the idea of approximating the human body through mocap in the form of a skeleton has been in the Vicon system since the inception of their software tools in 1979 (Vicon).

Motion Capture in Dance Performance: A Review of Works

With their focus on human body motion, mocap technologies may seem to be an inviting prospect to choreographers who work with multimedia performance. For this article, we are limiting our scope to live dance performances and artistic installations. Within this context, there are two main styles of working with mocap that emerge. The first involves mocap occurring prior to a performance, with the captured data then played back during the performance. The second is to use the mocap system live in a real-time interactive system. The latter, however, is relatively infrequent. Bevilacqua et al. emphasize the relative scarcity of the use of marker-based mocap in real-time, interactive dance systems, attributing this to the

complexity of handling such systems and the requirement of the performer to wear markers during the performance. To this, we would also add that an optical, marker-based mocap system is quite expensive, with no companies making consumer-grade options, and has quite a high barrier of entry in terms of technical knowledge required for operating the system. Due to this, many of these works involve either a link to academic research or the involvement of a private company that specializes in animation.

The latter is the case for two seminal works of the late 1990s. The Riverbed group, formed by Paul Kaiser and Shelley Eshkar, was responsible for several of the earliest forays into the integration of mocap with dance (Dixon). With the group, Michael Girard and Susan Amkraut developed a kinematic modeling software named Biped, which formed the basis of Riverbed's collaborations with a number of prominent and influential dancers and choreographers. This software formed the basis of their first collaboration with Merce Cunningham, an animated installation named *Hand-drawn Spaces*. Based upon this successful collaboration, Cunningham proposed to use the mocap technology in a work that also involved live dance performers on stage. The result of this was a work titled *BIPED* in 1999, named after the modeling software that had been developed by Riverbed. The work featured dancers on stage, accompanied by projections of animated captures showcasing two or three dancers[5] executing a series of Cunningham's movement sequences onto a scrim. As reported by Abouaf, the process used to create the work involved a single afternoon of mocap recording with the dancers ("'Biped': A Dance with Virtual and Company Dancers 1" 1). After processing the captured data, kinematic models were created that formed the basis for the following animation procedure. There were two main methods involved in the animations created from the kinematic models. The first was a rotoscoping technique, with hand-drawn animations traced on top of the kinematic models by Kaiser and Eshkar. Abouaf describes these as "an expressive chalk skeleton against a black background" ("'Biped': A Dance with Virtual and Company Dancers 2" 5).

The second method was the creation of a 3D model by mapping a spline curve to the kinematic model. Variations on this technique involved modifying the spline to represent more abstract forms. For the 3D animation, as noted by Dixon, much detail went into the

modeling of kinematic effects, such as skin and tendon behavior, and even "foot to ground collision response" (188). This method of mapping a kinematic model to a 3D-animated model has proved influential to proceeding developments of dance work involving the use of optical, marker-based mocap, with Dixon, in reference to an image of dancers in front of one of the animated figures featured in *BIPED*, noting that "*BIPED* images such as these have been so admired and reproduced that they have become archetypical of the digital dance and performance movement" (193). Following *BIPED*, Riverbed collaborated with Bill T. Jones on the installation *Ghostcatching*. In this work, several motion patterns performed by Jones were captured in a similar manner to those performed by the dancers in *BIPED*. The kinematic model created is mapped to representations meant to invoke "intertwinings of drawn strokes" (Jones et al. 1). This was achieved by using the same systems that were involved in the production of *BIPED*, both in terms of the mapping of the kinematic model created from Jones' capture data to a series of splines, as well as the modeling of the skin and muscle behavior (Baumgartner). After the premiere of the work as an installation at The Cooper Union in New York, the piece was later incorporated as a part Jones' *Breathing Show* tour. It sees multitudes of animated figures spawning from each other and performing the patterns captured from Jones. These are accompanied by recitations recorded by Jones, ranging from song to spoken word.

In the years since, further works have explored the possibilities afforded through mapping a kinematic model of the skeleton to an animated figure in dance including a re-envisioning of *Ghostcatching* in 2010 as *After Ghostcatching* (Barber); several works undertaken by Marc Downie including collaborations with Merce Cunningham and Trisha Brown for which he developed an agential approach towards kinematic modeling of the skeleton from marker positions; Vincs and McCormick's use of the model to drive representation outwards from the body of the dancer in a stereoscopic projection with a real-time system; Satore Studio's work on *HÁITA*, which incorporates mocap along within a wider ecosystem of sensing systems to capture a wide variety of dance styles; and Dan Strutt's telematic project, developed during the COVID-19 lockdown in the United Kingdom, for which the kinematic model is streamed in real-time over the internet and animated in a second location.

There are, of course, several marker-based dance works that do not attempt to kinematically model the skeleton with the mocap system. For example, the work *Lucidity* (James et al.) uses a custom-built tracking engine to trace the position of a dancer as a cloud of points from which higher-level features such as dancer proximity and groupings are extracted, with limb motion modeled through statistical methods relating to the point cloud.

Our Explorations: *Reconfigurations* and *The Shapeshifter*

During our research-creation practice, focused on the development of interactive systems and performances that foreground human body motion, we developed two dance projects centered around the use of optical, marker-based mocap. Both projects originated from a desire to explore marker-based mocap as a technology and its relationship to the human body in a physical environment as well as in its virtual representation. The projects form a continuity, sharing fundamental conceptual ideas, as well as developed systems. The first, *Reconfigurations*, was developed over the first half of 2022 and served as an exploratory probe into ways of working with the technology, as well as a testing ground for our core systems. Following this, in the summer of 2022, we began to work on *The Shapeshifter*, with which we aimed to expand upon work done in *Reconfigurations*.

The technological components of both performances are built upon the top of an OptiTrack mocap system permanently installed at our institution. However, instead of making use of the modeling and processing techniques of the OptiTrack software, named Motive, we employed the software as a simple throughput to stream the position of the markers in the capture volume onward to our own software. To date, performances have only taken place at our institution and so the presentation of the works in this article refer only to these performances. However, we are also in possession of a portable OptiTrack system and are in the process of working to transport our work to other venues. In the following sections, we will first discuss our high-level design motivations, followed by a discussion of each work, detailing their origins and the ideas that we wished to explore and providing a brief overview of the performances and the systems that we developed for each.

Motivations for Design

Our motivations for these works originated from a desire to interrogate how the body was represented by the OptiTrack system. Having previously worked with this system and other optical systems for work on motion analysis projects, we started to think about how the mocap software visually presented the human form as a construct of the motion data that was captured. We likewise started to recognize several limitations that mocap systems imposed upon how the body could be represented, owing to both software design as well as hardware capabilities. In view of this, we considered the forms of data that can be acquired by the mocap system and how these are presented visually within the software.

The OptiTrack system that we use as a base mocap system fundamentally works with the position of markers captured by the system. Motive presents the position of these markers visually as small, colored spheres within the 3D capture volume. Beyond this, Motive allows the organization of a collection of markers as either a rigid body or a kinematically modeled skeleton. The skeleton can be represented as one selection of avatars such as a mannequin which encompasses the markers. Alternatively, the skeleton can be represented by a series of sticks, which join the spheres of the markers along the path of the skeleton's bones. A rigid body is similarly represented, with a series of sticks demarcating the boundary of the object.

While this representation of the kinematic model is recognizable as the figure of a person, there is a sense of the uncanny to this representation of the human body. The body is reduced to a series of points and reconstructed by joining these points with a series of predetermined connecting lines. Importantly, these connecting lines are also fixed in terms of properties relative to the body that they are portraying, such as their length and the points which they connect, freezing it in this uncanny form. We began to consider how we could unfreeze this form and remove the constraints imposed by the modeling process. What if the markers were not assumed to be in fixed positions on the body so that the modeling process didn't break down when a marker is moved? What if the connecting lines were malleable, not presuming to reconstruct a part of the body in the capture? What if we didn't conceptualize a single human body as

the boundary of the modeling process, enabling the encompassing of inanimate objects, parts of the environment, and even a second body as part of the construction of the form?

Unfortunately, the Motive software is quite obstinate with its modeling process, being especially inflexible when it comes to reconfiguring these in real-time. There is no manual way to create connections between markers. Rigid bodies, once defined, stop being tracked if a marker moves outside of the margin of error (usually a couple of millimeters). A skeleton model is picked from a list of presets, each requiring the wearing of a specific marker set which consequently fixes the parts of the body to be modeled. A custom skeleton can be defined, but this requires creating a custom XML file, something that is not possible either post-facto of a recording or in real-time. Moreover, it is quite complex to do even without these constraints and still implies the wearing of markers in specific positions. These thoughts motivated the design of *Reconfigurations*, the first of our explorations.

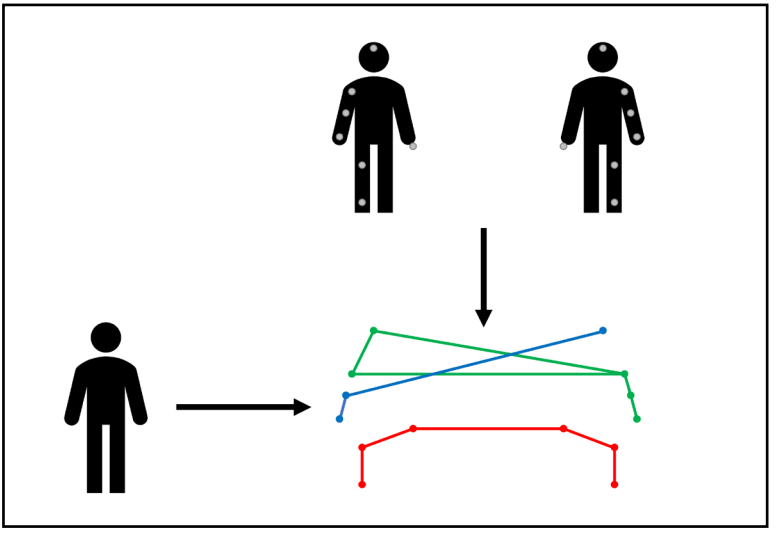
Reconfigurations

In *Reconfigurations*, we employed Motive to stream marker positions to our own software with the aim of enabling malleability in the formation of marker constellations. Using the programming language Python, we in effect recreated a simplified version of the Motive display. Each marker is represented in a pseudo-3D virtual capture volume. Depth is simulated by altering the size of each circle. However, we added an element of interactivity, which functions as a reconfigurable "modeling" process. Markers can be assigned to a "body" on the fly, with each body represented by a different color. Markers belonging to the same body can be joined together with a line representing a bone by clicking on one marker and drawing it to another. However, instead of these lines being fixed in position and length, they follow the markers to which they are connected, changing in length and relative position. Markers can also be disabled, removing the marker and any connecting bones from the display. We also decided to try and work *with* occurrences such as occlusions which are generally treated as errors in the system. When a marker is occluded, or otherwise not recognized by the system, its representation remains frozen in place. This means that a marker

can be purposefully covered to hold it in position while the rest of the body moves to a different position.

Using this software, we developed an improvisatory dance work for three performers (von Arnim, "Reconfigurations"). Two mocap performers improvise dance phrases within a performance area, employing up to thirty markers[6] which they are free to move and place wherever they wish at any point during the performance. The third performer uses a digital interface to control the software to reconfigure and connect these markers into up to five bodies. There is no limitation to the markers that can be connected within a body, meaning that connections can be built across both moving performers, and incorporate inanimate objects to which they attach a marker. Instead of being pre-defined at the outset of a performance, the form of the body is configured and reconfigured during the performance. Facing the performers is a video wall, displaying the bodies as a mirror of the physical performance space. We also

Figure 1: The two dancers position the markers in the performance space, either by wearing them, holding them in their hands or positioning them somewhere in space. The third performer uses the software to group the markers into bodies in real-time and draw malleable bones between them. The resulting figures are then displayed on a video wall in front of the performers and audience (2023), © Hugh Alexander von Arnim



created a sound synthesis engine to which motion parameters are mapped to generate musical material across a performance.

A performance was held in May 2022 as part of a concert of telematic music, that is, musical performance over a network connection. For this, the performers were in the laboratory where the OptiTrack system is installed and the virtual representation, a camera feed of the performers in the physical space, and the audio of the sound generated by the system were streamed over a network to a second location. There were audience members physically present in both locations.

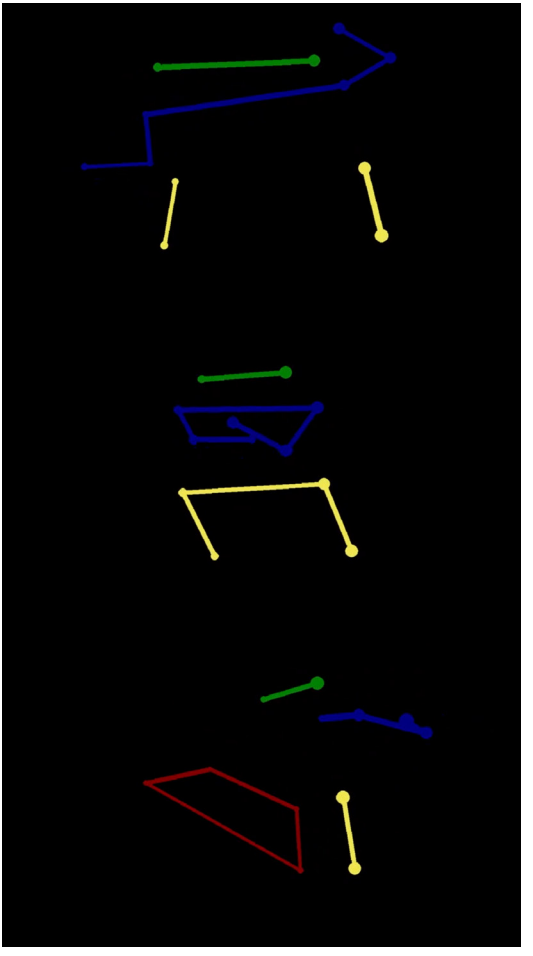


Figure 2: Three stills of the visualization display from a performance of Reconfigurations. Each dancer was wearing markers along one side of their body divided across the lateral plane, resembling the positioning of markers required for full-body kinematic modeling on one half of the body. Initially, this was used to create a combined body for the dancer, with the dancers coordinating their motions to move the shared representations. As the performance progressed, parts of the representation started to split off into more abstract shapes. Markers were eventually removed from the body and placed upon inanimate objects (2023), © Hugh Alexander von Arnim

The Shapeshifter

Aiming to build on the work done for *Reconfigurations*, in the summer of 2022 we began work on a follow-up project: *The Shapeshifter*. Our first goal was to create a system that presented a full 3D rendering of the virtual capture volume instead of the pseudo-3D rendering used for *Reconfigurations*. This would also allow us to have greater control over parameters such as camera placement and the projection of the data representing three-dimensional coordinates onto a two-dimensional screen. To this end, along with the Python components that we developed for *Reconfigurations*, we integrated an additional system component built in the Max/MSP/Jitter programming environment, as this enables a simplified rendering process based upon the Open Graphics Library (OpenGL). Moreover, as the programming language is primarily used for music and sound applications, we could easily integrate the mocap data with audio processing to expand the sonic components of the work (von Arnim, "The Shapeshifter").

With this follow-up project, we aimed to answer several questions that arose over the course of our work on *Reconfigurations*. Although we had moved away from using a pre-defined kinematic model of the skeleton, our work on *Reconfigurations* was still influenced by the visual grammar of the modeling process. Markers were represented by spheres and were connected by lines representing "bones". But what if we moved away from this component of that visual grammar? We would still work within a virtual recreation of the capture volume, but what if we displayed the markers and connections in a variety of manners? How would these influence where the dancer positioned the markers, and the bodies that they attempted to configure? It was at this point that the third author, who is a practicing dancer and physical theater performer, joined the process to collaborate on the work and create continuity through the development process.

The Shapeshifter is an improvisatory dance work for a single dancer. Prior to the performance, the dancer positions up to thirty markers[7] wherever they please, either on the body, attached to other objects, or placed within the environment. During the performance, they are also free to reposition these whenever and wherever they wish. A performance consists of nine phases, during each of which the danc-

er improvises a motion pattern and accompanying vocalizations. To trigger the end of a phase, each of the markers must be located within a corresponding space in the physical performance area. Each phase presents a different visualization style both for the virtual representation of the marker and any connections drawn between markers. At the end of the nine phases, the cycle begins again. During the second cycle of the phases, the performer's vocalizations for each phase from the previous cycle are looped within the corresponding phase in the current cycle. Starting in the third cycle of the motion phases, the representations of the markers and connections begin to shift, interpolating between the representations of all nine phases. The interpolation is based upon several factors, relating to the similarity of the performer's motion and vocalizations to the motion patterns and vocalizations performed in the previous cycles, with both the similarity measures influencing the amount and direction of the interpolation. The looped vocalizations begin to twist and distort away from the original recordings. As the number of cycles increases, it becomes difficult for the dancer to purposefully control the representations, building to a climax in the seventh and final cycle of the nine motion patterns.

A performance takes place with a similar setup to *Reconfigurations*, with the performer facing a video wall that mirrors the physical capture volume with a virtual capture volume. The audience is also positioned within the performance space. We took a similar approach to marker occlusions as we did in *Reconfigurations*, building these "errors" into the functionality of the system so that having the performer move around the audience becomes a part of the performance. Aiming to envelop the audience within the performance space, as well as provide audible "traces" of the performer's motion through the space, the looped vocalizations are played back over a spatial audio system in two manners. The first is an underlying sound bed that slowly envelops the performance area over the course of the performance. The second positions each vocalization at the point of the centroid of all markers at the time that the vocalization was recorded. Both have different processing applied and develop in different manners as the performance progresses.

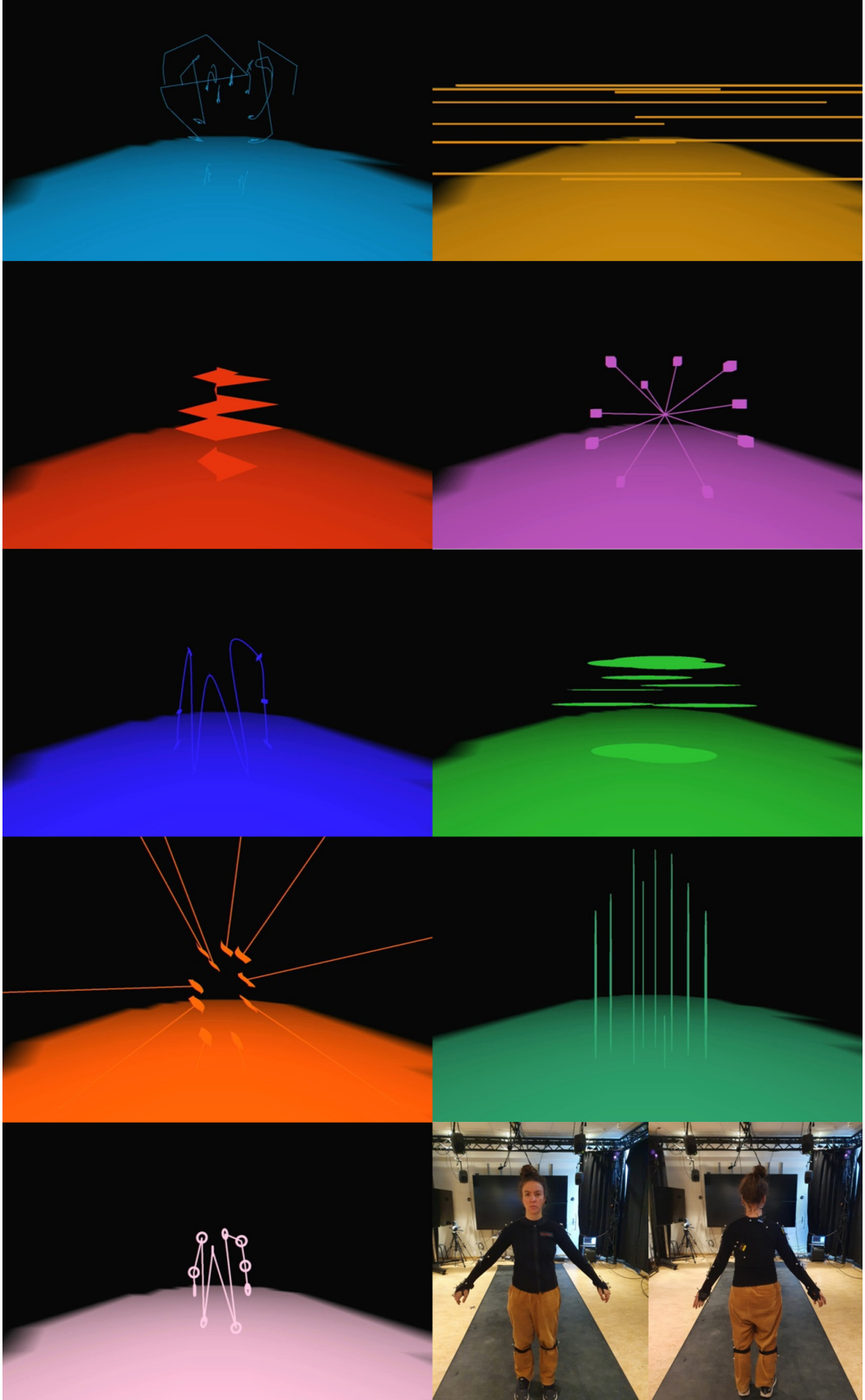
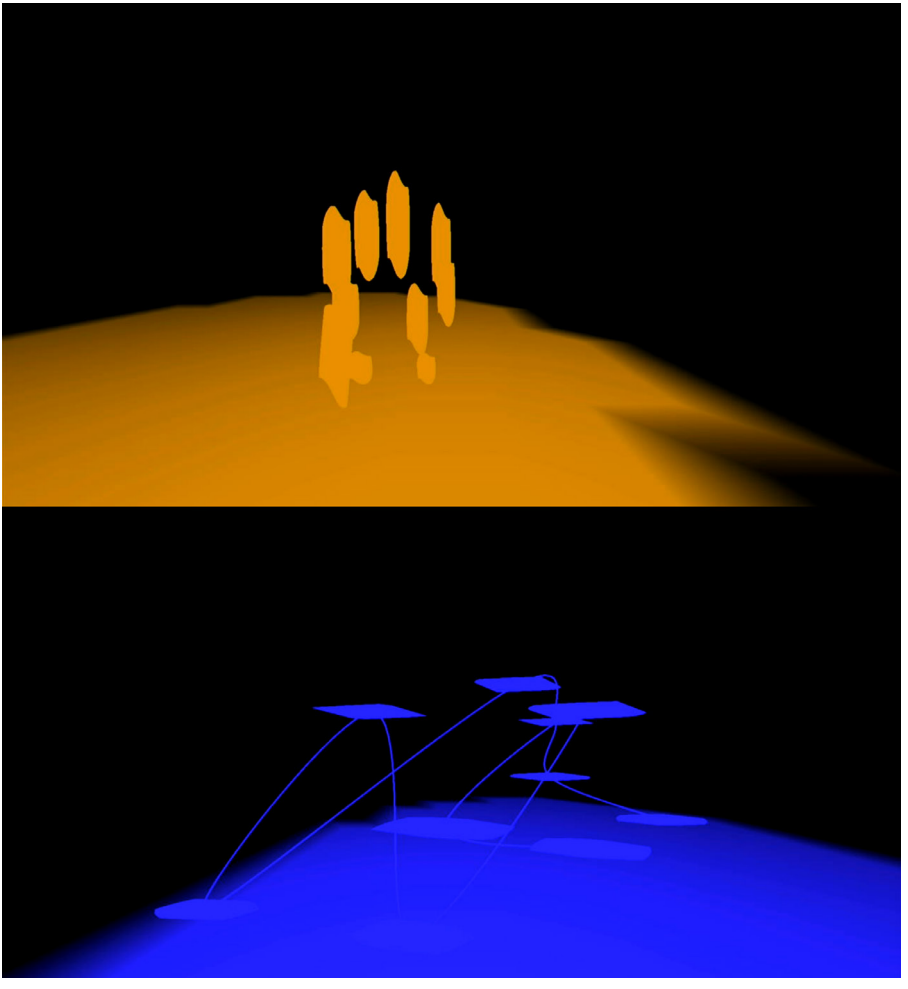


Figure 3: The initial visualizations of each of the nine motion phases for The Shapeshifter. These comprise a distinct style for representing each marker, sometimes including connections to other markers or points in space. These connections are not just calculated spatially, for instance the first phase creates a spline that passes through the positions where the marker was located across the previous few seconds of the performance. The final image shows the third author with the locations of the markers, all of which were positioned on her body (2023), © Hugh Alexander von Arnim

Figure 4: Two examples of the representations shifting to interpolate between the initial visualization styles. This is based upon a combination of the motion patterns and vocalizations performed by the dancer over the course of the performance. The amount of interpolation is also reactive to the performer's voice in real-time, providing an effect of a constantly shifting form (2023), © Hugh Alexander von Arnim



Marker Referentiality and Co-Construction of the Body

These two performances illustrate an attempt to move beyond the technology's origins as intended for biomechanical analysis with respect to the ways of working encouraged by the system and the methods through which a visual representation of the body is constructed from motion data, especially in view of the focus that is placed upon the modeling process by most producers of the technology. And although suitable for many applications, kinematic modeling as the primary method through which to construct the body results in a representation for which the form is already to an extent determined. There is a strain of thought that is repeatedly found in the discourse around mocap centered upon kinematic modeling for the performing arts that elides the motion of the dancer with the motion of the animated figure. Such discourse is present, for example, in the artists' statement for *Ghostcatching*, where Jones, Kaiser and Eshkar write that "the body of Jones is multiplied into many dancers" (1), or in comments made by ABBA's *Voyage* show producer, Ludvig Andersson, that "it is not a version of, or a copy of, or four people pretending to be ABBA. It is actually them" (ABBA Voyage).

Statements such as these point towards a situation where the collection of markers with which the dancer is outfitted are viewed as *invisible mediators* between the dancer's motion and the virtual representation. They move towards standing in for the body parts to which they are attached, referring the data that they collect not to their own motion but to the body of the dancer.

To underline this point, we can draw an analogy to another technology used in artistic performance: the microphone and loudspeaker. In her history of these technologies as musical instruments, Cathy van Eck outlines several approaches towards their usage. Building upon work on mediation technologies by Jonathan Sterne (*The Audible Past*), van Eck outlines that the thought underlying two of her approaches, reproducing and supporting, is that in their idealized form the technologies underlying the reproduction or support of sound are transparent. She details the train of thought underlying this concept, writing that.

> When I speak about this transparency in the reproducing and supporting approach, I must underline that I am not referring to technical possibilities, but about how the technology is perceived or even the cultural consensus of how it should be perceived, which means, in this case, that the technology should not be perceived at all. The music should sound as if produced by a human body interacting with a musical instrument, not with technology. … hearing a singer amplified through microphones, amplifier and loudspeaker rarely results in the audience perceiving a musical instrument consisting of singer, microphone, amplifier and loudspeaker. The main perception will remain that of somebody singing, whatever other technology is added to the voice. … The sound produced is affected by a combination of all of these [technological] elements, but the semantic acts of sound creation are associated with only the singer. (41–42)

Framed in these terms, we can view the mocap system as a sensing system which aims to either reproduce (in the case that the capture takes place prior to performance) or support (in the case of a real-time interactive system) the semantic acts of motion that are associated with the dancer. The markers and camera system, following the same logic, should remain transparent, leaving as little mark on the production as possible.

As noted by Naccarato and MacCallum, treating a sensing technology as transparent can lead to troubling implications. Framed through a discussion of the appropriation of medical sensing technologies for artistic purposes, they enter into dialogue with Sterne's discussion of the stethoscope and his claim that during mediated sensing the sensor apparatus must be "erased from consciousness" ("Mediate Auscultation" 123) and that as a consequence "the tool stands in for a whole process from which it erases itself" ("Mediate Auscultation" 123). They argue that the concept of mediated sensing implies in turn that an un-mediated sensing must also exist and that this overlooks the fact that all sensing, even unaided by technological apparatus, is to some extent mediated. The sensor cannot be removed from the causal chain of perception and viewing it as such can lead to the masking of ethical and aesthetic values which are imbued into the design of software and hardware.

Moreover, they frame their argument in terms of using sensors as control devices for interactive systems and argue that sensors employed in this manner imply a rigid causality and representation between the body being sensed and its form in the resulting media. This requires an "empirical conception" (6) of what the body part being sensed is and what it can do, with the authors writing that

> In control based interaction, be it with biosensors or motion tracking, comparable assumptions regarding what bodies (or body parts, or bodily processes, or bodily gestures) are, and therefore can do, form the ethical basis from which aesthetic mappings are designed. (6)

Naccarato and MacCallum's discussion of the propagation of ethical and aesthetic values points towards a broader discussion of what a human body is, and how discourse forms around what it can do and be. Here, a pertinent concept is the normate. In her book *Extraordinary Bodies*, Rosemarie Garland-Thomson examines social and cultural representations of bodies marked as disabled, contending that disability is attributed through socially layered exclusionary discourse, "not so much a property of bodies as a product of cultural rules about what bodies should be or do" (6). To aid her analysis, Garland-Thomson defines the figure of the normate, "the figure outlined by the array of deviant others whose marked bodies shore up the normate's boundaries … a very narrowly defined profile that describes only a minority of actual people" (8). Joel Michael Reynolds further explicates the normate in terms of ability, describing the figure as "the tain of the mirror of ableism … the invisible mechanism that allows slippage from being to being-able" (244). He also notes that the specter of the normate haunts not only those designated abnormal but also for instance a "job candidate … picked over another because they are perceived to be more attractive, conflating cultural ideals of beauty with labor-related abilities" (244). Reynolds folds these social forces back into the proprioceptive and kinaesthetic sense of the body, describing how "the normate, ever furnishing normative measures, reigns over the scale, scope, and content of ability expectations, it shapes everyone's experience of embodiment" (255).

Returning to the kinematic model, we can then begin to see the mechanisms that are already in place to begin imbuing the model

of the dancer with ethical and aesthetic values long before the point of its use to drive the motion of an animation. To design a kinematic model, two difficult questions must be answered: what form does a human body take and what does and does not count as human motion? These two questions intersect with two requirements that are aimed for in the development of the models, namely that they are generalizable, that is that they can be used by more than one person, and that they represent a simplified model of human kinematics.

For kinematic modeling to function correctly, markers must be positioned on the body in accordance with predetermined locations so that the rigid bodies required for the model are correctly defined. In light of the drive towards generalizability, designers tend towards pre-defining the location of the markers which form the rigid bodies in advance, and in effect must determine the form of the bodies whose kinematic chain can be modeled with their system. In many cases, if the entire marker set that is required for the model is not present or individual markers are not positioned with the correct spatial relationship to one another (within a margin of error), the modeling process will not function correctly, or in some cases, is incapable of functioning at all.[8] As a result, the system is rendered unusable by those, for example, who do not possess a body part that is required by the model.

The requirement to create a simplified model of the kinematic chain of the human body is likewise shaped by the figure of the normate. To take one example, the spine is often modeled as two to four rigid bodies connected by joints with either one or two degrees of rotational freedom. These rigid bodies are often modeled as forming a direct line between the pelvis and the skull. Such a model does not account for differences in spinal shape, such as found, for example, in people with scoliosis (Schmid et al.). Although models have been developed that can reproduce the spine in more detail,[9] these more complex models require more complex marker sets to function and have not found widespread use in live dance involving mocap. The larger number of markers required increases the visibility of the mocap system (as well as increasing the points at which occlusions and noise can occur), which negatively intersects with the drive towards transparency from the mocap system. Moreover, even though such models provide a closer approximation of the kinematics of the human body, they are nonetheless approximations.

As a cumulative effect of these factors, assumptions start to form about the types of bodies for which kinematic modeling is intended. This is namely a body that possesses all of the body parts required by the model, can reach poses and perform motion patterns that are recognizable to the model, and have a body whose nuances of form and motion can be represented through the simplifications required. This is not to say that bodies that do not meet these requirements cannot be modeled, but that the range of models widely available in commercial mocap systems must be modified and adapted, or a new model must be created from scratch. This is not a simple process, often hidden behind a barrier of knowledge of kinematics, mathematical representation, and computer programming. This also applies to those who possess a body that does fit the mold for the generalized models if they wish to adapt a model to create a representation that they think better fits their own conception of themselves, for example by concealing a part of their body.

Over the course of the development of *Reconfigurations* and *The Shapeshifter*, we began to work towards an alternative conceptual approach towards representing the body in dance work involving marker-based mocap. We conceptualize this approach as an alternative to kinematic modeling when representing the human body with creative application of marker-based mocap. We view this approach as an attempt to shift the emergence of a visual representation that refers to the physical body of the performer away from a concrete, bounded, and normatively-inclined process embedded within the mocap system's software10 and towards a process wherein that emergence occurs during the development and performance of an artistic work. Instead of fitting the motion data to a model of the body, we allow the motion data to play a role in shaping the body that emerges.

Motion Pointillism

We can start by returning to consider what we are capturing when working with a marker-based system, namely dimensionless points in space. Within capturing software, these are commonly represented with small, unconnected spheres of identical color. On captures of people wearing full-body marker sets that are required for kinematic modeling, it is possible to recognize a human form from these rep-

resentations before any modeling has taken place. This recognition can even take place at quite a personal level. For example, Jeannie Steele, one of the dancers who performed the mocap for *BIPED*, reported that she was able to discern herself from the collection of motion patterns that were recorded for the piece when observing the raw data before any modeling had occurred (Abouaf, "'Biped': A Dance with Virtual and Company Dancers" 2). However, although a human form can be recognizable, if markers are removed from the representation one by one, slowly the form that was visible dissolves. The work done in shaping the motion capture data into a representation of the human form is being performed in part by the viewer.

This thought stands at the center of our approach. Instead of conceptualizing points as referring to the motion captured from a human body to which we can apply a pre-defined model to drive an animation, with all the assumptions that brings, we instead envision these points as referring to the point within the physical capture volume at which they are positioned. We then view the development of their referentiality as part of the performance, taking place within the perception of those performing and viewing the work, leveraging the ambiguity and tension inherent in the implication that the marker *is* referring to an object within the physical capture volume but the uncertainty of what exactly this is. It is up to the viewer to "join the dots" so to speak. We liken this to the pointillist movement in the visual arts, in which painters worked with points of individual colors and allowed these to blend in the perception of the viewer. Here it is points in space that refer only to the motion of a marker, that blend to construct a form in the viewer's perception. Crucially, we see this as a collaborative approach, involving the performer, the audience, the system designer, as well as the mocap system itself.

This idea of playing with the referentiality of the visual representation of the markers can be linked to work done by researchers across several domains. Rebecca Solnit posits paths of walking as traces of motion in which abstraction "dematerializes" bodies and motion (29). Laura Karreman approaches a similar idea with the "motion capture imaginary" (245), an investigation of the discourse on the transmission of dance knowledge mediated through technologies which "take the performer's body as their main point of reference" (8) and yet which "present the absence of the dancing body" (253).

We intend our approach, however, to function on a practical level, and have therefore formulated *motion pointillism* as five guidelines that can be applied to future artistic work employing a mocap system:

1. **The mocap system should be acknowledged and the data it provides taken literally**

Everyone involved in a performance should be aware of the fact that any individual visual representation of a marker refers to a specific point in space. For example, the visualization of a marker placed upon a performer's hand refers to the motion of the marker and should not be considered to refer to the hand itself directly, neither by system designers, performers, nor audiences. To encourage and emphasize this, the mocap system should be as opaque as possible. This means that no attempts should be made to conceal aspects of the mocap system, neither markers nor cameras. This is connected to:

2. **The mocap system cannot provide errors**

Marker occlusions, confusions, and noise are major reasons for either abandoning working with the system or using a method such as kinematic modeling which provides a way of counteracting these phenomena. We see these as an opportunity for the mocap system itself to contribute towards the construction of forms. These can be purposefully worked into performance. For example, a performer can cover a marker to either remove it from the system or hold it in a fixed position.

3. **The performance should only work with points, but how those points are presented is open**

An interactive performance system built on top of the mocap system should only be provided with the coordinates of each marker to work with. However, how each coordinate is presented within the virtual mirror of the physical space is at the discretion of those who create the performance. They can be connected to each other or to a separate point in the capture space, have translational transforms applied to them, and be represented by any object or series of objects. What is important is that any work done with the motion data does not assume that this motion originates from or refers to any specific source within the physical capture volume apart from the markers themselves.

4. Markers can be placed anywhere at any time

Markers do not have a set location that must be maintained throughout the performance. The performer can attach them to their body, hold them in their hand, place them on objects, or drop them on the ground. The performer is encouraged to change the locations of markers throughout the entirety of the performance. The body is in focus, but it is not a boundary.

5. The performer must be able to see the forms

In many multimedia works involving mocap in real-time, the visual representation created from the motion data is projected behind the performer onstage. As we view the creation of the form as part of the work itself, and this as a collaborative process that takes place in the perception of all present, it is vital that the performer is also able to take part in this process and view the configurations that extend from their participation.

Conclusion

With *Reconfigurations* and *The Shapeshifter* we aim to raise critical questions that relate to the appropriation of technology developed for non-artistic purposes as an artistic method. These two works present an attempt to design a built-in way of reshaping, or remolding these systems to explore and demonstrate the boundaries created by their intended use and as a matter of artistic material we hope that these works help to spotlight the constraints by playing with the system's limits. Specifically, with these works we intend to highlight the complex interplay between the referentiality of the motion of markers, their visual representation, and the human body when employing marker-based mocap for artistic purposes. To this end, the work that we present here aligns with broader research on the phenomenological nature of the body, as well as mocap as a "legitimate source of knowledge" about the body (Karreman 99). With the formalization of our theoretical contribution of the five guidelines of *motion pointillism*, we hope to provide a framework that can be employed by other researchers and artists who work within this space.

We have framed this article from our perspective as system designers and performers, extending *motion pointillism* from an examination of the functionality of optical, marker-based mocap systems and our attempts to work around the assumptions, values, and limitations embedded within the technology. However, the work that we present in this article is situated within a wider discourse, in which visual representations referring to the body in performance, and the systems employed for deriving these representations, both shape and are shaped by wider societal views on what constitutes a body. Moving forward, we intend to turn our perspective to this wider discourse and examine how the material and perceptual representations of the human body that arise through our work relate to emerging theoretical bodies.

Finally, it is also important to note that we are presenting *motion pointillism* as one of a range of possible approaches towards modeling the body within creative applications of marker-based mocap. We do not mean to imply that modeling the skeleton as a kinematic chain cannot result in fruitful results or exemplary works of art. However, it is by far the most common approach to working with mocap, and the approach towards which most mocap software is nowadays oriented. Through the requirement that markers explicitly refer to the body to which they are attached, it is also an approach heavy-laden with assumptions about the bodies that can use the technology, consequently also contributing to the construction of those bodies that it claims to transparently represent.

Open-Source Contributions

Both *Reconfigurations* and *The Shapeshifter* can be accessed and used as open-source code repositories (von Arnim, "The Shapeshifter"; von Arnim, "Reconfigurations"). We welcome anyone interested in working with motion capture and dance to engage with the works and use them in their own artistic and research practice.

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Notes

1 As noted by Plaete et al., a number of younger stand-ins also provided additional motion capture for the animations.

2 Nymoen makes the distinction between motion capture and motion tracking, noting that the latter refers solely to the sensing and processing of motion without the storage of the data. However, he notes that these terms are often used interchangeably. For the sake of simplicity, in this article we will use the term motion capture (mocap) to refer both to the real-time tracking and processing of motion data as well as its storage and any processing that does not take place in real-time.

3 Key here is that this is a global coordinate system, which tracks the position of the marker in relation to a defined origin. The alternative is a local coordinate system, which tracks position against another position within the global coordinate system, usually another point in a kinematic chain. If two chains do not share a global coordinate system, there is no way of knowing their position relative to another, and this is a disadvantage of many other techniques used for

motion capture such as the use of Inertial Measurement Units (a combination of an accelerometer, gyroscope, and magnetometer).

4 To briefly summarize Müller, the kinematic chain used to model the human body is *open*, meaning that the chain does not loop back and connect with itself. This allows the organization of multiple rigid bodies into a hierarchical tree, connected by joints with determined degrees of freedom, therefore enabling the parametrization of the model. These parameters are divided between skeletal parameters (relating to the chain's topology and length of the bones) and free parameters (relating to the position and orientation of the chain and the relative orientation of individual bones). Importantly, as the chain is organized hierarchically, the position and orientation of child rigid bodies can be defined in a local coordinate system relative to their parent, all the way back up to the root of the chain. Therefore, through the observation and manipulation of free parameters of a single rigid body, the motion of rigid bodies either further down or further up the chain can be calculated through *forward* and *inverse kinematics* respectively. Müller provides a mathematical description of a simple kinematic model, with joints modeled as possessing reduced degrees of freedom. He notes that more complex models exist to account for joints with a greater number of degrees of freedom, as well as phenomena such as skin deformation and muscle force. Müller frames these more complex models in relation to providing "enhanced realism in computer animation" (198).

5 Abouaf reports that the captures took place with two dancers ("'Biped': A Dance with Virtual and Company Dancers. 2"), whereas Dixon reports three.

6 To be able to preserve marker identity across gaps, we used the position of a pre-defined rigid body consisting of three markers in a fixed position as a stand in for a marker. These are pre-produced by *OptiTrack*, only a little larger than a single marker, and likewise have adhesive tape affixed to their rear.

7 Here, as we did for *Reconfigurations*, we again employed the 30 pre-defined rigid bodies to stand in for the markers.

8 This is the case, for example, in the modeling function of the *Motive* software, which is used for both animation and biomechanical research (OptiTrack).

9 For example, the IfB-marker set developed at ETH Zürich makes use of a large number of markers positioned on the back in the location of individual vertebrae (Zemp et al.) and can be used to model the spine of a person with scoliosis.

10 A pertinent question to raise here is *why* the bodies modeled by mocap software take the normatively inclined form that they do, or more precisely, why mocap software designers narrowly limit the range of bodies for which they implement a kinematic model. It is possible here to begin to draw links to various values placed upon certain body types, such as the commercial value placed upon non-normative bodies within a capitalist ecosystem, as well as the broader social and cultural implications of these value judgments, however a full examination of this is beyond the scope of this article.

Breaking Acts of Dance: Capturing, Tracing, and Figuring

–– Laura Karreman (UTRECHT UNIVERSITY)
ORCID: 0009-0002-5214-9213

–– Nanna Verhoeff (UTRECHT UNIVERSITY)
ORCID: 0000-0003-1293-4794

This text is inspired by several encounters. Firstly, our encounter with an artwork that combines dance, digital code, and projection. Secondly, our scholarly encounter with each other as scholars of performance studies and screen studies in thinking with this work about the meeting of dance and new technologies. From such combined and layered encounters—between dance and projection, between public art and scholarly reflection, and between complementary theoretical perspectives—in the following, we propose a set of conceptual contours to think about dance, technology, and also the street, as the site of encounter. These we develop through our combined perspectives on dance, performance, and motion capture (Laura) and on urban screens, media architecture, and projection art (Nanna), and our shared interest in developing theoretical concepts and methodological tools for thinking with art. Specifically, we are interested in how art works invite us to analyze the ways in which they respond to the world around us—how they reflect (on) perspectives on this world and propose specific ideas about the world through

their specific engagement with it. From our collaborative thinking with dance and technology about dance and technology, we take up the work's invitation to conceptualize its reflexive potential— in both senses of the word: as medium and as method. Thinking about the specificity of its working with the concepts of capturing, tracing and figuring, and of its site-specificity with hodos, meaning both "street" and "way" (Verhoeff, Urban Screens 2024), we ask how the work artistically and theoretically (and thereby also critically) speaks about the impact of new technologies on contemporary culture and society. And more specifically, how does it do so, precisely, on the level of the street?

Keywords: breakdance, urban projection art, dance capture, tracing, figuring

In March 2023, Laura was the first of us to encounter the work of Australian urban media designer Wendy Yu in Melbourne during the opening of the new dance festival FRAME. Presented by the Centre for Projection Art, the event Body-Cites: Conversation Series #2 took place at the Brunswick Mechanical Institute. For its inauguration as a new dance festival, FRAME hosted a conversation between artists Wendy Yu and Megan Beckwith, who both experiment with digital animations of dance performance in their work, chaired by Carol Brown—choreographer and Head of Dance at the Victoria College of the Arts.

During this event, one iteration of Yu's projection art series *Acts of Holding Dance* was projected onto the screen at the back of the space (fig. 1). The work is visually spectacular. It shows six vertical columns with a breakdancer dancing at the top of each column. As the dancer (Joe Newton Keough) goes through his moves—each column features different sets of the same dancer—an animated graphic trace feeds downward from the places where he makes contact with the ground, producing a continuous sequence of anamorphic swirls. The six projected dance figures unfold in ever-changing shapes. In

other works that belong to this series, Yu has worked with different dancers, and different numbers of dancers. She has also worked with single and multiple columns, and worked both with black-and-white projections and projections with color. The projections belonging to the *Acts of Holding Dance* series have been projected in public urban spaces on the walls of tall buildings (fig. 2), but have also been presented in indoor exhibition spaces. Throughout our text, we will refer to different works within this series.

In the curated conversation at the Brunswick Mechanical Institute as well as in a later interview with Laura, Yu traced the background of her creative act of making the work. After graduating as a dancer and choreographer with a Bachelor of Fine Arts at the University of Melbourne, Yu became more aware of her interest in immersive and new media art. She did a residency to investigate this, starting with connecting dancers via interactive touch interfaces which produced sounds. During an internship in Berlin, she joined creative coding communities and meetups, which helped her acquire programming skills. She then made the move to connect her programming to projection work, holding dance as her major focus and inspiration. Yu's growing interest in urban media spaces and projection led to a residency at the Centre of Projection Art in Melbourne, during which she was challenged to design a work for a long vertical shaft attached to the façade of a building. This particular projection site in Melbourne invited her to design movement graphics for a dance work that emphasized this vertical orientation. Her choice to work with breakdancers was also meaningfully inspired by her graduate research into how local communities of dance can be literally and figuratively—in multiple senses of that word, as we will argue below—elevated through projection design.

Yu's thesis for her MA of Interaction Design and Electronic Arts at the University of Sydney explored how breakdance communities could be represented through public projection art. Based on interviews and fieldwork she conducted in breakdance communities in Sydney, Yu concluded that a prototype made with 3D motion capture created a dilemma. On the one hand dancers within the community could still recognize which avatar belonged to which dancer because of their signature ways of entering the floor through dropping and posing. On the other hand, such motion-capture-based avatars could not do justice to the importance of individual style in breakdance. Curat-

Figure 1: From left to right: Wendy Yu, Carol Brown, and Megan Beckwith at FRAME biennial dance festival. Projection: *Acts of Holding Dance* with Joe Newton Keough. Brunswick Mechanical Institute, 2023. (c) Laura Karreman.

ing your physical appearance with, for example, battle gear—what b-dancers wear to breakdance competitions—is a significant part of a dancer's identity and part of breakdance culture, which is lost in the stripped but figural representation of motion capture.

This loss is one of many losses that are an inspiring and generative force in Yu's creative work. The title of Yu's projection art series, *Acts of Holding Dance*, refers to Anna McDonald's PhD thesis *Acts of Holding: Dance, Time and Loss* (2019). In her research, McDonald connects the ephemerality of dance to a sense of mourning. McDonald's work is a recent contribution to a central academic debate in dance and performance studies that reflects on the relationship between performance and time. In this debate, different positions are taken on with regard to ways in which dance can be captured and transmitted or, conversely, must be understood as necessarily resisting any form of documentation. In the field of dance studies, the standpoint that is represented by McDonald can also be recognized in previous observations by well-known dance and performance scholars such as: "Dancing exists at a perpetual vanishing point" (Siegel), and "Performance's being…becomes itself through disappearance" (Phelan). Such views have been identified by performance scholar and dance dramaturg André Lepecki as being part of the "choreographic-melancholic project of modernity"(130), since they stress a "*melancholic affect* in relationship to the dance-event" (128; emphasis in original), rendering "the dancer always already an absent presence in the field of the gaze, somewhere between body and ghost, a flash suspended between past and future" (125). In opposition to this dance ontology, Lepecki proposes ways in which dance could move away from this "melancholic entrapment at the vanishing point" (131), by drawing attention to different understandings of temporality and proposing alternative affects.

As an aim for her residency at the Centre for Projection Art, Yu thought about how she could convey the sensation of loss resulting from the improvisational nature of breaking through visual and material output. For example, for the work that was projected at the event at Brunswick Mechanical Institute, Yu worked with dancer Joe Newton Keogh, asking him to improvise along with the score prompt. Yu recalls: "I really wanted to capture a dance that he has been working on himself as an iterative performer, and a very compulsive dance creator. By capturing this, I produced a print of

the dance that has passed. These prints can then be displayed, but also acquired by collectors."[1]

Beside this fascination with time in the relation of improvisation, capture, and materialization that we recognize in Yu's work and words, she reflects on working with light and the temporal considerations; therein:

> Light and projection are always clashing. You need strong projectors in order to create a clear image, and low outside light to make it visible. It is best to project works with nautical twilight. Every time I document my work, I try to do it in nautical twilight. It is good to still have some color in the sky. When it is completely dark, the projection is visible, but it is less engaging. (Yu)

Nautical light refers to a deep dusk, when the sun is 12 degrees below the horizon and a dim bluish sky is still visible, as are stars and bright planets. This type of light is bound to planetary time. The timing of large projections on building façades thus fundamentally affects their effects (and affects) for urban spectators.

On one level, we can think with the work by considering how the temporality and materiality of dance in relation to urban projection art produces particular forms of spectatorship. On another level we can discern socio-economic empowering potentials for the artists involved. With her work of capturing and transmitting dance, via both printed objects and light-based spectacles, Yu has also converted her works to NFTs that she sells through her website. She has sold her work to festivals and presented her works in and on buildings. She has been commissioned by several cities to work with local breakdancer communities and produce artifacts of their dance to be projected in their local municipalities. In two commissions, these works were even significantly projected on the walls of Federal Reserve Bank buildings. "The fact that we were able to elevate local breakdancers and place them and their practice onto these federal buildings made them feel more recognized by the city," Yu stresses.

Breaking (in Sydney)

Wendy Yu's projects in the projection series Acts of Holding Dance are based on video portraits from several members of 143 Liverpool Street Familia (143 LSF). This Sydney hip hop dance crew has been active since 2005 and was "named after the address of the building in the Sydney CBD whose forecourt [is utilized] for practice" (Gunn and Scannell 54). Currently, Sydney 143 LSF (pronounced "one-four-three") is one of multiple dance crews in Greater Sydney, and part of a breaking scene that "is constituted of participants from a range of socio-economic and cultural backgrounds," many of them being "first or second-generation migrants with Asian heritage" (Gunn, Deterritorializing Gender 12-13).

Hip hop culture emerged in the South Bronx of New York City in the late 1970s, a creative collision of expression of African American, Afro-diasporic, and Latino youth cultures. Hiphopographer James G. Spady notes that this Hip Hop Cultural Revolution was spurred on by the Civil Rights, Black Power, and Black Arts movements in the 1960s, and "the anti-colonial struggle of the fifties, sixties and seventies" (Spady, Lean Back 489). Rap lyrics arose from African American orality and narration (Spady, Mapping and Re-Membering 127), and breakdance was informed by Afro-Brazilian capoeira, which combines martial arts, acrobatics, dance, music, and game elements. Dance scholar Thomas DeFrantz describes the early form of breakdancing as follows:

> Breakdancing began as a form of fighting, a mixture of physically demanding movements which exploited the daredevil prowess of their performers, and stylized punching and kicking movements directed at an opponent. A descendant of Capoeira, the Brazilian form of martial arts disguised as dance, breaking developed as the original movement aspect of rap music when breakdancers filled the musical breaks between records mixed by disc-jockeys. (DeFrantz 74-75)

Sydney was the first city in Australia in which hip hop culture gained a significant following in the early 1980s. According to Ian Maxwell, whose book Phat Beats, Dope Rhymes: Hip

Hop Down Under Comin' Upper (1997) is an investigation of Sydney's hip hop scene in the early 1990s, the "standard narrative" of the encounter of African American hip hop with young Australians identified US-based, music manager and fashion designer Malcolm McLaren's music video Buffalo Gals (1983) as a crucial event. Maxwell relates that "for audiences in Sydney, what apparently most stood out about this clip was not the music, but, at least in the first instance, the break-dancing, and then the graffiti art that formed the background against which the dancing was shot" (Maxwell 51). The clip thus effectively introduced an Australian audience to all three practices at once that initially constituted hip hop culture: "breaking, rapping, and writing" (Maxwell 51), where the latter—writing—refers to graffiti. The recently introduced technology of VHS video recorders enabled recordings of the clip to be made, so that it could be watched and rewound, enabling viewers to study and learn the breakdancing moves featured in the clip.

Inspired by these and other hip-hop based media arts outputs (Mitchell 124), which were mainly coming from New York and East Coast US at this time, several breakdancing crews began to emerge in Sydney over the course of the 1980s and engage in so-called battles: "breakers going head-to-head in contests, the winner being whoever could produce the most astonishing move" (Maxwell 231). Their members were predominantly male and represented heterogeneous cultural and socio-economic backgrounds. Even though some narrators have identified the Western suburbs of Sydney as the working-class origin of Sydney's hip hop scene, Symonds and others have noted that this distinction is not so clear-cut and that, from its beginnings, the scene included members from both working-class as well as middle-class backgrounds. By the end of the 1980s, Sydney had established its own position in the "Global Hip Hop Nation" (Meghelli). Recently, there has been increased scholarly attention for the appeal of American hip hop to Australia's first nations' youth, and the Aboriginal hip hop practices that have emerged from this (Stavrias; Mitchell; Dowsett), as well as for the participation of women (b-girls) in breakdancing crews (Gunn; Aprahamian).

Thinking (with) the Work

These multiple and layered encounters with and within the work of Yu are an important starting point for us to bring together several questions around dance and technology on the street level. Analyzing Yu's work, for us, implies that we take the facets and forms of encounter very seriously—as a situated and situating meeting with its spectators, as reflexive of its own specificity and workings, and as pointing towards the affordances of these aspects. In this sense, we take the work as more than itself, pointing in multiple directions. Moreover, we take it as our interlocutor in thinking about some fundamental questions about the intersection of creative-theoretical perspectives on materiality, technology, and spectatorship in both art and scholarship, and a critical perspective on the social and cultural meaning of both technology and art in (co-)shaping our world.

How to do this thinking with the work? In the following we propose a set of theoretical concepts that articulate ways of looking and thinking beyond the specificity of Wendy Yu's work. We want to emphasize that these concepts are temporary tools, activated and (re-)conceptualized in the encounter with objects and phenomena and providing, in philosopher Donna Haraway's words, responsive and *situated knowledges* (1988). This relational understanding of concepts enables objects to "speak back", as per cultural analyst Mieke Bal.[2] In line with Bal, who in turn, is invoking art historian Hubert Damish (Bois et al.), we consider the objects we think with—here specifically Wendy Yu's projection art and the breakdancing recordings she works with—as *theoretical objects*: as objects that speak to us in a theoretical key. That is, they raise questions for the theorist to reflect upon. Moreover, they address explicitly on their own status as such an object to think with. This implies that *Acts of Holding Dance* is not so much our analytical case or case study. Taking the work as a theoretical object involves an approach that does not think of the object to demonstrate what is the case, but rather, to think *with* the object and allow it to guide us in finding out and theorizing what is, *actually*, the case. The concepts articulated here are not intended as fixed parameters, but as generative nodes activated in the encounter with the work, and as proposals for thinking beyond the work and this text. With this text, then, we seek to also demonstrate this method of *concepting* with art.[3]

Capturing

The word capture has different meanings. It can refer to a gesture of seizing, taking hold, or arrest. This somewhat negative idea of capture implies an authoritative subject and may also involve a quality of aggression or overpowering. In a more positive sense, capture can be used to describe the attempt to represent, encapsulate, or express something in a life-like or accurate way. Furthermore, in an applied sense, capture is also often used in relation to the mediatization of live arts and performance practices, for example in so-called motion capture— the process in which movement of human or non-human actors is recorded and transposed into motion capture data that describes the three-dimensional trajectory of a moving body's movement in submillimeter detail.

The double meaning of capture provides insight into the way in which practices of dance capture have been problematized. Critics comment that through the selection and taking hold of specific elements of dance in such works many elements that are understood to be vital to the meaning and practice of dance—such as embodied expression, affect and intention—are downplayed or erased. Activated as a theoretical concept, the performative notion of capturing, allows us to think of this double-sidedness and somewhat paradoxical thrust of technology as both an affordance of, and resistance to, mediatization. Both allowing for transmission (i.e., projection), yet also fixating and breaking—here, figuratively—the continuity of liveness and the encapsulation that (break)dance, as both a participatory and spectatorial performative art, entails.

Yu's *Acts of Holding Dance* series is an example of the creative use of digital dance capture. As such, it demonstrates how digital technologies can be employed in dance practice, mediation, and research. Over the past two decades, the dance field has manifested itself as an experimental playground in which dance practitioners, designers, and dance researchers explore the opportunities of emergent digital technologies for the creation, transmission, documentation, and representation of dance. A key voice in this area, choreographer William Forsythe, has been an important instigator in the need to articulate and publish expert knowledge about dance practice through his projects *Improvisation Technologies* (1999), *Synchronous Objects for One Flat Thing, reproduced* (2009), and the digital scores

of *Motion Bank* (2010-2013). Forsythe has termed the results of the above-mentioned projects "choreographic objects", describing the choreographic object as "an alternative site for the understanding" of choreographic principles (92). His research in this area was instigated by the question: "What else, besides the body, could physical thinking look like?" (91).

Choreographic objects transpose choreographic ideas into a different mode that allows for a closer examination of choreographic ideas because of their abstraction of the ephemeral, bodily based event that the dance performance constitutes. Elsewhere, Laura has argued that the impetus to create such objects comes not only from creative exploration, but is also elicited by austerity measures in the arts and the accompanying pressures to reach new audiences and acquire adequate funding and recognition (Karreman 58). In this sense, the creation of choreographic objects can be understood as part of "strategies of self-visualization" that the dance field has deliberately created to appeal to the values of knowledge economies by demonstrating how dance thinks (Karreman 58). A central aim of this endeavor is to show how singular performance knowledge and experience in dance may be made explicit in order to show their relevance to other professional fields. In accordance with this, social anthropologist James Leach identified the way in which these choreographic objects "look for feedback" in other spheres as their defining characteristic (13). He defines choreographic objects as "prototype socio-technical essays", proposing that they are "prototypes of new relational forms: experiments in building new groups, new constituencies and new audiences" (3).

How do these ideas tie in with the work of Yu? Yu notes that she herself has also been inspired by Forsythe's initiatives in this area (Beckwith et al.). Indeed, the individual iterations of *Acts of Holding Dance* can very well be understood as choreographic objects in how they present breaking practices through a new representational and relational mode, employ digital capturing and animation technologies to do so, and create conditions to reach new audiences by presenting the work in public urban settings with a high visibility.

As with all choreographic objects, Yu's work prompts the question of what ideas and design choices were involved in the translation, or, more precisely, the transmediation process of a specific dance

practice into a new medium and representational mode—in this case: a series of urban media art, or projection art, presented in public spaces. Tools that Yu has used to create this work are digital technologies, which include digital video technologies, graphic design software and coding, and projection technologies. The combination of these technologies constitutes a specific *apparatus* of capture. Building on Michel Foucault's notion of "dispositif", Giorgio Agamben defines an apparatus as "literally anything that has in some way the capacity to capture, orient, determine, intercept, model, control, or secure the gestures, behaviors, opinions, or discourses of living beings" and points out that "[t]he apparatus always has a concrete strategic function and is always located in a power relation" (14).

This critical notion of an apparatus invites us to reflect on how exactly *Acts of Holding Dance* performs breakdance through its specific mode of capturing. The projection subverts the traditional breakdance setting in multiple ways. The work breaks open the cypher—the name for the circle created by a group of dancers to demarcate a stage for a performing dancer. By moving them from their circular stage to a vertical column, Yu's projections reveal individual dancers in a different way. In a concomitant gesture, the dancers are also lifted from street level and put on display high up on the walls of buildings in urban areas. These projections excel in conveying the virtuosity of dancers' individual performance style and technique, and in celebrating the colorful fashion of these dancers. However, in this capturing of breakdance, several key features of this dance practice necessarily remain hidden. Most importantly, this is the environment from which this dance form emerges, which consists of a community—which may be made up of several competing crews—music performance (rapping or emceeing, turntabling or deejaying), and the iterative dance creation that emerges from this particular dynamic. Then, on the one hand, Yu's work can be understood as a successful "prototype of a new relational form" (Leach 3) in how it has created new stages for breaking as an art form that has been able to reach new audiences. On the other hand, this form of capturing inevitably also runs the risk of abstracting a highly developed dance practice from its multi-faceted performance context. Viewed from this perspective, the looped sequences of dancers in the projections may also be understood as potentially going against the grain of hip hop culture's defining spirit of resistance and protest against being singled out, pinned down, or captured in any sort of way.

Tracing

Beside this paradox or ambivalence of capturing dance—Yu's projections are also hybrid images of dance in the sense that they simultaneously produce what we can call two visual modes. On the top of the projection, we can see the (photorealistic) video image of a breakdancer. Below, in a painterly flow, an abstract animation tumbles down, fed by the dancer's image above. The border dividing these two visual modes is blurred, and therefore difficult to determine precisely. However, it is clear that the viewer is invited to interpret the animation as a continuous trace of the dance, produced by the body's contact points with the floor. Since breaking, as a dance form, stands out precisely because of its highly dynamic relationship with the ground, the animation shape-shifts rapidly. Furthermore, since breakers specialize in certain moves and develop their own styles of doing these moves, these dance traces also differ significantly between dancers.

Using the terminology that semiotician Charles S. Peirce introduced in his taxonomy of signs, this trace can be understood as both an iconic sign, as well as an indexical sign. It is iconic, because it bears a certain resemblance to the referent: we can recognize the colors of the dancers' outfit in the swirl, as well as their body parts—even as they become distorted in the animation process. It also possesses qualities of an indexical sign because the trace has a dynamical and spatial connection with the referent it is drawing on, and the similarity with the object is limited, due to its abstraction. The combination of these two semiotic layers in this animation has a powerful effect. On the one hand, its iconicity strengthens our belief in the causal relationship between the dancers and the traces. It brings us in touch with the empirical reality of the image: the animation appears when the dancer touches the ground. The indexical quality of the animation adds another layer. It does not lose sight of the photorealistic referent that yielded these images: the abstract swirls of color and the disjointed limbs that are stretched out in vertical blazes, highlighting different qualities of the dance. The binding effect of the index between the past (as the point of origin of the trace) and the present—in the entangled situatedness of the trace in the here-and-now—is perhaps heightened by what appears to be the emergence of the trace before our very eyes.[4]

Figure 3: Wendy Yu's *Acts of Holding Dance: Rachael|Cypher* (2022). Still from *https://culturevault.com/assets/228. (c) Wendy Yu.*

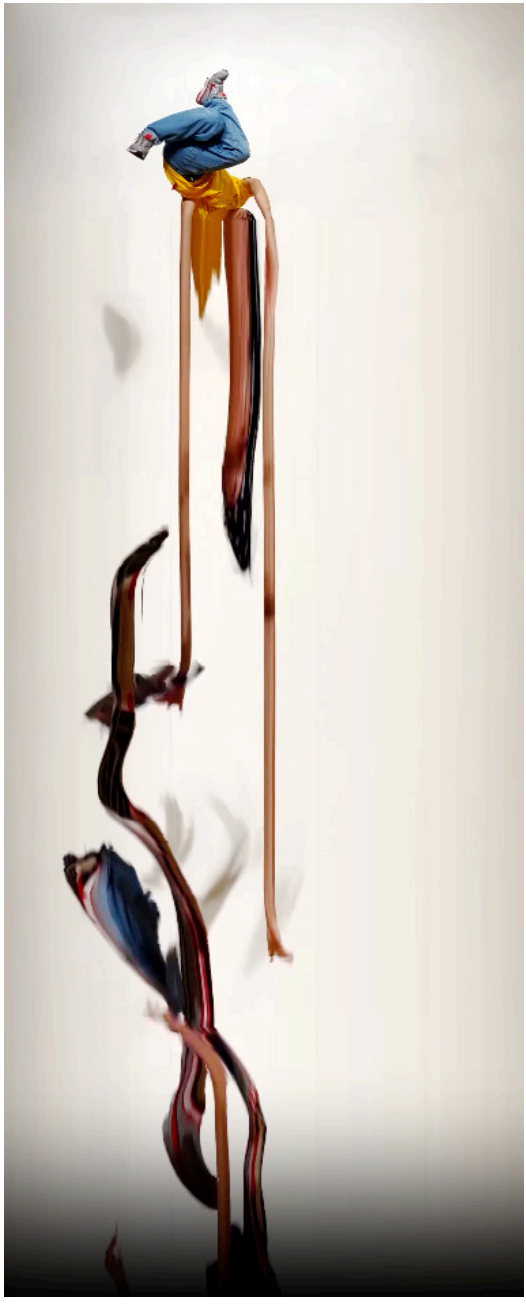

Fig. 4. Wendy Yu's *Acts of Holding Dance: Kohey|Footwork* (2022). Still from https://culturevault.com/assets/230. (c) Wendy Yu.

Figure 5: Kellom Tomlinson, *The Art of Dancing, explained by Reading and Figures* (London 1735), book I, Plate XIII, "The 1st movement of the Chaconne". Engraving by H. Fletcher. Image taken from Laurence Louppe, ed. 1994. *Traces of Dance: Drawings and Notations of Choreographers*. Paris: Editions Dis Voir.

Figure 6: Kellom Tomlinson, *The Art of Dancing, explained by Reading and Figures* (London 1735), book II, Plate XIV, "The regular order of the Minuet Continued". Engraving by H. Fletcher. Image taken from Laurence Louppe, ed. 1994. *Traces of Dance: Drawings and Notations of Choreographers*. Paris: Editions Dis Voir.

While these traces disappear fairly quickly as they flow downwards and out of the frame, these animations do manage to hold the dance a little longer. In *Rachael|Cypher* (fig. 3) the subsequent punctuated traces of her hands and feet touching the ground bring us in touch with the rhythm of Rachael's flare, and how she physically supports

this move. Similarly, in *Kohey|Footwork* (fig. 4), the black, stretched-out blaze that emerges from Kohey's cross-legged headstand freeze emphasizes the prolonged contact of Kohey's head with the ground.

These examples show how the animation in these works makes the dance more legible by adding a kinesthetic layer. Through visualizing the movement qualities, rhythm, and flow of the dance in these traces, the viewers acquire a more profound sensory perception of the movement. These animations can be understood as "phenomenal dance images", a notion by Nigel Stewart who used it to describe:

> [E]xpressive figures [that] elicit in me an aesthetic response, which re-enacts the aesthetic response to [dance] movement…whether I am reader, spectator, notator, or dancer, "I" (the subject) have to embody "It" (the object) by becoming kinaesthetically conscious of the object. (Stewart 49)

Following a similar phenomenological interpretation, mathematician and philosopher Brian Rotman's notion of "gesturo-haptic writing" (2008) also seems apt here, since the image invites us to conceive of the body as a writing instrument that leaves traces behind in a three-dimensional space, helping us to imagine the experiential perspective of the performer.

The underlying dramaturgical device that Yu employs in her projection works is not (all) new. Many projects that use motion capture and motion graphics to represent and animate dancing bodies employ a similar approach—such as the above-mentioned projects *Synchronous Objects* and *Motion Bank*. It has appeared to such an extent in digital scores and dance documentation that it can be discerned as a trope that can be described with the conceptual metaphor of the "dancing-drawing body" (Karreman 185-190). This imagery visualizes a dancing body as a drawing instrument that leaves traces behind when moving through space.

It is important to note that this metaphor predates digital dance capture and can be recognized from early on in the history of dance notation. Consider for instance the drawings in Kellom Tomlinson, *The Art of Dancing* (1735) (fig. 5 and 6).

In these pictures, Tomlinson includes different channels of information, including text, music notation, dance notation, and realistic illustrations of 18th century dancers. The symbolic dance notation depicted here is Beauchamp-Feuillet notation, developed at the end of the 17th century to record Baroque dances. This notation mostly focused on the trajectory of the dancers' feet on the floor, which left much unknown about the many other elements of the dance, including upper body movements, rhythm, and other movement qualities.

Even if Tomlinson's drawings may obscure part of the notation, they add a rich interpretative layer to the score by adding detailed drawings of the dancers' posture and styles. Like Yu's projections, these images, are also multiple in their semiotic dimension. As opposed to Yu, Tomlinson combines an iconic sign (the dancer as referent) mainly with a symbolic sign, namely dance notation. However, the path of the dance notation on the floor still provides an indexical trace, which we also recognize in Yu's projections. Furthermore, the particular aesthetic of the colorful swirls in Yu's work and the public locus of their projection also conjure associations with graffiti art—also referred to as writing or graph—as one of the main pillars of hip hop culture.[5] Just as tags in graffiti can be understood as a form of creative expression, and as signatures that represent singular artist identities, the graphic animations in the *Acts of Holding Dance* series can also be interpreted as identity-laden traces that give voice and presence to dance artists in the city. As two examples of graphic and lyrical forms of dance notation, thus both Yu's and Tomlinson's works engage the viewer through their kinesthetic appeal that is the result of their smart use of the dancing-drawing body metaphor.

Figuring

From this dancing-drawing body metaphor, the third concept that we want to propose is *figuring*.[6] With figuring we refer to the creative act of producing form for thought, and vice versa, thought for form. This progressive form of the verb—like capturing and tracing—emphasizes the performativity of the work. Whereas the concept of *figuration* often refers to a fixed result of figuring acts or practices, with figuring we want to emphasize the emergent form-process. Figuring as a progressive form underscores the creative act with which figures as thought-images are imagined, designed, and performed

as a form of *taking shape*. Moreover, the progressive form gestures towards its emergent as well as its presencing process. Also, figuring acts do not necessarily take part in setting up a traditional opposition between the *figurative* versus the *abstract*, as two distinct categories of representation. Moreover—and related to this point—discarding such a binary makes the concept move away from the opposition of figurative and abstraction as based on verisimilitude and representational realism. Thereby we also take leave of the anthropomorphic standard of the figure or figuration as having a human-like shape. Similarly, the proposed understanding of figuring is not steeped in the logic of binary opposition between the *literal* and the *figurative*. This one comes from linguistics—specifically rhetoric—where it is used to distinguish metaphoric from non-metaphoric, or literal usages of words. Finally, figuring does not necessarily and foremost produce figures in the sense of characters, referring to the human, humanoid, or anthropomorphic actant in fiction.

The understanding of figuring in relation to Yu's work with dance, code, and projection—and, perhaps more generally, in relation to time-based arts—comes closer to, although does not fully coincide with, Gilles Deleuze's "time-image" and Jean-François Lyotard's notion of "the figural". Kinship with Deleuze's time-image can be found in the notion of the figure as already encapsulating the question of what the form harbors in conceptual terms. For the concept of the figural as proposed by Lyotard, it is best to heed media philosopher David N. Rodowick's lucid account of Lyotard's concept. He presents it as a proposal to deconstruct the opposition between word and image, and between philosophy and aesthetic. Instead of opposition, Lyotard elaborates the figural as a central concept for analyzing language and, for Rodowick, also specifically for digital audiovisual images. These are not seen as (pre-figured) fixed sign structures, but as temporally oriented (audio)visual *events*. This view points at a meaning of the experiential that exceeds discourse and the semiotic. Rodowick invokes Lyotard's recognition of the force or movement of figuration when he writes:

> In homage to Lyotard, I can thus present a first definition of the figural as a force that erodes the distinction between letter and line: "The letter is a closed, invariant line; the line is the opening of the letter that is closed, perhaps, elsewhere or on the other side. Open the letter and you have image,

scene, magic. Enclose the image and you have emblem, symbol, and letter". (Rodowick 1-2; quoting Lyotard 268)

The analyst can, therefore, approach the image not so much a representation indexically pointing to a past, but instead to unpack the image as a figuration of its (potential) futurity (Verhoeff 2012). Taking up this multi-directional temporality, or inter-mediacy, as foundational to an understanding of the figural through the practice-based notion of figuring acts, here we activate before all else the processual and performative connotations of the verb to figure. This emphasizes the act before—in connection with the process during, after, and beyond—the (encounter with) figurings.

Figuring as an enactment or performance of the figure can be recognized in shapes and drawings such as the silhouette, circle, line, arrow, bracket, or matrix. Such geometric forms can similarly be both expressive of, and simultaneously yield, emerging thought. These figurings express and produce the spatiotemporal dynamic structures and (emergent) relational constellations within which human subjectivity is produced. As a concept for the bond between acts of creativity and the production of thought, figuring is therefore our proposal to think with shapes or forms that prescribe and inscribe thought in form. For these forms draw out emerging possibilities for seeing and thinking, and for transforming relations as they are already programmed in shapes, lines, or forms.

Both anthropomorphic and geometric figures are capable of making, articulating, or suggesting thoughts, ideas, concepts. This brings to the fore how philosophy, cultural theory, and creative practices such as design, scenography, architecture, and installation may share a double-sided creative and conceptual impetus. To give abstract thought shape or form as a creative-philosophical act, is to materialize thought: to make thought possible and make it happen. Moreover, to approach or take a specific shape or form *as* figuring, is to conceptualize it—to accept the shape or form as a concept to think with.

Acts of Holding Dance is particularly relevant for the distinction—with the help of David N. Rodowick—between, on the one hand, the conventional notion of *the figure* as fixed form, not-abstract and based on anthropomorphic recognition (of the dancer), and, on the

other, *the figural* (of the dance) as a temporal event, a process and effect of mediation. Yu's installations comprise of the composition of often multiple parallel columns, featuring dancers at the top of each column engaged in an improvised breakdance routine. While this breaking is projected in a loop, from each dancing figure streams of colors flow down their column, as if the dancers are leaking paint. It is hard to describe the spellbinding visual effect of these mesmerizing and disorienting images.

A lot is going on in Yu's works: dancers circle, tumble, jump, and seemingly defy gravity. For onlookers below, the blown-up projections high up on the façades skew proportions and perspectives reveal even more. The vertical direction of the colorful, abstract downward flows decenters the dancers' core as the center of movement. This disorients what the viewers see while looking up from street level, forcing them to search for a vantage point of their perspective and the origin of the figures' movements, all while they are unable to clearly determine what is up, down, left, and right. This disorientation is, of course, the point—as is the elevation. We can speak of figures here in reference to the dancers' recognizable, but also disorienting, human-shaped bodily representations. Such a use of the figure in these images is clearly not intended to reaffirm the opposition through abstraction or the non-human, as was a point of critique discussed above. There, Rodowick's insistence on force and movement in his rendering of Lyotard's conception of the figural provides a specific perspective on these verticalized break-dancers and the streams of digital paint they emanate.

By means of creative coding design, Yu has drawn beautifully animated visual extensions and transformations of the dancers' bodies. She did so by capturing and tracing their physical movements and extending these movements by animating the dancers' bodies. Their limbs seem to stream away from recognizable, individual dancing human figures transform into four-dimensional moving and morphing abstract figurings of more-than-human techno-bodies. Defying their original transitory states, the digital images of dancing bodies can now be(come) looped and infinitely figuring and re-figuring. Visually, they appear to drift, fold and merge into a multimedia and multichannel shapeshifting, streams of dance. Watching these screen images in live and site-specific projection, spectators can be enticed to read the image both horizontally—discerning each

of the five dancing figures lined up next to each other—and vertically. This verticality results as a figuring-effect of the figuring and trans-figuring streams of color, and of the spectator's simultaneous tracking of these movements, by looking up and down with one's eyes. Simultaneously, going in and out of recognition and tradition, spectators easily follow cinematic cues of horizontal framing, as they shift to the verticality and multi-format forms of framing of urban media art.

Projecting Dance on Street Level

What can we take from this combination of capturing and tracing in figuring in the way that Wendy Yu's work brings acts of dance back to the level of the street? What does the work do by projecting breaking onto the city's facades? Or, as we could phrase it, what is the work doing in the realm of the *hodos*?

Ancient Greek terminology is frequently deployed as providing concepts for specific domains within urban societies and ecologies. Think of *demos* (the public), *oikos* (home), *agora* (market), *polis* (city), or *gaia* (earth). In line with such invocations, Nanna has elsewhere proposed to adopt *hodos* to denote the street or "street level" of urban living (Verhoeff 2024). Etymologically, hodos (ὁδός) means threshold, road, or street, but importantly also "journey" or "way" —in the combination of a "way to get somewhere" and a "way of thinking". This double meaning also becomes clear in the compound-word *methodos* (μέθοδος), which connects "meta" (pursuit) with "hodos" (way) as the "way towards". Hodos as a concept, therefore, not only refers to the street as a location, or a level on which we locate "public space", but also, and more specifically, to the situatedness of urban experiences, relations, and practices that emerge from and in this location, as we traverse public space, *along the way*. *Hodos* as between locus and trajectory, between "street" and "way", then, articulates a performative perspective on the city as a scenographic grid on which we move, act, and connect, or navigate. It acts as more than a word, because, by also harboring such a performative perspective, the concept of hodos fundamentally connects the street with the method.[7]

Such a situated and performative perspective on hodos is particularly relevant when we think of how urban interventions work—whether they are practical and pedestrian—such as, for example, the signage during the recent COVID pandemic on the pavement for social distancing, or as activist or artistic. It helps us think about how these interventions work with and respond to the street-level of urban living. In interventions that work from an inherently *temporary*, that is, a time-based, impermanent, and thus mobile and dynamic situatedness within the mediatized infrastructures of our public space, we can recognize experimental—and hence, also obviously provisional—strategies deployed in experimental artistic projects. Such projects work to make visible and thereby debatable; for example by exploring alternatives or by repurposing, rescaling, repositioning, or reterritorializing the technological assemblages that shape our habitats and habits. In other interventions that are more practical and mundane, we may recognize similar strategies, albeit for a different purpose.

This view of urban interventions connects *hodos* to *methodos*: the situated, street-level of the "method" of urban intervention. Urban interventions, as temporary and experimental—in the widest sense of the word—in various ways offer specific perspectives on the city from such a situated perspective. That perspective harbors a transformative potential from both a creative and a critical stance. As mundane and sometimes regulatory practices point to a futurity of directly intervening in standard routes or behaviors to steer towards new ones, artistic works often also point back to, and reflect on, such practices precisely by breaking in and doing differently. With such a firmly situated "hodological", experimental engagement with (and in) the contours—as figurative demarcations and performative incentives—of public space for our experiences and actions in it, critical artistic and/or activist work is radically different from any sort of external, dismissive form of critique. With inquisitive responses to the challenges and questions of urban publicness in our time, we see various urban interventions on the street level. We can consider these as not only descriptively "urban" positions or locations of their work, but also fundamentally as strategies for a perhaps more productive form of relating and reflecting on the potentials of this space and its own possible role within it. Moreover, through its situatedness in public space, the hodological object positions its public as collaborators or participants invited to be part of a (self-)reflexive process.

This change of status—from distant object to situated interlocutor—performed by the hodological object also affects the observer/researcher and her methods. For us this entails picking up the methodological question of the concepts proposed by us in response to the work. In short, how does the site-specific working of hodos put a particular spin on the performative principles of capturing, tracing, and figuring in Yu's work?

Throughout our text, we have come to interpret the project of *Acts of Holding Dance* as both choreographic object and urban intervention. For onlookers at street level, the work connects past, present, and future in relation to this specific locality. It is rooted in the past by capturing the performances of local breakdancers, revealing and celebrating the virtuosity of their performance style and technique, thereby creating rare documentary traces of an art form that is characterized by its iterative and improvisatory performance practice. It is also based in the past, because the work acts as a tribute to the local cultural legacy of breakdancing, which deserves more study and scholarly attention. It lives in the present because the dancing-drawing figures in Yu's projections trigger an instant kinesthetic appeal in viewers, which makes them stop in their tracks, making them feel the connection of their own feet to the ground as they contemplate the complex and continuously evolving dancer-ground relationship displayed on the wall above them. And it is future because these projections act as a point of indexical connection with places and practices that onlookers may have been unfamiliar with, but that are located in the city that they too inhabit. This is how *hodos* materializes through this work: it opens up alternative ways to navigate the city, it enables new encounters, and it breaks open potential future acts of dance.

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Notes

1 This and other direct quotes from Yu are from a conversation between the artist and Laura held in Melbourne (Yu).

2 For more about Bal's incorporation of Damish and the connection of specific types of theoretical objects to knowledge objects, see Bleeker, Verhoeff, and Werning (2020). There, *knowledge objects* are defined as theoretical objects that produce knowledge about phenomena or data that are otherwise inaccessible for human perception and (thereby) reflection. William Forsythe's *Synchronous Objects*—also discussed in the following paragraph—are a case in point. Here, our argument remains on the discursive level of theoretical objects as presenting themselves as reflexive objects through their own qualities and workings, while responding to wider phenomena.

3 With this phrase, we refer to the practice of working with theoretical concepts by means of

and in response to art. About the meeting of theoretical and creative practice and concepting on both ends; see the introductory chapter of *Critical Concepts for the Creative Humanities* (van der Tuin and Verhoeff).

4 See Mary-Anne Doane (2007) for more information about Peircean semiotics, the trace, and the index in photography and film. For further analysis of the situatedness and binding of the trace, see "Trace, Tracing" in *Critical Concepts for the Creative Humanities* (van der Tuin & Verhoeff 2022: 196-198).

5 The other pillars are: MCing (rapping), DJing (turntablism) and breakdancing.

6 This discussion about the concept of *figuring* is discussed more elaborately in the chapter of the same name in Verhoeff (2024).

7 See Liddell, Scott, and Jones (1940).

Drowning in Dance Data: The Liquidity of Digital Choreography, from Sweat to Currency

–– Jorge Poveda Yánez
(UNIVERSITY OF CALIFORNIA, RIVERSIDE)
ORCID: 0000-0002-6024-6294

Starting with the synovial fluid lubricating the dancer's knees at the motion capture studio, continuing with the sweat stains on gamers' couches, and culminating with the liquid income that the companies behind hit titles like *Fortnite* generate by selling choreographic material; there is an overarching liquidity that dance turned into data traces across bodies and devices. Different kinds of liquification can be seen throughout the digitization stages of the dancing body, demonstrating an interconnecting thread between performance and dance on the screen that is fundamentally material, chemical, and physiological. This thread fosters a juxtaposition of digital and physical corporealities that forces users' bodily schemas to be reformulated into techno-human embodiments. The mutual correspondence of the incursion of dance into the numerical field and the numerical into dance evidences the kinetic motor behind the capital accumulation of the new emergent economy of digital dance, whose hallmark is a fluidity that liquifies bodies into currency and back, for the service of an information society.

Keywords: digital dance, screen cultures, motion capture, video games, post-ephemeral

The first time that I played *Fortnite*, one of my adversaries could not help but tell me "I am going to liquidate you". As he ranked number one in the aftermath of our sixth consecutive round, and the battle heat rose, he proceeded to perform one of the rarest "emotes" in the videogame, the "Waterworks". In a matter of less than a second, his now triumphant avatar was shown on my screen weeping profusely, with impossibly large tears expectorated from his eyes in every direction; sobbing out harmless projectiles. With now the full irony sinking in, and before I could complete my eye-roll, I saw my contender physically leaving his seat only to imitate the crying gesture of his on-screen character. Upon standing up, there was a sweat stain left on his seat, both on the backrest and the cushion. My "liquidation", the sweat of my opponent and the tears of his digital avatar, are taken as cues to focalize an ubiquitous liquidity of dance once it is turned into data and migrates through physical and virtual bodies: from its conception to its consumption. The specificities of every stage of this itinerary's impact on bodies and devices are the main object of this article's interest, each phase will be described below in terms of the corporeal secretions each one affords as they nourish a new emergent economy for the commodification of dance in the digital. The guiding thesis for this text is the proposal that the liquefication of dance offers a suitable theoretical framework to explore the enmeshment of performance and its digital iterations, whose commodified circulation interrupts the isometry between a single (human) body and a single subjectivity.

The first section contextualizes the use of computerized technologies for digitizing the dancing body within an information society and its compulsive drive to turn daily life into knowable and commodifiable bits, making *Fortnite* a salient example. Section two mobilizes a close account of the very moment human movement is recorded in a motion capture setting, to trace what is (and what is not) translated into the digital. Then, by referring to how such recordings circulate in the form of data through video games, the third section advances the interruption of kinetic causality—a fundamental transformation in the sequence of actions required to take place in order to see dance deployed in the form of a digital commodity. The final section offers an analysis of famous Twitch live streamers who make a living playing *Fortnite* in front of thousands of followers, whose re-introduction of the eschatological and the foul in their online personas, accompany the ultimate liquification of dance in the form of currency.

Before Getting Wet

The digital abstraction of the dancing body is advanced within a postindustrial, consumer society, and media—often designated information society—that Frederic Jameson famously equated as synonyms for the cultural paradigm of the postmodern era. Either to increase the recognition of dance as a scholarly field, to boost the chances of obtaining funding, or even just by falling prey to the zeitgeist, contemporary academics and practitioners repetitively frame dance as information and knowledge, because "knowledge" has become a value-term in its own right (Leach 141). Turning dance into knowable pieces of information for the sake of its institutional or academic legibility facilitates and expands the "process by which objects, behaviors, actions, motions, communications, and spaces are converted into machine-readable data flows" (Smith 7). Even though the framing of dance as knowledge is nowadays widespread, the sanctity of its ontological status as uncontaminated from recording devices remains. Illustrative of this are the discussions from performance scholars regarding the impossibility of capturing and reproducing live movement through digital technologies (Fischer-Lichte; Phelan; Pritchard and Mawdsley; Taylor). The infatuation with ephemerality, contingency, and disappearance in dance (Schneider) foreshadows the purist stance that separates performance from the technologies that record it. Regardless, the factual impossibility of being able to experience dance as a product without the service of a dancer is at the core of why the performing arts were more difficult to commodify than other arts, at least until the emergence of motion capture.

The heightened recording affordances of motion capture through mathematical precision fulfill dance's status as a complete commodity; sequences of movement no longer need the service of a dancer to be enjoyed as a product (Davies) or be bought in virtual online markets. The originators behind bodily practices circulating as virtual commodities are not always aware of—let alone pleased with—the conditions under which their movements are disseminated on the broad-reaching scale of online platforms. A prominent example of this is the use of dance material, sold through emotes in the video game *Fortnite*. *Fortnite Battle Royale* is based on the 2000 cult film *Battle Royale* directed by Kinji Fukasaku, the premise of both the game and film is that a group of people is left on a desert

island. Each person is given the mission to kill everyone else and be the last one standing. In the game version, players can personalize their characters through in-game purchases of costumes, skins, and emotes in exchange for "V-bucks". 1,000 V-bucks equates to £7.99 and players can amass this in-game currency by winning challenges or by directly buying it in exchange for real money. Here, emotes are salient among the customization options as short dance sequences or single gestures that can be used to "express yourself on the battlefield" (as marketed by *Fortnite*), allowing a virtual avatar to dance in a specific way and celebrate victory over opponents. The majority of these emotes cost around 500 V-bucks, therefore one can own a dance and have it performed by one's character for £3.99 (Poveda Yánez and Davies).

Emotes can act as a way to communicate with other players online to form allegiances or act as bait against enemies. The movement sequences offered in the game are either direct replicas or based on popular and traditional dances (Goslin). Except for a couple of steps, *Fortnite* has renamed these dance moves and does not credit the creators, further alienating works from their originators. This is how video games make their profit, by selling players attractive add-ons, including emotes, to customize their avatars. The dances here become an item to be owned and reproduced at will. The first versions of the game saw dances copied from the internet, TV, and music videos. *Fortnite's* developers were taken to court by dancers, musicians, and actors for the use and renaming of their work (Goslin). Since short sequences of movement are usually considered too simple to be deemed worthy of protection, and as none of these four plaintiffs copyrighted their work beforehand, they lost their cases against Epic Games, the company behind *Fortnite*. This is due to the U.S. Supreme Court ruling in the case *Fourth Estate v. Wall-Street.com*, which imposed the need to have a copyright registration at the Copyrights Office before any copyright infringement claim can be made in Court—again, something that none of the dancers did before suing Epic Games.

However, the abstraction of dance movements for video games through motion capture is not the first iteration of the computation of movement—as a systematization and codification of its qualities outside the dancing body. Choreographic thought had been already identified in itself as a form of movement computation

(Sheets-Johnstone) even prior to its entrance into the digital space (Portanova). The incursion of dance into the computational is also marked by the incursion of the logic of computation into dance. As Stamatia Portanova remarks from a philosophical angle, "Rather than having a moving subject measuring its own relation to movement and space through numbers, it is the number that now becomes a subject, through the becoming-number of the moving body" (102). An example of this is the mathematical abstraction of Labanotation but also any other notational system that transposes the dancing body into a scientific plane of reference through geometrization or quantification. Following this intermingling of dance and the computational taking place even before the digital age, might result in different conclusions than the aforementioned clean distinction between dance and its recording devices. However, a good alternative to further destabilize such a separation is to inspect it through a political analysis. Dance scholar Harmony Bench states that the separation between dance and recording technologies was never really about dance's ontology in itself but more about the shift from its state-sponsored archive "as a repository for and producer of histories to the archive as a market-authorized site of circulation for cultural memories" (157). The "(neo)liberalization of the archive" (Bench 157) as privately owned devices allow for the recording, reproduction, and circulation of dance is then another stepping stone in the moving body's interpenetration with the numerical, the computational, and the digital. The sway and impact of these different iterations are the prequels for the conversion of dance into a liquid commodity, as will be revealed henceforth.

Wet Data and Other Impossibilities of Digitizing Dance

Think of a photograph soaked in water; an image that does not fully comply with itself, or rather an image that exceeds its own confines by reverberating in the adjacent, but evanescent, ripples around it. Every color and shape is there, they are just not as sharp, more of a blurred suggestion, a euphemism of themselves, yet still there. The image's spectral and dreamlike feel does not take away its prowess, as all the particles of water that sink the portrait are bound to subordinate their transparency to its reproduction. Like this smudged enchantment, choreography turned into data touches and transposes

itself onto many different bodies and devices, physical and virtual. Undulating in soft dizziness, sets of choreographic movements get to be reproduced in ripples, a tide that recurs in waves. In the first wave, human bodies are recorded at the motion capture studio; sets of thousands of hundreds of data points are splattered as the customary set of fifteen infrared cameras intrusively follow every trajectory in the dozens of reflective markers latched onto the skin-tight bodysuits that dancers wear to facilitate the transformation of dance into flows of data.

As much as the motion capture system is geared to track the performer's movements in the studio to the millisecond, it is nonetheless restricted and can only account for the plastic markers reflecting the light emanating from the fifteen cameras. Strictly speaking, then, the human body is never really digitized, its flesh escapes the most invasive tracking system ever produced; more than a dozen cameras within a ten by ten space are pointing in its direction, yet they are all irremediably distracted by the markers it is wearing (Chang 316). Objects tracking other objects and human flesh being washed away in the shore of this conversion. What is underneath the tight body suit—the dress code at any motion capture studio—remains intact, incapable of making its way into the digital. Its sweat, the humidity that it produces as it keeps dancing, does not soak the data being harvested; the glistening particles of saline liquid emerging from the dancing body's pores cannot be welcomed through the digitization vortex of the motion capture studio. The dancing body is not in itself what is captured here either, but the ripple that it creates; a material of a second order, not the unmediated gestures of a human body, but those of the ancillary second body resting as a supplementary skeleton made of the markers atop of it. By summoning these dots to produce a scrap of a human silhouette made out of rudimentary sticks and dots, the computer's eye produces a second body in the form of a gestalt.

In a second moment or wave, the resulting dance data is then transposed to the dancing avatars that populate video games and VR environments that reproduce the gestures with exactitude, irrespective of their shifting and customizable appearances that might range from human-size squirrels to official renditions of Ariana Grande's body, sanctioned by the artist. No pedagogical process is needed for

this migration of dance data to this third avatar body. With a flick of a wrist or a couple of taps from a thumb, any of the more than four hundred million registered users of *Fortnite* can instruct their customizable characters to repeat the more than six hundred emotes or short capsules of dance movement currently sold on the platform. There is, however, a different kind of labor that is still needed to get to dance, even if by proxy of a virtual avatar. Users of the popular videogame scroll through their emote library, comprised of all the dances that they have purchased in advance, and select the one they want to be deployed in front of others, after killing them in the battle royale. Then, dance in the form of data resurfaces as a synonym for triumph and dexterity, as proof of one's purchasing capabilities, and as the tongue-in-cheek celebratory ritual to madden defeated opponents. This surplus or proliferation of bodies—physical and digital—from the *first* dancing body at the motion capture studio, to the *second* rudimentary skeleton constructed from the reflective markers placed onto it, and this *third* ever-morphing virtual avatar of the videogame, finally shatters the limitation of having only one subjectivity per body.

The isometrical correspondence between one subjectivity and one body was thought of as the very backbone on which modernity was established (Cherniavsky), and for workers to commodify their labor in the marketplace as sovereign persons inhabiting an individual body. Along with the overabundance of virtual corporealities that online platforms allow users to inhabit; new sensibilities, behaviors, liquids, and economies are unleashed. Notably, the new economy put forward by virtual platforms that commodify human behavior sits in direct contradiction to the Fordist, industrial, or early capitalist marketplaces wherein sovereign subjects operate through a single corporeality. On the contrary, the conclusion here is that the commodification of dance data and its liquidity not only fosters, but requires the sedimentation of multiple bodies and for their labor to be juxtaposed and mobilized. But for such a conclusion to be fleshed out there is one final body that needs to be accounted for, that of the end-user, the customer, and the gamer, who gets to invoke all the other three bodies as they decant into their dexterous hands.

Same dance, New Kinetic Causalities

When Fanon famously recounted in the first person the experience of grabbing a cigarette, this was an action that could not be operated in the world without the animation of his right arm, without the action of grabbing the matches from a "drawer in the left" that required him to "lean back slightly" (111). Through this detailed itinerary, what peeks through is not only the micro-actions performed to complete a goal but how they all feed back into the consolidation of a body's image and what it is able to pragmatically do. This consolidated image in the form of a "bodily schema" is shaped by the spatiotemporal conditions of the world and the specific affordances possible within it. The bodily schema as an articulation then encompasses the mental representations made of the body based not necessarily on its visual appearance but on its operations and actionable affordances. As such, the schema of the body is not given by the effect of its appearance, but "painstakingly built up" in action (Silverman qtd. in Salamon 29). A bodily schema that is built-in action and not a given seems conceptually coterminous with the definition of a "bodily ego" described by feminist scholar Gayle Salamon when theorizing the misalignment between inner and outer self-perceptions of a transgender body.

> The concept of the bodily ego is of particular use in thinking transgender because it shows that the body of which one has a "felt sense" is not necessarily contiguous with the physical body as it is perceived from the outside. That is, the body one feels oneself to have is not necessarily the same body that is delimited by its exterior contours, and this is the case even for any normatively gendered subject. (14)

But if inner and outer perceptions of the body do not collapse as identical, meaning that there is no absolute isometry between the body's physical appearance and its imaginary representation, then the painstaking forging of the bodily ego can instead be traced through the keywords of rehearsal and action. But any action rehearsed by a body is fundamentally an interaction with a contained environment of specific spatio-temporal conditions. Thus, these interactions, along with the conditions of the environment that contains them, are to be inspected in order to understand how we "understand" ourselves. When the spatiotemporal conditions of the environment

are altered—e.g., the length of the arm, its grappling force, the distance between the two, or the dimensions of the matches—the sequences of bodily actions needed to see a result are different, and, therefore, the bodily schemas they rest on top of are also fundamentally challenged. If one wanted to see a ballet dancer performing a pirouette in the analog world, a dancer needed to hold their center down, bend their knees slightly, engage the adductor muscles, twirl their body to the side led by the lateral thigh, the buttocks, and later the entire leg to build momentum through an openness of the arms that would enclose back when the standing leg permits the dancer to return to their original position. Now, synthesized sequences of digital movement, of a twirl, a *relevé,* or an entire choreography for that matter, can be played out in a video game with the pressing of a single button on a controller. This is the precise moment of fracture of the kinetic causality of the action required for a specific result to be played out in an environment, which was suggested to be the very substance that informs the configuration of the bodily schema. The new contours of the actions required for the synthesized versions of dance to appear in the world, mobilize not an impermeable body and its corresponding bodily schema, but rather a form of techno-human embodiment with altered affordances and reach.

This transformation, facilitated by digital technology, has also altered the once stable coupling of action-sound in music (Jensenius), whereby one specific action unleashed one specific sound. For example, the activation of the shoulder's deltoid muscle and the arm's flexor muscles followed by an outward rotation of the wrist that concludes in a burst of movement from the fingertips in a plucking or strumming of strings used to be the only way to produce a guitar chord in the "real" world. With the appearance of electronic instruments, that same chord could be experienced with the click of a mouse or by tapping a screen, unhinged from the spatial laws of physics that govern the production of acoustic music. But to avoid the precipitated conclusion that the production of the same chord through electronic devices implies disembodiment, we have to confront the fact that the muscular chains and lines of connective tissues that are needed to enact the click of a mouse or tap of a screen also require a certain activation of the user's body; shorter and simpler, but an activation nonetheless. Instead of a cause for disembodiment, this altered sequence of actions illustrates here the reformulation of the bodily schema into a techno-human enmeshment of actionability.

The thrust, the intensity, and the adroitness of the two pathways of kinetic effort that produce the same chord with either electronic instruments or acoustic ones greatly diverge from each other, but, if we attend to the production of electronic music only, the muscular efforts needed to play the synthesized version of the sounds of the guitar, drum or saxophone are identical across the board.

Back to the case of choreography, regardless of the kind of dance intended to be produced within the video game's virtual space, the same physical sequences of muscular effort are required for their appearance. Once an array of dance steps is synthesized and available in the form of emotes, the user gets to see them all enacted with the press of the same single button, activated through an identical kinetic causality. Right at this conjunction, the reformulation of the kinetic causality collapses previous iterations of bodily schemas, now bleeding into a techno-human assemblage. To interact with the video game controller, one has to press buttons with the thumb muscles, move joysticks with the finger extensor muscles, and manipulate triggers or bumpers with the index and middle fingers; all of which require engaging the wrist flexor and extensor tissues to stabilize the controller in the hands. But doing all of that alone won't allow the dance emote to appear on screen. This chain of muscular activations and interactions required for the manipulation of a video game controller has to be complemented or followed by another set of operations within the machine. A preliminary, but partial, causal order of such interactive techno-human embodiment needed to deploy dance in the form of emotes could look like this:

Wrist – thumbs – extensor muscles of the fingers – controller – console – engine – screen – dance.

Even though it would be arguably impossible to contend that experiencing dance performed by flesh-and-bones dancers and watching it obliterated through the perimeters of the screen is the same, this paper is not interested in ratifying the already theorized distinctions between these two domains (Dodds). On the contrary, and to prepare the ground for the main thesis of this paper, we follow Silvia Citro's notion of "digital-carnalities" to productively explore the techno-human continuum at play when producing and consuming dances after their conversion into data. While Citro pins down the images of people dancing within the onscreen perimeters of our

devices as "luminous oniric-surrealist flashes" (347), we sink our attention into the fluidity that was required for their production. Not fluidity as a synonym of a certain flexibility or plasticity, but rather the actual liquification of dance data as it migrates across devices and bodies, thus seen as always already imbricated.

The act of dancing mobilizes a specific subset of substances, for instance, synovial fluids to lubricate the knees as they bend and extend, providing nourishment to the cartilage and ensuring smooth joint motion. Sustained dancing elevates the heart rate and entails the production of sweat, primarily composed of water, but also of small amounts of electrolytes and metabolic waste products that moisten the skin's surface. Dancing involves movement and physical exertion, which can increase blood circulation throughout the body, as well as increase the production of mucus to moisten the airways. The heightened blood flow of moving the limbs of the body can lead to a temporary redness of the skin, perceivable from the outside; and an increased circulation of cerebrospinal fluid irrigating the brain on the inside. Even before stepping into the motion capture studio, performers might experience a rush of cortisol and epinephrine, more commonly known as adrenaline, which suits the body for physical activity. As the movement continues, the blood vessels might get dilated by nitric oxide while the nervous system gets inundated by a tide of endorphins and other neurotransmitters. The contrast between all these bio-physiological operations entailed in the production of dance steps in the studio and the deployment of synthesized dance on the screen hint not only at the reformulation of bodily schemas but, more fundamentally, at their heretofore machinic entanglements. Put differently, given the enmeshed, sequential, and relational operations of humans and consoles required for the deployment of digital dance, the users' bodily schema is qualitatively contaminated by the computer, which is never autonomous but requires the mobilization of a techno-human form of embodiment, the assemblage of a techno-bodily schema.

But there is another series of excretions produced by the bodies of gamers who purchase and consume dance steps in the form of emotes, following their digitization in the motion capture studio. An excessive amount of gaming is now known to produce decreased epinephrine and norepinephrine levels (Kim et al.), which are substances that travel through the cerebrospinal fluid and in the saliva,

as a response to excitement or danger. That is to say, once dance data reaches its consumers, it is accompanied by the liberation of dopamine through plasma, the liquid part of the blood, associated with the behavioral addiction produced by video games (Clark and Zack) and their pleasurable effects. The liquification of dance data that starts with synovial fluid and lactic acid of the human dancers at the motion capture studio continues with the segregation of hormones and chemicals that percolate through those who consume it in the form of in-game emotes on the other end of the production chain. This liquification is useful to illuminate one of the many interconnecting threads between dances on the screen and dances "in real life", which, despite their ontological differences, keep bleeding into one another through the exacerbated indexicality of liquid as their pervasive hallmark. Liquification—the continuity traced by these byproducts—is here made traceable through the excretions produced at each stage of its circulation. All together, they meet in an encompassing scatological orchestration that is both literal and metaphorical. Actual excretions and discharges were focalized in the previous sections, but when the possibility for these to be directly palpable disappears due to the limitations of the screen, the eschatological returns in the form of theatricality. This theatrical mimesis of eschatological excretion is explored in the following section in correlation with the final form of liquification that dance produces while circulating in the form of data: liquid capital.

Foul Dance Steps and the Reintroduction of the Eschatological as a Theatricality

So far, we have framed dance data as repositories of movement to customize virtual avatars and mock other players, but more fundamentally, as the result of a transversal liquifying force across bodies, orchestrating their fluids. But when those fluids are out of reach and impossible to be smelled, felt, or touched through the mediation of the screen and its ocularcentric nature, the eschatological returns to overcome this impossibility via theatricality. This theatrical staging of the eschatological is evident in the gestures of Twitch streamers who make a living by playing *Fortnite* in front of hundreds of thousands of online followers. The narration below is representative of how streamers build their online persona and how allegories to bodily excretions lubricate the para-social interactions

required across digital platforms to amass visibility, virality, and potential revenues:

> *During one of the live streams by famous gamer @MrDylanEvans, user @Chloe95220 gifts 5 subs to viewers (a reward within Fortnite), causing the host of the Twitch Livestream to ramp into what he calls a "Shrek Rave". Standing up from his chair and dancing ravenously, he then assumes the starting posture of twerking but instead of shaking his buttocks by tilting them up and down as the movement would normally require, he cues a sequence of fart sounds while he taps on his butthole. As he screams "Have a Shrek Rave, that is for you Chloe!", loud EDM music starts blasting, thanks to the moderator of the live stream. The figure of the beloved Dreamworks character appears naked in the upper left corner of the screen as the host continues dancing frenetically.*

This combination of debauchery and competitive gaming presents itself on a split screen that allows followers to see the famous streamer alongside his in-game avatar, shaped as Ariana Grande's physical appearance. "Oh, it's getting sweaty!", he shouts as he abandons his progress in the game to stand in the middle of his room illuminated by LED neon lights and perform the viral sensation dance "flossing", which is also one of the most popular emotes in *Fortnite.* This kind of celebratory ritual and interruption of the actual game happens every so often when the Twitch server notifies him of a new subscriber who has enjoyed his content enough to follow him.

> *[In the next round of the same livestream, the host is "liquidated" by an opponent, who proceeds to dance through a celebratory emote] @MrDylanEvans: "Cranky [referring to user @cranky_serpent23], it doesn't matter, it doesn't matter, I was tracked, I was tracked, it's fine. Cranky… Kamikaze! Shut up dancing mate! I've got the bean community behind my back". [As he whines while talking to his audience and his opponent keeps dancing on his in-game grave before the new round starts]. Shortly after, hundreds of bean emojis start appearing in the chat box, sent by the people who have joined the live stream, accompanied by more fart sounds.*

Later, when @MrDylanEvans finally wins a round, we see his in-game avatar in a celebratory dance with both arms extended forward, accompanied by short little hops, both feet elevated at the same time. Simultaneously, @MrDylanEvans stands up from his seat and starts crouching as he claps rhythmically in a 4/4 time signature. He cries "mate… Let's go!" and cues a series of hand gestures, punching both arms in the air, pushing and pulling, one hand at shoulder height and the other close to the ribs. This feast of violence, social dance, excess, digital communality, cuteness, and "Havoc Pump Gunshots" is replicated daily on Twitch and delivered to massive audience numbers. Users like @mamabenjifishy1 have as many as 527,3k followers worldwide and are among the site's top gamers. However, their participation in the videogame is far from passive, quite the contrary, the top gamers on Twitch like @SarahNicole and @pinqeu are popular for enduring uninterrupted marathonic live streams of more than nine and ten hours, respectively. But to push through such taxing sessions and their ensuing back pain, carpal tunnel syndrome, bloodshot eyes, and plastered thighs; along with the arguably humiliating simulation of passing gas in front of half a million subscribers, is not without a reward.

In the new economy facilitated by online platforms and social media, "smaller streamers typically earn anywhere from $50 to $1,500 per month with 100 viewers—or up to $30,000 per month with 10,000 viewers" (Folger). As high as these numbers might seem, they are only a fraction of the startling takings that the companies behind these video games generate; an industry that is now more successful than movies and music combined. The "film industry's $42 billion pales in comparison to the more than $150 billion in video game revenue in 2019", revenues that include the $2.4 billion a year that games like *Fortnite* generate by selling customizable options like emotes to its users (ITRC). With the amassing of all these profits, stimulated by the excess, frenetic wickedness, and popularity of the enduring sessions of streamers on Twitch, the liquification of dance data completes its cycle here taking the form of liquid assets. This final iteration of dance data adds to its organizatory force through a financial incentive; an invitation to participate in a new emerging economy consisting of those who surrender their bodies—digital and physical—to its reproduction. At this shorebreak, the organizatory quality of dance data finally reveals the intermingling muscular, chemical, theatrical, and economic aspects of its liquidation of bodies,

starting with actual physiological liquids and ending here, with the production of liquid assets.

Conclusions

Reaching the ebb and flow, we underpin how the adoption of movements from machines to human bodies happens in both directions; but this process, regardless of the revolting evocation of human secretions at the ellipsis of the celebratory rituals of famous live streamers, is inconclusive. Seen in tandem with all the other instances of the circulation of dance data, from its production through motion capture to its consumption, the outlines of this swell of fluids are rendered visible, but the liquidity of major capital accumulation—of which streamers and software development companies are a prominent part—is only the whitecap of a kinetic groundswell. The hallmark of the liquification of dance therefore consists of not only the perceivable liquids that are left as it migrates through bodies and devices, but also the same identifiable sequences of movements that recur in its migration—performed by human bodies and virtual avatars, regardless of the kinetic causalities required for its deployment. The blueprint of the dance steps recorded at the motion capture studio is the formal layer that allows tracing the organizatory quality of the liquification of dance because it is precisely the sequences of movements that it contains that define the orchestration of excretions in different bodies as they come into contact with them. Without recovering a receding melancholia for a pure dance of stable conceptual borders centered around the phenomenon of unmediated human presence, the liquification of dance gestures towards a notion of dance as a transmedial maelstrom that is "dynamic, transhistorical, and intersubjective". A flowing system "of incorporations and ex-corporations" (Lepecki, "The Body as Archive" 39).

The material emphasis of this paper overcomes the misleading distinction between "real" and "digital", making the palpable interconnecting thread between the two domains visible as physiological and theatrical, collapsing the distance between these fields. For dance to persist in its revised iterations across the digital, it needs to find coherency and pervasiveness; coherent for us to indexically recognize the same dance steps across digital and physical bodies

on a formal level, but pervasive because it needs to be transposable enough to migrate across different corporealities. The collapsing of this distance is then the backbone for the sedimentation of different corporealities described in the third section of this paper, through the alteration of kinetic causalities and their ensuing refiguration of bodily schemas into techno-human embodiments. In this way, amending Lepecki's assertion about the hyperkineticism of capital (*Singularities*), we could say that the movement that capital requires to liquefy itself is, as seen, not exclusively human but assembled through techno-human embodiments at the service of dance as an organizatory force.

By tracking the itinerary of choreography after its digitization, dance glints as a fugitive yet effective orchestrating force arranging bodies of flesh and bones, but also those made of numbers and capital, as it migrates throughout them. Thus, dance in its digital iteration is not an epiphenomenon consisting of the circulation of capital in the emergent, but abundant, economy of digital commodities, it is, in fact, its motor. As its kinetic motor, dance's value goes beyond an adornment or ancillary quaintness of the body's presentation in the digital and is proposed here to be absolutely central for the arrangement of bodies, flesh, pixels and money due to the pervasiveness of its liquidity. If Lepecki's assertion of dance as a "system of incorporations and ex-corporations" seems too evocative; by accentuating the material remnants left behind as dance circulates through bodies and devices, we finally see its perlocutionary force as a topology maker across disciplines of what would usually be considered media and cultural studies or visual arts on the one hand and performance studies or dance on the other. The echoes of this destabilization of dance could result in future conceptualizations of corporealities that are not necessarily based on epidermal confines or anthropomorphic isometries, but rather on a trace-ology that maps the humid dashes left behind as it sinks in and emerges back from the sea of the digital. Like a photograph soaked in water.

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An Alien Phenomenology in Dance: Virtual Telematic Performances as Embodied Philosophy

–– Dan Strutt

(UNIVERSITY OF LONDON)

ORCID: 0000-0001-5169-1145

This article suggests that dance practice-led exploration of avatar embodiment and telematic performance in 3D virtual environments (such as those generated in real-time graphics engines) can be a meaningful mode of philosophical discovery—a mode of affective doing, creating, becoming, and embodied thinking. By exerting kinaesthetic agency and shared expression within corporeal forms that are both of our body and yet virtual as well as in avatar representations that do not necessarily correlate to our actual anatomical articulation, can we explore a new remote relationality of extended, non-human, or alien embodiment within virtual space? I explore the possibility that, if this experience is indeed philosophical, it can be expansive and joyous, critically and socially engaged, and even ethical in nature, despite the techno-political forces of capture and control which are understood to be at work in so-called *volumetric regimes*. To consider this I draw upon a proposed alignment of ideas from Ian Bogost (from "procedural rhetoric" to alien phenomenology) and from Laura Marks (unfolding-enfolding aesthetics and the "talisman image") to think about

virtual media forms that enhance dance's inherent virtuality and its propensity for kinaesthetic metaphorism, ethical intersubjectivity, and play.

Keywords: Digital Dance, Phenomenology, Aesthetics, Virtual, Immersive Media

Film philosophy suggests that the relationship between philosophy and cinema can be understood in a couple of different ways: that films can act as a bridge to the understanding of philosophy (i.e. that they "represent" philosophical principles in action), or that they might be said to "do" philosophy, enacting it through audio-visual forms and processes. In this second mode, film becomes not just representation, but rather a form of somatic thinking through syntheses of bodily sensations that turn affects into percepts, and then into concepts, to yield "new" experiences that are not reducible to existing thoughts. It was the specific perceptual and phenomenological experience of cinematic time, alongside the ineffable quality of *photogenie* (Epstein), that for twentieth-century theorists allowed film to reveal the real world in newly sublime and powerful ways. Film, for these writers and their intellectual inheritors, added a new dimension of reality such that we can talk about the evolution of a cinematic consciousness, and an ontology of film (and other derived audiovisual media) that actively *shapes* our embodied, affective awareness of what is real in the universe, rather than simply representing it (see discussion on Cavell, Badiou, and Deleuze in Mullarkey, *Refractions of Reality*).

Within our current post-cinematic audiovisual culture, we are now offered options beyond filmic linear recorded media forms, in modes that are nonlinear, operational, immersive, and *real-time*, and so we might ask how these "do" philosophy in ways that might be either similar or distinct from the filmic. In particular, how do the 3D interactive media systems into which we are sensorially immersed, including gaming devices and softwares, virtual reality or mixed reality interfaces, and motion-capture (mocap) sensors, manifest new or emergent embodied knowledges, thoughts, and feelings in ways that enact novel modes of being-in-the-world? Without intending to reify the old-media-passive/new-media-(inter)active binary, film

is indisputably a medium that captures and represents the world for a cognitively active but corporeally passive spectator, while interactive technologies of virtual embodiment explicitly require movement, activity and agency to activate simulated, rule-governed environments. These simulated models of reality select and virtualize specific aspects of our phenomenological experience of the world, including many, but not all, of our sensory inputs (e.g. sight, balance, proprioception). While to some this might seem like an impoverished illusion of reality due to the fact that there is always a reductive selection of sense data (e.g. of touch, weight, temperature—whilst also losing some of the dense richness of indexical reality that *photogenie* refers to), within the same framework we can also choose to augment and extend selected sensory and *synaesthetic* aspects to reveal a uniquely digital sublime, that, like the cinematic sublime before it, is capable of revealing something new to our cognitive experience. We can consider that the emergence or evolution of a specifically digital embodied philosophy might thus be traced through the diverging degrees of agency and linearity afforded by media-technological development.

In this article I will draw on digital dance practices (dance and movement-based expression in virtual or simulated frameworks, as opposed to just screen dance) as an elemental way of thinking about the new modes of being offered to us in virtual and immersive media. Specifically, I explore embodiment and agency in virtual environments, and more broadly, *corporeal consciousness* as the way that we experience having a body through our kinaesthetic and proprioceptive senses.[1] Drawing from applied research, I try to think through some of the dimensions of an affective (post-)phenomenology of virtually dancing; of moving one's body with expressive intention in immersive, simulated spaces, with and through avatar figures. By doing this, I argue that these practices can extend and augment the sensation of being an embodied human and *relational entity* in the world through a new sensory matrix. Through concepts of "Alien Phenomenology" (Bogost) and "Talismanic Images" (Marks) I largely frame these dimensions of experience through ideals of agency, creativity, becoming, and expansiveness (not dissimilar to Deleuze's cinematic virtual). While I acknowledge that the historical regimes of representation that empower the world view of one group and suppress the perspectives of another endure and are reproduced (re-mediated) through new "volumetric" 3D media technologies

(Pujals), I attempt to make a case for certain practices and aesthetic frameworks that can challenge and dispute these hegemonic regimes. Ultimately, I position digital dance as a potential ethical practice, where one's disposition (mindset or intention) toward the work itself both determines the outcome, and whether or not it can be said to meaningfully "do" philosophy in a creative, critical way.

Working towards a philosophy of *digital* dance in virtual spaces and with avatar bodies entails understanding dance as inherently a form of thinking. Theorists from Suzanne Langer in the 1950s and 1960s to Maxine Sheets-Johnstone and Erin Manning in the twenty-first century have described how dance connects to processes of consciousness in primal ways–learning about one's own body, its vitalities, its capacities for meaningful connection with its environment and other people, and its ways of simulating thoughts and feelings "virtually". The dancer's body is always dynamically caught in a system of real/virtual relationships or interacting forces–between body and physical qualities of space, light and gravity, between body and body, body and music, and between performer and audience experience. For Suzanne Langer, dance is thus always essentially virtual and processual, "an apparition of active powers, a dynamic image", that leads to the expression of a "stream of direct experience, life as it feels to the living" (79). However, when there is a shift in the technological frameworks in which some forms of dance are becoming, we can start to ask how alternate dynamics shift the sensation of connection, communication, intimacy and agency as part of the unique phenomenology, and therefore embodied philosophy, of digital dance.

The Technological Frameworks of Digital Dance

Digital dance can be defined as an emergent system (arisen in the last fifteen years) that introduces a new complexity of technical and interfacial dynamics for choreographic expression. This is a system that allows the capture, alteration, and extension of the expression of human motion and form within mediated environments and complexifies the relationship between performers, and between performer and spectator. With the 2010 hacking of the Xbox Kinect body motion-tracking system (only recently discontinued in 2023) and extending through waves of increasingly affordable sensor-based

inertial mocap and recent markerless AI systems (e.g. Move AI), we have seen an explosion of both amateur and professional motion capture (mocap) dance and performance practice. Alongside recent mocap hardware releases, a range of software is also needed to do this work of re-interpretation of body data–a cluster of real-time rendering games and graphics engines, 3D modeling and rigging software (in which data points are attached to avatar joints), network and telecommunication software protocols (ports, plug-ins, APIs, SDKs, and codecs). Since all of these technological developments have become consumer-accessible, artists have learned that expensive, industry-standard motion capture is not necessary to create expressions of dance movement in virtual spaces. Human movement can be captured as data that can manifest as either image or sound through many different kinds of audiovisual or haptic interfaces. The physical dancer can move in and with the screen image, multiple figures (as avatar representations of motion data) can move with each other within shared virtual spaces, and spectators are able to assume mobile perspectives or indeed participate in the work. All of these agents are enmeshed within a system *ecology* that is determined by the human designer of the system, the software parameters for movement and action within the virtual space, and the hardware's technical affordances (their observable capacities for user action). The combination of human intentions and machine determinisms, automatisms, and affordances yields both potentials and limitations that are complexified through their relationality.

The most immediate and obvious use of the capture of body movement data is to create a realistic *digital twin* or likeness of the actual person who moves, for instance, to monitor and track locomotion for efficiency, accuracy, archiving, and analysis (in sports science applications), or simply to render realistic dance motion on a digital interface for artistic purposes. However, the avatar figures used to articulate captured motion data do not really need to be humanoid, as users are afforded the possibility to move and dance in different bodies, identifying with and projecting one's kinaesthetic sense into a diversity of human and non-human figures on the screen. This process seems to happen almost automatically or intuitively when we are moving identically and in real-time with an avatar figure in front of us (Miller; Strutt and Cisneros). However, in experimental practices that explore the limits of intuitive avatar embodiment, we can see a challenge to realist paradigms of the representation of

body movement, and a blossoming of different animated expressions of motion data ranging from abstract, painterly or geometric patterns to *weird* animal and alien forms. In these practices, I observe a complex aesthetic of dance movement emerging that stretches our ability to recognize the human figure, and a radical reconfiguration of embodiment in sculptural, non-human virtual forms (see for instance the work of artists Remi Molettee, Tobias Gremmler, or the various artists in Alexander Whitley Dance Company's 2021 *Digital Body* project).

The possibilities of going beyond human representation generate a fundamentally different framework for choreographic creation. No longer is the dancer's "tool" the body that they were born with, but now, instead, the body is a controller of, and interface to, a system architecture. This multiplies the creative choices that have to be made for the performance, as Johannes Birringer describes:

> It is crucial to ask where the interactive system is used, on stage, off stage, by the trained performer who is improvising or following a precise cue structure or choreography, by an untrained audience member [...]. The questions extend to who is interacting with whom? With what? Performers with other performers using the interface or performers with the interface or performers with performers within an interface which organises its total output via the actions of the performers? If the notion of choreography is replaced by "user experience", is it because a performative interaction environment has been specifically designed for the user? Who is the user and how does she know what to use? (35)

The traditional phenomenological architecture of separate stage and audience spaces, and the conventional relationship of active performers to the seated spectator is folded such that the performer is a controller, the audience is a participant, and the computer is an active agent in the event of the "dynamic image" (Langer). The task of steering authorial intention through this system is a new field of practice, one in which tried and tested dramaturgical strategies do not necessarily work. New workflows also see the rise of a new kind of practitioner—the dancer technologist—who is not only a choreographic creator and performer, but someone who can learn

new systems, research and develop, technically problem-solve (often hacking and hybridizing), and innovate through iteration. They need to hone, through practice, an awareness of the different experiential spaces of virtual dance that artist Paul Sermon calls the "third space", which, alongside the actual physical space of the dancer, includes layered mediated spaces of representation given by different (virtual) camera angles, screens, and in person or online audiences. Dance theorist Pauline Brooks refers to this as a "virtual interplay" between actual and imagined "territories of performance space" (53).

The performance work then, the dynamic image, becomes more of an interactive installation experience than any conventional linear theatrical presentation. Birringer describes "a shift from *form* to experience [...] dramatically different synaesthetic and kinaesthetic scenarios" (xix). In similar terms, Kriss Ravetto-Biagioli calls it "a complex set of iterations—an indeterminate play of modulation and differentiation producing unexpected affects and relations—rather than discrete and manipulatable events" (4). It is, in effect, an improvisation that is processual rather than formal, such that the open-ended *agency* of the actors within the system space (either performer or audience) becomes more significant than accuracy or fidelity to a fixed concept, inflexible authorial control, or pre-determined form. This open-endedness is, however, not to be understood as an unbridled freedom to create beyond the limits of the real world. New system ecologies often extend or augment *existing* realities, and this means that real-world perceptual and cognitive habits (that are conditioned and ideological) persist, and are built by design into the new systems. In a practical sense, the technological interfaces themselves are often designed with a set of normative assumptions about what a body is, and its capacities for motion—excluding non-normative and disabled bodies in the process. Then, in software and systems design, we can also critique how the parameters of creative decision-making are both shaped and limited by a set of assumptions about what people would want to do in a given scenario.[2] This *creative normativity* becomes deeply embedded in both aesthetic and technical procedural limitations, carrying cultural and ideological baggage into emergent spheres of creation.

Critical Theory

Whilst overall I assume a cautiously optimistic perspective on the creative potential of new dance and performance systems and practices, it is necessary to acknowledge how powerful institutions have shaped how the body is technically captured and reproduced in virtual performance systems. Body tracking and mapping originates in military, surveillance, and bio-scientific applications that present as practices of objective positivistic measurement and classification, and yet carry a legacy of disciplinary regimes of monitoring and regulation that can be described as bio-political in nature. In recent work from 2022, the Possible Bodies Collective's *Volumetric Regimes* project offered a grounded analysis of the technical bases in which this occurs in contemporary 3D and immersive media.

> In *Volumetric Regimes* we find, as a kind of resonance chamber full of case studies, an inventory of techniques used in the context of 3D computing to artificially design *humanness*, referred to as so-called bodies, so-called earth or so-called plants. Mechanisms such as rigging, agential cuts, slicing, dividing, dimensional axes of power, x, y, z, simulated environments, processes of modelling, capturing, rendering, printing and tracking unveil how scientific knowledge incorporated in computational tools is still based on dividing, separating and creating boundaries in a fictional composition of the tangible, in which the world is bounded and organized according to categories of hegemonic fictions. (Pujals 10)

Here, the world, nature, and our bodies are rendered as tangible and real through a set of discourses or "fictions" that are inherently imbued with power hierarchies. In a philosophy of technology—from Heidegger to Stiegler—it is understood that we are produced (enframed) as humans through téchne or technical processes (from the tools we use to language and media) which shape not only our behavior but also our understanding of our place in the world. Addressing the new 3D volumetric technologies, the Possible Bodies collective describe this as an inherently disciplinary regime, a violence and violation of the potential of bodies and their agency.

In a material sense, what is being described through the notion of "volumetric regimes" is that the mechanisms and processes of 3D capture and immersive media production reproduce and preserve normative parameters for potential action. Herein lies a paradox; that so-called interactive or immersive media allow for physically active bodies though they are still rendered discursively "docile".[3] In this perspective, (inter)activity does not equal *agency.* This observation has also been described by several dance theorists—Harmony Bench, Kiri Miller, and Kriss Ravetto-Biagioli—while observing practices of web-based "hyperdance", popular dance-based video games, and multimedia live-dance installation works, respectively. In their analyses of these choreographic works there is a tension between the possibility for bodily action as a "freedom" towards "opening more choices for customizable and unique experiences" (Bench 31), and the sad regularity that despite the proposed interactivity the user often cannot really transform the dance scene in any substantive way. They are, instead, caught in programmed repetitive loops that fall back on conventional representational tropes, and with many interactive or gameplay systems we are merely modulating the formulation of fixed, recorded and linear media—we can tweak its appearance (to us), but we cannot instigate true change. For Bench's analysis of web-based platforms:

> Hyperdances do not offer a place from which the screen-dancers can act, nor do they offer an alternative to spinning one's wheels—they expose bare repetition or repetition of the identical as the core of turn-of-the-century interactivity. (42)

There is thus a clear distinction to be made between *interactivity* as a simple operation or activation, and meaningful *(inter-)agency* as making a substantive change within an environment. We have to ask what kind of interactivity we are dealing with in immersive media frameworks: merely a surface level of choice, or live, processual and fully-embodied activation of difference. The distinction between interactivity and agency cannot be simply mapped over a dichotomy of recorded/pre-rendered versus live/real-time media. We need to look at the underlying computational processes, procedural mechanisms of interaction, and the parameters in which they take place to understand if the mode of action does indeed permit agency,

or whether it forces us to follow a certain repeatable pattern that offers only a semblance of creative decision-making.

In Kiri Miller's analysis of mimetic dance games, although the figures on screen are essentially "playable" in that they invite us to dance with them, they do not lead to "a play of difference" but rather to a predetermined schema (41). The gamified dances of *Just Dance* and *Dance Central* lead to a problematic masquerade of normative gender and race stereotypes through the playable figures onscreen, made all the more potent through the affective immediacy of the embodied dance interaction, that disallows any distance of analysis/reflection. Speaking about Miller's ethnographic research, Kriss Ravetto-Biagioli describes:

> A sense of vicarious play may be part of our attraction to playable bodies and deepfakes, but we (as players) also vicariously open ourselves up to being played, conditioned to accept the terms of play and limited by what can be reconciled between them and the source material. (25)

This points to the very real idea that the systems described above that have the potential to present us with "unexpected affects and relations" (Ravetto-Biagioli) can often actually direct us to very expected, ideological and indeed programmable effects, affects, and modes of embodiment. Responding to this, Ravetto-Biagioli encourages a decisive move away from figurative representation of dance–to deny simple identification and thereby *playability,* instead recommending "a practice of disfiguration carried out by extracting the figure of the dancer from the work or by multiplying the figure to the point that it bleeds into so many iterations that it loses shape" (26). While this might seem fine for extrapolations of dance movement into more abstract fine-art practices, in dance communication the visible presence of an at least quasi-humanoid and recognizable figure with *legible* movement seems imperative. This observation is borne out of the practice-based research of our Goldsmiths Mocap Streamer project; that there is a limit to disfiguration or abstraction practices before the process ceases to serve the dancer's expressive intent, and actually gets in the way of agency or intimate communication between dancers. We have to thus ask, how do we maintain the figure of the dancer in ways that can extend their kinaesthetic

sense of embodiment, while denying simple "playability", and also permitting a kind of productive reflexivity and empowering creative negotiation in the process? In other terms, how can we counter the ideological forces and programming processes of capture and control by offsetting "regimes of the tangible" through tools of creative agency and empowerment, without "losing shape" or losing the dance itself?

Rather than approaching the issue of how immersive and high-immediacy media reproduce ideology only through a conceptual framework of figurative representation and identification (as Miller arguably does with the focus on race and gender stereotypes), or its negation (as does Ravetto-Biagioli), we can instead productively think about the procedures, processes and operations within systems design that either extend or limit agency. Procedural Rhetoric is a concept from games theorist Ian Bogost in his book *Persuasive Games*, which captures the sense of both the Possible Bodies collective's *Volumetric Regimes* and Miller's *Playable Bodies* by articulating an idea of "persuasion" through procedural or operational images such as, but not limited to, video games. Quite simply, persuasion is achieved not through representation, narrative, or speech, but rather through crafting interactions within a simulated environment through which implicit messages are carried, arguments are made, and expressions are constructed. Rather than being explicitly told what the meaning of our activity is, it is woven into the choices and decisions we make to act within the game system parameters—and these processes can influence people's attitudes, opinions, and beliefs. A game might, for instance, convey an anti-capitalist meaning through its gameplay mechanics in our committing to actions that ultimately make us realize that the game is unfairly rigged against us. For Bogost, we would be guided to this persuasive attitude through the interactive options laid out before us. Indeed, this is really classical Althusserian sociology—that ideology is not carried in abstract discourse, but in the "material practices" embedded in everyday procedural interaction, specifically those with institutions (Institutional State Apparatuses), that carry and reproduce the common sense ways of living into which we are interpellated (Althusser, "Thesis II"). This is the procedural rhetoric of everyday life.

For Bogost, however, simulation technologies can also permit productive disruption of the common-sense everyday, presenting us with

alternative spheres of activity that could fold back on and inflect our perception of everyday life. He admits that it can go both ways:

> I would like to advance persuasive games as an alternative whose promise lies on the possibility of using procedural rhetoric to support *or* challenge our understanding of the way things in the world do or should work. Such games can be produced for a variety of purposes, be they entertainment, education, activism or a combination of these and others. (Bogost 59)

Or, for that matter, possibly for oppression? Nonetheless, by exposing and discussing the possible forms of oppression through the procedural rhetorics of new volumetric systems for embodied simulation, gameplay, and performance, we can start to be attentive to the normative assumptions of system design, and maybe even resist them by focusing on the possibility for new actions. This is also the position ultimately taken by the Possible Bodies project:

> Possible Bodies explores … what the imaginary produced within that ontological and epistemological status of computational volumetrics does, and how it intervenes into power relationships. At the same time, they offer us a new imagine-action to rethink previous categorizations, by renaming them. (Pujals 11)

Reflecting on this potential to rethink and rename normative imaginaries, in the following section I draw upon current research to understand some of the more progressive and imaginative possible bodies and interactions that are afforded by the new systems. Although not explicitly educational or activist, I would like to think that in the procedures and operations generated within the affordances of new systems, there is a seed of resistance to dominant ideological regimes—one that could be productively germinated through more widespread and continued practice.

Practice-led Research Findings

In AHRC and British Academy-funded research ongoing since 2020, our research collective at Goldsmiths, University of London has been exploring aspects of digital dance through a series of experiments, residencies, and live showcases that have played with avatar embodiment and motion capture systems and procedures.[4] Called the Mocap Streamer project, we have focussed on inclusive and affordable *telematic* dance practice in *metaverse*-type spaces, which is to say that we have worked primarily with dancers who are in different locations, connected by motion capture data-streaming such that they can meet each other and move together in simulated virtual environments. Our dance partners over this time, Mavin Khoo (Akram Khan Company), Alexander Whitley Dance Company, and Candoco Dance have provided meaningful engagement and critique, and have shaped a research ethos directed not just at digital aesthetics (i.e. how dance data can be *represented* in digital modes), but at questions of meaningful *agency,* communication, and intimacy in the virtual space.

This research has been theorized and published in several articles and book chapters,[5] and the majority of these have focussed on the experience of the dancer more than, for instance, the experience of the audience (on which most recent research into digital performance centers—see Cîrstea & Mutebi). Specifically, in a chapter for the book *Adaptation And Resilience In The Performing Arts* titled "Dancing into the Metaverse: Creating a Framework for Ethical and Ecological Telematic Dance Practice and Performance", some of our dancers' insights were positioned within an understanding of new ethical intimacies in virtual spaces through avatar dance expression, whereby sensitivity and shared intentions allowed for a delicate intersubjectivity to develop between one dancer and a remote digital other. This research leads directly into what follows, framing the digital affordances of representation of an extension of the dancers' virtual interiority through the design of avatar forms and interactions within simulated environments.

Our research asked a simple question, which was how to harness the technical affordances of new technological devices by hacking and hybridizing (i.e. combining or assembling the different capacities that various hardware and software offer for action or use), to create or

enhance a sense of embodied presence between two remote dancers who, wearing motion capture sensors, could control their own avatars in the digital space. If certain physical qualities (we could call these the affordances of the physical dance studio) are taken away from the dancers' reality, namely gravity, the sense of touch, facial expression, eye contact, and even the natural movement of the body (in the sense that sensor-based motion capture often does not effectively capture many nuances of dance movement such as breath, back-arches, or floor work), we asked how we could design virtual interactions through the digital systems that could in some way substitute for these intuitive modes of physical dance practice. We thus experimented with digital effects such as particles (objects within the scene that are controlled and affected by dancers' movement), colliders (that trigger a change based on two avatars coming into contact, textures), and shaders (allowing objects to be reflective, change color, or to have natural gravity-based material qualities).

For avatar design, we experimented with humanoid and animal forms and with varying levels of abstraction, quickly learning that total abstraction in ways that limit the legibility of human movement created difficulty for meaningful dance interaction. It was also felt that recognizable animal and plant forms, albeit humanoid or anthropomorphized, too easily took on a storybook animation quality which while interesting, seemed to limit the dance expression to narrative fabulation. As a consequence of these early experiments, we developed an approach of maintaining a level of abstraction of nonetheless recognizable human forms that had changeable qualities based on the interaction design. These avatars may be seen in some ways alien—with distorted forms or extra extensions—or with physical qualities of liquidity, geometry, gravity, or morphability that are distinctively non-human (See Figure 1).

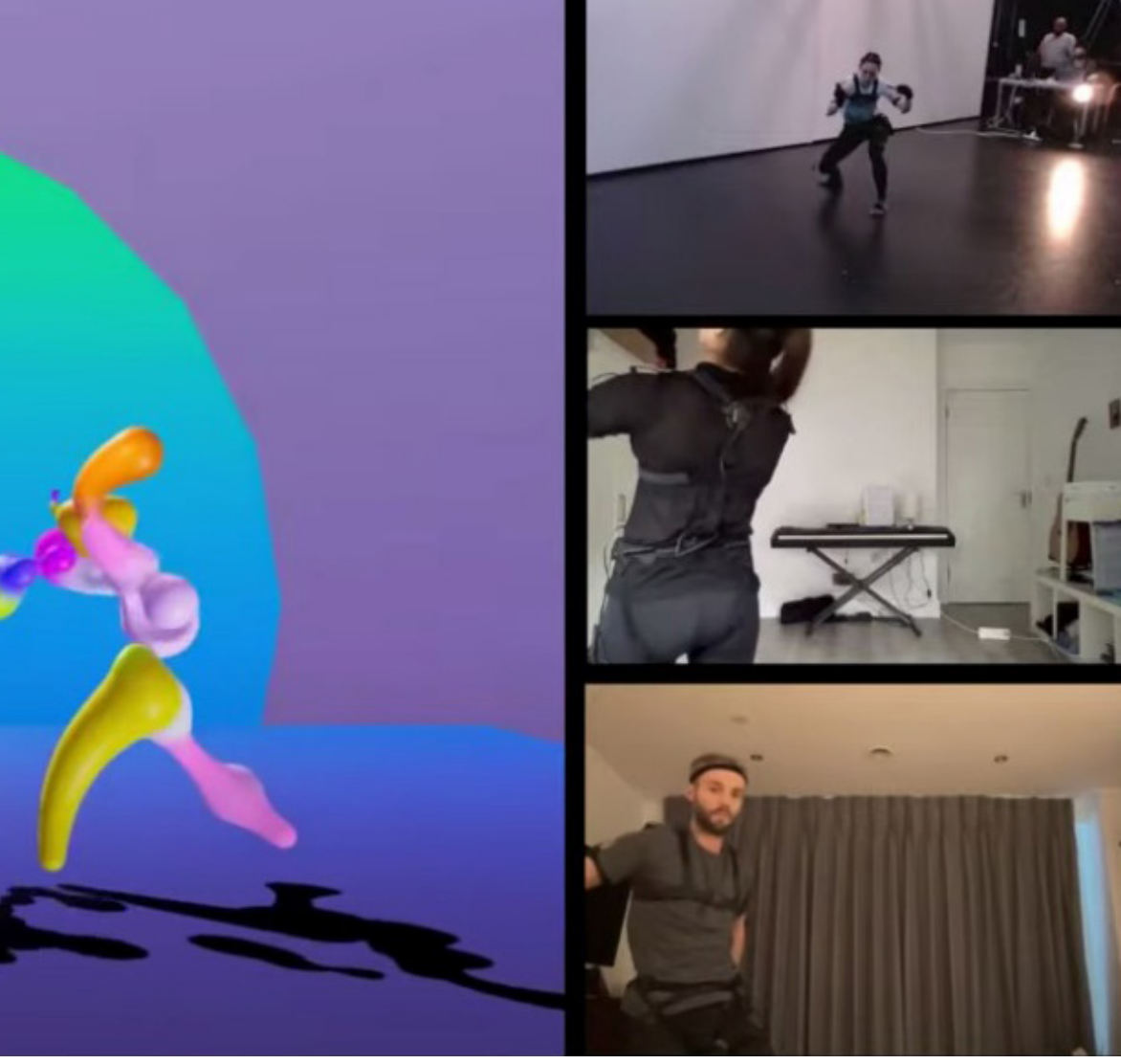
We then explored modes of interaction, and discovered that tightly choreographed work did not speak to the affordances of the networked mocap-streamer system. Dancers would just perform their piece independently, and without direct physical input there was a kind of disconnect where they were not meaningfully responding to each other. Together, we acknowledged that the work needed to be non-linear and at least semi-improvisational if not totally improvisational in nature. In this way dancers would have to be attentive to the screen image, find each other in the virtual space, explore

Figure 1. Participants take part in a movement workshop based around avatar forms generated for the Goldsmiths Mocap Streamer livestream event "Dancing into the Metaverse" in 2021. Two users in London interact with dancer Kristia Morabito in New York. Art Director: Neal Coghlan. © Dan Strutt

the space around each other, and experiment with forms of virtual touch and interaction such as mirroring, trailing, and moving into and through the other dancer (Figure 2). This yielded strong results that felt potent and meaningful to the dancers, albeit forcing them to slow down and in many ways dispense with their conventional choreographic intentions of virtuosity, accuracy, or hyper-activity such that they could gently attune to the other dancer (see Strutt, "A Simple Tool for Remote Real-Time Dance" for a deeper analysis

Figure 2. Dancers Alexander Whitley, Tia May Hockey, and Nicky Henshall explore dance movement in a shared virtual environment and through abstract avatar shapes that could blend and morph. Art Director: Neal Coghlan. © Dan Strutt

of these findings, supported by dancer interview data). What was revealed through this *telematic* framework is that the performance comes to feel less like digital puppetry (where there is a clear ontological distance between the dancer and the avatar) and more like the development of a phenomenologically affective intimacy between the dancers embodying virtual figures.



One avenue of our research, presented at SXSW in 2023 as *Figural Bodies*[6] and drawing on the ethical disability-centred research of Goldsmiths Ph.D. candidate Clarice Hilton, was to workshop these systems using dancers with non-normative bodies or neurodivergence. While findings from this specific work will be reported within Hilton's own theoretical framework, the learnings for the wider Mocap Streamer project seemed to solidify our critical attitude to realist representation in virtual dance interaction. While so much mainstream development within this field is fixed on skin and hair textures, on the fidelity of facial expression and eye contact, and on

microdetails of finger and hand capture, our research has leaned towards the finding that, at least for dance, realist representation is displaced as the main measure of meaning. This takes on particular significance in working with disabled dancers, where the profoundly normative assumptions that are made by tech developers about realistic body shape and locomotion are highlighted. While gestures are currently being made by some developers and creators towards the *representation* of disability in immersive virtual software, especially in social VR such as VRChat through visible prosthetics, mobility and assistive devices (Zhang et al.), very often the underlying algorithms and procedures that calculate captured movement are inherently normative, while the devices and hardware used assume normative capacities for movement (for instance in calibration processes that require a standing subject with arms spread). This denies agency to a large section of potential users within virtual environments, and indeed a user group who might have a particular vested interest in exploring the extended-reality opportunities for embodiment and expression.

Working with non-realist and non-human modes of representation proved productive in collaborations with disabled dancers. Through a series of workshops, avatars were crafted according to their specific need and desire to see their capacities for motion and feeling expressed in meaningful ways. Color, form and texture took on increased importance, and non-humanoid figures were crafted that nonetheless felt deeply connected to the possibilities for expressive motion. Challenging the simple paradigm of representation that says that if we are accurately represented (as we appear in reality) then we can immediately identify, here we see that a non-accurate body image can still yield a strongly affective sense of embodied presence and, moreover, empowered agency. This reflects Anne Rutherford's assertion in the article "Cinema and Embodied Affect" that while body-centered genres of film such as horror and porn provide immediate and obvious affectivity through an excessive "aesthetics of embodiment", we can also easily engage in a more metaphoric, mimetic sensuous relationship to an image that is not a humanoid body, or not a body at all. In her words:

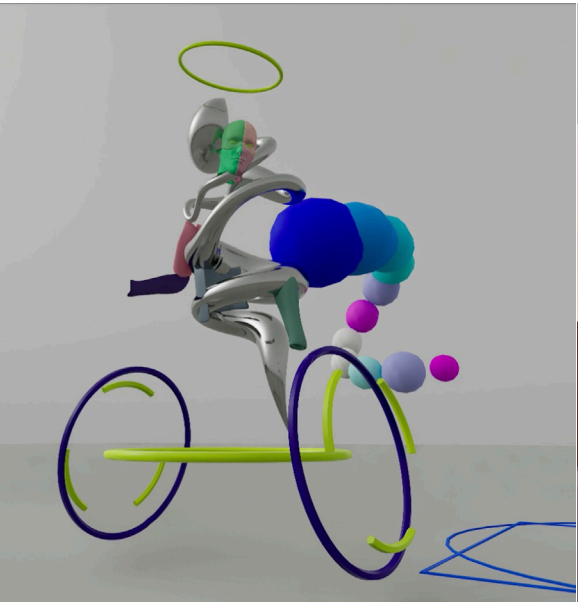
> In a film like *Microcosmos* you may be down there in the mud with the copulating ladybirds—it doesn't mean that

> this is identification, an imaginary mimicry. It may be red-and-black-spottedness, or jiggleness that attracts you, just as in watching an aquarium you may not have an anthropomorphic identification with a fish, but a recognition of floatingness or bubbleness. It may contact some place in yourself that knows weightless suspension and set up a sympathetic vibration with it. Similarly, you may find rollingness in the image of giant wave, spinningness with a windmill, or bristliness with the spiny protuberances on a prickly pear. Shape, colour, texture, protrusions and flourishes all reach out and draw us to them in an affective resonance. (n.p.)

Resituating this sentiment to an immersive media context in which the interaction is procedural and where the body is in actual movement (rather than imagined/cognitively mirrored motion), we can see how this could be an empowering form of dance expression; going beyond representation/identification to exploring affective embodiment through movement, texture and form that is not of our own self-image, and that extends and challenges our kinaesthetic and proprioceptive sense.

For the work *Figural Bodies*, from the Fairmont Congressional Ballroom at SXSW in Austin, Texas, performer and co-creator Kat Hawkins danced with their counterpart Susanna Dye in a London studio, in a shared virtual space and through a variety of insectoid and patterned graphic form, figures and interactions, with a reported sense of intimacy, agency, expansiveness and joy (see Figures 3, 4 and 5). This performance was implicitly disruptive within the context of the festival and in the specific exhibition context dominated by representational XR documentary, narrative, and character-driven experiences. Not positioned as a direct critique of the other work presented, it nonetheless prompted critical discussion about normativity, accessibility and inclusivity that was acknowledged as important by organizers, audiences, and indeed critics/commentators (see for instance Kent Bye's Voices of VR podcast #1195: "Exploring Non-Normative Avatars with Disabled Dancers in "Figural Bodies" Research Project").


FIGURAL BODIES




FIGURAL BODIES
Research that challenges the normative ways the body is understood and represented in immersive technology.
Reimagining fantastical embodiment beyond the humanoid form.
Presented by
Director & Researcher - Clarice Hilton
Director & Designer - Neal Coghlan
Choreographer & Creative Producer - Kat Hawkins
Choreographer & Creative Producer - Suzanna Dye
Sound Design - Ashley Noel-Hirst
Executive Producer - Dan Strutt
SXSW 2023
British Underground
Goldsmiths
UNIVERSITY OF LONDON
Future Art and Culture
2023
candoco dance company
UKRI
Arts and Humanities Research Council
TARGET3D
NOITOM
STUDIO ASZYK
Mocap Streamer

Disability-aware design thinking holds lessons for *all* users and makers of virtual and immersive tech. Following the insights of the Possible Bodies project (and more broadly of both crip and queer theory), realist paradigms of capture and re-presentation are not, in fact, Real, but are imaginations that often passively reproduce hierarchies of inclusion and access based on apparently "common-sense" normative assumptions. These exclusive regimes are imbued in the everyday procedural operations of software and hardware. The problem, then, is at once technical, cultural, and philosophical, at times seemingly insurmountable since it carries the barrage of the whole of human history and (often specifically global-North) ways of being-in-the-world. What *can* be done, however, is to address aspects of design thinking specifically within this burgeoning field of practice of immersive media to afford agency to all potential users. Whilst it is dangerous to suggest that virtual spaces can compensate for, or provide an escape from, a real world of exclusion, oppression and violence, we can say that there are inherent possibilities for agency, intimacy, joy, expansiveness and disruption in the embodiment and experimental exploration of non-human forms. We could, indeed, frame this dance practice in a universal manner as Deleuze and Guattari's full Body-Without-Organs writ large—a virtual body that defies classification, open and porous, and full of potential expansive modes of becoming: "This body without organs is permeated by unformed, unstable matters, by flows in all directions, by free intensities or nomadic singularities, by mad or transitory particles" (40). Through the experimental projection of embodied consciousness into these forms through motion-captured dance procedures and mechanisms, could we start to relinquish the stable, ideological images (imaginaries) of what an organized *normal* body is, to embrace diverse bodies and minds as *dis-organ-ized*?

Figure 3, 4, 5. For 2023's *Figural Bodies,* Kat Hawkins and Susanna Dye of Candoco Dance Company connected remotely from Austin, Texas to London through alien avatar forms. This work was produced as part of the Goldsmiths Mocap Streamer project. Director: Clarice Hilton; Art Director: Neal Coghlan. © Dan Strutt

An Alien Phenomenology of Digital Dance

Moving from material practice back to the theoretical leads to a return to my opening point about these practices "doing" philosophy, by way of noting an optimistic or rather "pharmakological" potential inherent within them (Stiegler). To do this I go to Ian Bogost—wearing his speculative realist hat—and by drawing his methodology of Alien Phenomenology together with the aesthetic and cosmic philosophy of Laura Marks. In doing so, I see interesting parallels develop between their work that suggests that a close attentiveness to the material automatism of both natural and digital systems, alongside a willingness to engage in playful, speculative, and magical, apophenic or metaphorical thinking, can yield new patterns of thought. I suggest that the inherent virtuality of dance that Suzanne Langer described, extended into digital virtual systems, may align with an intention to disrupt modes of habitual thinking and that this can creatively connect perception and feeling with immanent realities full of ethical potential.

I turn to Ian Bogost's notion of "Alien Phenomenology" mainly as a critique of Kantian idealism—the idea that objects are inherently knowable—rather than in his more speculative idea of the "mind" of objects. This idea resonates with our critique of realist representation in immersive media, in as much as metaverse visions often assume a *naïve* model of a knowable reality reified in the perpetuation of sociocultural values such as those of "normal" bodies and identities. Meanwhile, digital media generates a profoundly different relationship to the representation of reality through a set of technical automatisms and their entailed material processes or procedural logics that are totally distinct from the analog. This automatism, for theorists such as David Rodowick, generates images that juxtapose with photographic realism, destabilizing photography's indexical ontology towards a kind of hyperreality.

> The key point of reference now will be to mental events–not physical reality moulded to the imaginary, but the free reign of the imaginary in the creation of images *ex nihilo* that can simulate effects of the physical world (gravity, friction, causation) while also overcoming them. (Rodowick 104)

Rodowick points to the fact that while trying to reproduce a credible reality in immersive media, or a photographic realism in synthetic images, 3D and immersive designers are actively struggling to reproduce anthropocentric "deeply recalcitrant norms of depiction", battling against the "powerful countercurrents that reconfigure these norms" (101). The question is "why?" There is an apparent assumption in the tech industry that we can only experience immersion and presence within a virtual space if its representation directly mimics our experience of external reality. Our practice-led dance research challenges this, as agency—the power to meaningfully act and interact—overcomes identical representation as the measure of feelings of embodiment.

Bogost intervenes here in interesting ways possibly because he has a background in video game design. He proposes a set of speculative, practical, yet playful methods for getting out of an anthropocentric view of reality. His focus is objects and things in the real world, as by focusing on them he engages in an ontological exercise of actively trying to decenter a priori knowledge about them, destabilizing habitual perception, and revealing new understanding of things. Everything, in fact, is revealed as "alien" and in speculating about their inner existence a new poetics of reality can occur, dwelling in immanent and dense complexities of Being, and towards a new kind of humility (121). To do this, he offers a philosophical practice of crafting or assembling things that he calls *carpentry*—"constructing artifacts that do philosophy" —that instead of putting into words, crafts meaning through things. Knowing resides in doing, not just thinking or writing about, and carpentry contends with "material resistance of a chosen form", i.e. the force or automatism of a thing that acts as a "countercurrent" against our creative intention. It is a very broad concept of making: "To do carpentry is to make anything, but to make it in earnest, with one's own hands, like a cabinetmaker"; Bogost himself notes that it seems like a fairly absurd idea, even when done with the practice of philosophy in mind.

> It might seem silly to talk about making things as if it's a new idea. Designers, engineers, artists, and other folks make things all the time. But philosophers don't; they only make books like this one. (99)

So to engage in *philosophical* carpentry is to attempt "to capture and characterize an experience it can never fully understand, offering a rendering satisfactory enough to allow the artifact's operator to gain some insight into an alien thing's experience" (100).

Perhaps counterintuitively, software programming is one method that is offered as carpentry, and in fact this is Bogost's primary example, given his own track record in making videogames. He describes how a piece of software can be designed to disrupt and break down internal processes and reveal it in a different way. It can essentially open the black box of computation and make us contemplate "the internal experiences of withdrawn units" (105). Extrapolating this to actual wood carving, we can imagine a knot within the wood that was a reaction to an experience that the tree had, and yet that experience is locked within the tree. Through carpentry, we discover a material resistance to our understanding of the object, within the knot, and we discover a new perspective. Of course, a knot in a tree, like a glitch in code, is perceived by human instrumental thinking to be a fault, and yet through an alien phenomenology it can also be understood as an experience that the thing had, and we can attempt to appreciate it through metaphor—what it was "like" for the tree/software to experience that event. This is what Bogost calls a "weird realism" (109).

This leads us to another *alien* method that Bogost offers that seems relevant—*metaphorism*—a technique of creative distortion for revealing how objects might perceive and experience. This is a truly imaginative practice—a thought experiment where we engage in "speculating about the unknowable inner lives of units" (61). He notes that this methodology is distinct from "representational metaphor" which would suggest using metaphor to explain and/or solidify meaning through likeness (i.e. *molecules are just like lego bricks*), instead saying that these metaphors should distort and "break with some of our own modes of knowing" (67). Bogost offers what he calls the "clarity of distortion" as "we never understand the alien experience, we only ever reach for it metaphorically" (66). Referring back to Suzanne Langer and her conception of the "virtual powers" of dance, we can see that choreography is inherently a form of *kinaesthetic metaphorism*; where metaphors of emotion, objects and forces are crafted through the body's capacity for expression. There is something specific about dance's ambiguous abstraction of

affect that permits a richness and density of metaphoric interpretation. As an example of this, and seemingly channelling Bogost's absurdism, international science students are invited to "Dance your PhD" in an annual contest (now in its sixteenth year) (Ouellette). While this may seem like a whimsical exercise, it interestingly illustrates how complex ideas about force and substance can be evocatively interpreted through body movement expression and kinaesthetic metaphor, encouraging new modes of thinking about and representing abstract principles.

Following the principles of a distorting yet revealing metaphoric relationship, I see the potential of situating our digital dance research within the conceptualization and methodology of alien phenomenology. The philosophical proposition made through this positioning in theory is that in the experience of moving in different bodies, distorted forms, and through de-realized or non-human manifestations of force, intention and agency, we might think metaphorically, in de-anthropomorphizing ways, about secret intimacies with things. We can speculate what it is like to be an insect or an amoeba, interacting with a river stream, and how they experience each other (though this selection of agents is perhaps already too tangible and suggestive of narrative). This is perhaps all the more powerful because this form of speculation in the form of dance is not merely a thought experiment, but rather embodied acts of crafting/carpentry in an alien space. For the dancer, this is the making of a dynamic image, not "with one's own hands" (assuming the dancer has hands at all) but with the capacities of motion of a total body; for the developer-technologist it is the stitching together of base-meshes, particles, colliders and textures as if sculpting a material. Framing this work through notions of carpentry and metaphorism may indeed assist in an iterative, collaborative creative process with a tacit acknowledgment that dancers and digital artists are *both* creative technologists capable of "virtual" metaphoric thinking. A deliberate and strategic estrangement towards taken-for-granted things (like a normative body) and the disruption and re-interpretation of the cultural structures in which our own body is enframed can be intentionally developed with a collaborative willingness to challenge disciplinary knowledges.[7]

Talisman Images and Cosmic Connection

Finally, I turn to the work of media philosopher Laura Marks. More than a *speculative* realism of the secret lives of things and objects, Marks offers a kind of metaphysical *realism* that nonetheless resonates with Bogost's often absurdist critique of idealism and anthropocentrism. What it offers to digital dance research is a way of thinking beyond images as mere representation, or as only modes of imaginative thinking, and instead positions them as entities that enact real difference in the world. In her book chapter "Enfolding-unfolding aesthetics, or the unthought at the heart of wood", she applies a Deleuzian/Liebnizian lens to describe a way of experiencing the world that is similar to Bogost's notion of carpentry—an aesthetic mode of affording agency to both image makers and the images themselves. For Marks, aesthetics describe "how we engage with the world" or more precisely with images: "by image I mean not only the visible, but all that is perceptible: visual, audible, tactile, olfactory, etc." (152). Actual images are extracted from the infinite virtual through what she calls "calculations" or "procedures", which *unfold* immanent information into specific forms that are cognizable—our own perceptions, but also material things and objects: "photographs, brushstrokes, and iconic images". Images are therefore always technical, dependent on processes and interfaces (both technological and cognitive) that organize noise into signal. These are, for Marks, aesthetic processes rendered technical, that determine what images are unfolded and what stay enfolded. She describes:

> Enfolding-unfolding aesthetics is useful for critical thinking: what is deemed useful information, what is forgotten as mere matter? What continues to be taken up, to generate new signs as it circulates? (153)

Of course, usually what we carve out as images and things is determined by very normative anthropomorphic frameworks. Reflected in the position of the Possible Bodies collective given above, Henri Bergson tells us that things exist unto us as far as we can use them, act upon them, or organize them into categories such that we can know them—he calls this the "poverty of perception" (38). Nonetheless, we can also, with an effort of will, instinctively engage in metaphorism to get beyond this utilitarian aesthetics, and to think

about the dense, infinite immanence of things and substances—such as wood.

> We humans are not so different from the things we think about, and that is why we are able to think alongside them. That's why we can anticipate their reactions: from massaging a dog based on where you think it might ache, to sectioning the muscles of a slaughtered animal, to responding mimetically to a potato plant infested with bugs, and calling on our plant nature to find a way to cure it... This response to the world, according to Bergson, is instinct: what we have in common with animals and plants. So, when we get in touch with the heart of wood, we are using our instinct to call on our internal cellulose-like nature. (Marks, "Enfolding-Unfolding Aesthetics" 156-157)

Carpentry for Marks does not engage in *speculative* thinking, but rather it weaves a real connection between the wood within us, and the us in wood. Like carving form out of wood, mediation—that is, making images—does not simply represent the world, it weaves connection and unfolds the relations between objects and things:

> Mediation does not destroy nature but is part of it; it is an extra set of folds, a surface complication, codifying and altering nature, and contributing its own materiality. (159)

There is a processual intersubjectivity between human and thing suggested here by Marks that allows us to potentially explore (or unfold) aspects of reality beyond the representational, naïve realism "that has been unfolded for us". This involves the materiality of objects, and the "agency of non-human perception, and also non-animal, organic perception, and even the perception of non-organic entities" (160). This observation, running from Bergson through Deleuze and Guattari and to Marks, tells us: "it is a question of surrendering to the wood, then following where it leads" (157). This seems complementary to Bogost's alien phenomenology of speculative experimentation, and indeed, to the above-proposed methodologies of digital dance practice.

In more recent work drawing on Persian and Arabic ontologies of representation, Marks extends these concepts around mediation to a specific type of intentionally ethical image that she calls a "talisman-image", which, by design, acts to unfold the infinite in specific ways.

> A very few works make an affective fold that reaches all the way from the cosmos to your body, through delicate and risky processes of contact, correspondence, sympathy, and passion. ("Talisman-images", 253)

She draws upon a magical/mystical metaphor to elaborate a genealogical approach to a type of talismanic images that have been specifically crafted, carved, embossed, woven, or *coded* for the explicit purpose of effecting a change in the world through the harnessing of "cosmic" energies. These aesthetic images, throughout history, have been diagrams of the stars, animals, object and things, abstract and algorithmic patterns, presented in ways that cultivate "the interrelatedness of things … making themselves microcosm of the universe" (232). Rather than simply *following where the wood leads,* these intentional images try to harness the energies of cosmic connection, between the cosmos within us, and its continuity with the infinite.

Bringing these concept back to dance research, I articulate a wilfully optimistic perspective about new immersive technologies as potentially talismanic images. While it is clear that these systems have parameters and limitations and do not afford total freedom, they do permit a style of embodied agency within the materiality of the digital that aligns with an intention to weave affective connections through an intentional *unfolding*. This is experienced by the dancer/user themselves, in their own words, as full of potential, as Tia May Hockey remarked in an interview as participant of the work *Virtual Touch, Virtual Dance* in 2021:

> There were definitely some out-of-body experiences and moments where I felt the potential of the virtual connection with the other performers. It required me to fully engage with my imagination and to let the reality around me disappear in order to let my attention be fully present in the

virtual space. (quoted in "A Simple Tool for Remote Real-Time Dance Interaction in Virtual Spaces")

Digital tools can remove obstacles to metaphoric thinking and the mimetic imagination through the simulation of the impossible. With intention, we can attempt to collaboratively craft or *carpenter* multisensory, embodied and operational images, and to create *procedural rhetorics* that are designed to augment non-representational thinking and fracture normative perception. As a talismanic image, this may feel creative, expansive and joyful; moreover, it is, through the lens of an alien phenomenology, also engaged in the work of cultivating ourselves as a microcosm—an inherently ethical (if not magical) process.

Conclusion

Immersive tools and interfaces, interactive design processes, procedural logics, and digital aesthetics can, I suggest, help us unfold alien phenomenologies and weave connections between objects and things that decenter the human experience (anthropocentric), while revealing something different about us as relational beings. Together, the new systems of creation have the potential to unfold new affects, perceptions and concepts, and thus new ways of being in plural, porous, and diverse bodies-without-organs, even if only for the duration of the dance. However, this is not as simple as just jumping in, as these systems can easily carry with them unquestioned normative assumptions and ideological legacies of surveillance and control. While entering the phenomenological space of digital dance can indeed be immediate and instinctual, to do it critically and mindfully requires "activation" —an effort of will. As Marks describes: "…unfolding requires a certain *force*, a desire to bring something into actuality. Some things resist unfolding" ("Unfolding-Enfolding Aesthetics", 153–my emphasis). We can perhaps think of the "force" that Marks' here describes as an effort of positive creative intention that must be leveraged against the ideological structures of categorization in volumetric regimes.

In this vein, both Bogost and Marks offer a prerequisite to their respective "alien" and "talismanic" processes. For Bogost, this is

captured by the concept of *wonder*, whereby we cannot just simply and easily engage in alien phenomenology without doing the groundwork of dismantling prior knowledge.

> The act of wonder invites a detachment from ordinary logics, of which human logics are but one example. This is a necessary act in the method of alien phenomenology. As Howard Parsons puts it, wonder "suggests a breach in the membrane of awareness, a sudden opening in a man's system of established and expected meanings". To wonder is to suspend all trust in one's own logics, be they religion, science, philosophy, custom, or opinion, and to become subsumed entirely in the uniqueness of an object's native logics—flour granule, firearm, civil justice system, longship, fondant. (*Alien Phenomenology*, 124)

For Marks, this groundwork also needs to be done and is captured through notions of *ceremony* or *ritual*—the work of setting intention, clearing space, and preparing the affective body before invoking the "irrational cut into the perceptible world that may be able to discover primordial bodies, or bodies yet to come" ("Talismanic Images" 252). In past mystical practices, this involved "performance, mimesis, incense and disorientation" (251) through disciplined or devotional practices such as fasting, chanting, ritual preparing of materials, or performing repetitive actions to increase focus and place the body in the correct somatic disposition. While we all may have our little rituals before engaging in acts of creation, there is an added layer of *faith* that she calls upon before activating the talisman. Drawing on Persian philosopher Al-Kindí, Marks describes that "the operator and the recipient of image magic must have focus and right intention, and the magician must have imagination, desire and confidence/faith (*fides*)" (250). Of course, this does not have to be magical, and in many ways, this is the normal "virtual" practice of the performer who has to mentally and physically prepare to enter into the "phenomenological space" of the dance (see "Interview with Hubert Godard"). Similarly, with motion capture there is an almost ritual process of calibration before entering the virtual space, by suiting up with sensors or markers and going through a sequence of poses. Only then does the avatar figure snap into shape and take on the identity of the dancer (or is it vice versa?).

What these activation rituals do is suspend normative perception/recognition, and engage imagination and wonder before creative action. There is a decisive difference, however, between cultivating this specific disposition in embodied, interactive, and immersive media, and doing the same with "old" media that is consumed with a more-or-less immobile body. While with film we do of course still engage both imagination and embodied simulation processes, there are valid concerns over our unobstructed processes of identification with continuity-style media representation that endure today (from Apparatus Theory onwards). Although no longer framed through the simplistic dualism of active vs passive spectatorship, the reproduction of ideology in mainstream media is real, well-documented, and manifold in its techniques. Nonetheless, thinking about the affordances of embodied media *only* within this same regime of representation/identification leads both producers and critics down a narrow path of a politics of difference—where digitalization (capture) feels like appropriation, and simulation is seen as artifice. Through this lens, we will always have an impotent *playability,* or docility, without the agency to instigate substantive change.

However, thinking phenomenologically and through aesthetic frameworks that see images as portals rather than reflections, we can start to see a reconfiguration or extension of what is considered to be embodied expression. Through virtual and telematic dance movement experimentation we can see that this is not some transhumanist dream of escape from the flesh, but rather extended and transformed sensations of embodiment that occur *with others* in shared digital environments. Motion capture alongside XR technologies can, if designed correctly and for all users, afford agency to craft (or unfold) ethical intimacies between distant subjects—not through the instrumentality of "playable bodies" but through a non-human aesthetic and speculative metaphoric exploration. It also has the potential to resist normative perception, challenging the naïve representational regimes of realism that are both destructive, exclusionary, and oppressive. In this way, we can start to think about digital dance performance as being a practice of (un)doing philosophy.

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Notes

1 This type of work is also done in recent philosophy work such as *Reality+* by David Chalmers, or by Metzinger, but without any specific mention of dance.

2 As an example of this, most motion algorithms in inertial sensor motion capture (where poses are estimated or interpolated from abstract sensor data) are trained on walking, running, jumping or fighting movements, with normal gameplay style movement in mind. Dance, in its greater complexity, often "breaks" the algorithm, for instance with long jumps, floorwork, or back bends that the system cannot recognize, and tries to correct in often unusual ways.

3 For Foucault, *docility* occurs when a group of people are so used to being watched continuously that their discipline becomes internalized and they no longer have the capacity to resist ("Discipline and Punish"). When people enter into this state, they become docile bodies. Through Eugene Thacker's analysis the codification of the body is a form of biopolitical discipline "the relation between discourse/language and the body/materiality is one of docility, a "technology" of bodily production. Change the code, and you change (render docile) the body hardwired as that code" (6).

4 The core research collective included dancer and technologist Clemence Debaig, 3D artist Neal Coghlan, creative technologist Clarice Hilton, and developer Paper Plane Software–see mocapstreamer.live.

5 Strutt and Cisneros, Strutt et al., "Motion Capture, Kinetic Synaesthesia and the Digital Aesthetic", "A Simple Tool for Remote Real-Time Dance Interaction in Virtual Spaces".

6 "Figural" here refers to Deleuze's formulation of the *figural* as opposed to the *figurative* in his "Francis Bacon, the Logic of Sense".

7 Dancer Tia May Hockey described this intention: "When I had a shared intention to play with in improvisation with another performer, I felt moments of connection with our virtual characters and through to my being. It's kind of like the connection you make with an animal and you both know that you're watching each other, there's a level of sensitivity required by both parties to listen, anticipate, predict, and respond. It was hard to maintain this sensitivity, but I did experience flashes of it" (Strutt, "Dancing into the Metaverse").

Entangling Designer, System and Participant: An Interdisciplinary Methodological Account for Reimagining Embodied Knowledge in VR

—— Ioulia Marouda (GHENT UNIVERSITY)
ORCID: 0000-0002-5467-0689

—— Adriana La Selva (GHENT UNIVERSITY)
ORCID: 0000-0002-8524-5327

—— Pieter-Jan Maes (GHENT UNIVERSITY)
ORCID: 0000-0002-9237-3298

The design of interactions for immersive environments is a process and a craft that connects diverse disciplines and methodologies. Informed by theories in posthumanism and human-computer interaction, this paper aims to explore the ideas that emerged during the implementation of a series of actor training exercises in VR. This work is part of a broader research project that focuses on reimagining embodied techniques of training that were developed by Odin Teatret. For this particular experiment, we selected three exercises to work with and translated their intrinsic qualities into interactive environments, drawing from Diana Taylor's notion of scenarios as meaning-making paradigms. Meeting this challenge required crafting our own tactics which include three theoretical concepts that address the intricacies of the work, along with a unique design process. The concepts that we will expand on in this paper

are "translation", "agency", and "event". "Translation", in our context, entails the preservation of embodied meaning recorded as motion capture data used as the primary source to create a virtual archive. The notion of "agency" helps us understand the intentionality of each agent of a VR project as an emergent property of the experience. Lastly, the concept of "event" interprets the dramaturgy of interactive artworks as encounters to be experienced through the participants' bodies. These concepts replace a strict methodology as a common ground to navigate the complexities of a collaborative project and the instability of working with new technologies.

Keywords: embodied knowledge, immersive technologies, digital archive, interactive art, theater training

Technological advancements and digital mediation create both possibilities of transformation and challenges in our approach to archives of intangible heritage, as they introduce novel methods for curating and disseminating knowledge (Hou et al.). This paper delineates a virtual reality (VR) interactive experience titled *Odin Teatret: Entangling Practices,*[1] which has been developed as part of the interdisciplinary doctoral project *Practicing Odin Teatret's Archive*[2] (*POTA*).[3] The text delves into the connections between the developed work and the underlying theoretical foundations, offering insights into the design process that was developed through the research.

With a history spanning over sixty years, Odin Teatret holds an extensive archive that encompasses various forms of documentation, including paper and audiovisual materials such as photographs, videos, letters, sketches, and notes. Within this project, however, our interest lies in the "bodies-as-archives" of the performers (Lepecki). Throughout their careers, the performers have developed and mastered a series of exercises designed to cultivate embodied knowledge and technical skills, foundational to the actors' scenic presence. The initial challenge of the POTA project has been the exploration of innovative methodologies to capture, translate and find different means of transmitting these performers' embodied practices through an immersive and interactive experience with a virtual archive.

In her seminal book *The Archive and the Repertoire: Performing Cultural Memory in the Americas,* Diana Taylor articulates the fact that archived documents hold a certain status of unchangeable truth, which frames a colonial and Western epistemology that has ignored many other forms of knowledge. For Taylor, performance—just as performance training, we would suggest— "functions as vital acts of transfer, transmitting social knowledge, memory, and a sense of identity through reiterated, or what Richard Schechner has called 'twice behaved behavior'" (2). Acts of transfer then imply complex and hard-to-trace processes of transformation through time, a constant cultural process of reproduction and re-creation. Furthermore, the ways in which these acts of transfer occur are, for her, a way of renegotiating the gaps between archive and repertoire, calling us to "situate ourselves in relationship to it" (32). Following this plea, Taylor proposes a methodology for these acts of transfer based on the construction of scenarios: "meaning-making paradigms that structure social environments, behaviors, and potential outcomes" (26).

We have taken this scenario proposal as a common ground to design virtual environments in our project. However, it became explicit from the very beginning that creating meaning-making paradigms within it would be a challenge. To effectively determine what to archive and how to capture embodied knowledge, it was essential to develop a shared understanding of such knowledge and the potential ways of translating its meaning into the virtual realm. Following our initial experimentations, we realized that this undertaking would span multiple fields of research, encompassing not only contemporary performance theory (from which our scenario common ground came), but also digital performance (Jürgens et al. 1), advancements in human-computer interaction (ibid; Edmonds 11-23), interaction design (Goodman et al. 1061-1070), as well as disciplines that touch upon computer graphics, virtual reality technologies, neuro and cognitive sciences, geopolitics, and anthropology. We as researchers come from diverse backgrounds, which often gave rise to dissonance in the terminology and methodology used to approach the project. Notions such as training, texture, user, experiment, energy, and presence, often so clear in our disciplines, became the subject of long discussions among us. These tensions underscored the need for a tailored design framework, giving rise to two overarching questions that will be explored within this paper: a) what guiding principles can be implemented to approach transdisciplinary modes of documentation and transmission,

and b) in what manner can the entanglement of disciplines occur, and what form does this hybrid research assume?

In order to create a virtual archive, a fresh methodological framework helped us approach notions such as energy and presence from a data-centered perspective, translate the performer's body in the virtual, and create a navigation system that encompasses the dramaturgical structures of the training exercises. Along with Mieke Bal's notion of "traveling concepts" as a methodological common ground for interdisciplinary studies, we embraced the task of looking for the ones that would serve our research, and *do* something for the scenarios we were creating within the virtual archive (22). Looking at concepts as *actors* working with our research objects has provided us with significant insights into innovative methodological approaches in the field of digital humanities. What follows further is an account of a methodological speculation on the subject.

In *Entangling Practices* three distinctive exercises from the theater group—Resonators, Slow Motion, and Out of Balance—are explored using VR interactive displays, accompanied by a navigation system interlinking them.[4] The participant can opt to explore each exercise either as a demonstration by a virtual avatar or as an interactive encounter, grounded in a metaphorical interpretation of the inherent qualities of each exercise. Accessible through a dynamic menu that unfolds based on the participant's selected path, these exercises and their varied experiential modes contribute to an immersive exploration of the archive.

In this paper, our exploration begins with a comprehensive overview of the three exercises that form the core of *Entangling Practices*. Subsequently, we delve into the processes of translation, into an interactive VR-based system, as well as the participant's experiential journey within the project. The subsequent section articulates the theoretical underpinnings that have significantly shaped our work, establishing a connection between the theoretical concepts and our design endeavors. The concepts of translation, agency, and event serve as a conceptual framework interwoven across multiple dimensions of the project. Within this framework, the term "translation" involves both the transferring of content across mediums and bridging interdisciplinary intersections. "Agency" refers to the composite intentionality between the designer, technology, and the

participant of the work. Finally, the concept of "event" encapsulates the diverse small narratives that emerge through exploration and bodily perception. The placement of the theoretical concepts after the introduction to the exercises and their interaction is deliberate. This arrangement illustrates that the three concepts have emerged as tactics throughout the design process of the scenarios that host each exercise, rather than being predefined or imposed beforehand. It enables the seamless integration of theory and practice by presenting examples from the research alongside these concepts. In the following paragraphs, there is a section dedicated to the feedback garnered from the public display of the work. As a conclusion, the paper culminates in reflective insights into the emergent possibilities brought forth by the project and the intricate interplay of the three theoretical concepts within the overarching work.

Entangling Practices

Selection of Exercises

Within *Entangling Practices*, a selection of exercises was made, each interpreted and translated into interactive experiences. This involved distilling the inherent qualities of these exercises and orchestrating an interactive play. By inherent qualities, we mean the goals of the exercise, its rules and constraints, the evocative images proposed by its original iteration, and, the most challenging part, the manipulation of bodily energy it intends to generate for practitioners. To define the ethereal—and yet so palpable—notion of energy in theater has taken the time and imagination of many practitioners. Throughout decades of work in a field he denominated Theatre Anthropology, director of Odin Teatret Eugenio Barba conducted a captivating study on the utilization and manipulation of energy across various theatrical traditions. As a field of study that investigates training practices which are prior to creation—termed the pre-expressive field of work of the actor—Theatre Anthropology emphasizes the importance and the ways of harnessing the inherent energy within a living body as the crucial factor in attaining an extraordinary presence in a performance:

> Every theatrical tradition has its own way of saying whether or not the performer functions as such for the spectator.

This “functioning” has many names: in the Occident, the most common is energy, life, or more simply, the performer’s presence. In Oriental theatrical traditions, other concepts are used [...], and one finds expressions like prana or shakti in India; koshi, ki-hai and yugen in Japan; chikara, taxu and bayu in Bali; kung-fu in China. [...] It is paradoxical that this elusive quality is arrived at by means of concrete and tangible exercises. (Barba and Savarese 21)

In order to experiment with a range of energetic qualities, and in conversation with the practitioners captured, we have selected three exercises from the vast array we have captured so far, which approach this "elusive quality" in different and yet complementary ways: energy as vibration, energy as flow and directional energy. Our hypothesis is that this approach to energy and a robust navigation system amongst them can be applied to other exercises within our

Figure 1. Stills from Iben Nagel Rasmussen and Mika Juusela performing Slow Motion during the Motion Capture Sessions, October 2021. © Bruno Freire

virtual archive in the future. The exercises are elucidated below:

Work with Resonators–Energy as sound vibration.
This is a vocal and breathing work, activating different boxes of resonance in the body—top of head, nose, mouth, neck, chest and stomach more generally—but it can be subdivided into more specific and subtle compartmentalizations. While the roots of this practice, specifically developed for actors, lie in the work of many different practitioners such as Grotowski, Dario Fo, and the Roy Hart tradition, our approach counts on the expertise and years of work of Iben Nagel Rasmussen, Roberta Carreri and Patrick Campbell. Capturing their techniques in our lab allowed us to test a series of applications and technologies that can be implemented in our virtual archive to enhance the possibilities of VR as a medium for generating interactive feedback.

Slow Motion–Energy as flow.
This exercise aims at creating a collective and continuous slow flow of movements, which demands the practitioner's gravity center to shift constantly, according to the impulses given by other bodies and stimuli in the space (such as the breeze produced by other movements, heat, the sound of breath). Iben Nagel Rasmussen describes this continuous and collective flow as a "seaweed dance". There is a sense of surrender and passivity to it, of being danced by the space, of becoming part of a larger ecological system. Paradoxically, the slow and improvisation-like character of this exercise allowed us to investigate with a certain degree of precision the interaction of the visitor with virtual objects in the designed training studio.

Out of Balance–Directional energy.
In this exercise, the body is brought out of balance and, just before it falls, the descent is interrupted by one leg. With a fast twist in the opposite direction, the force that was pulling the body down becomes an "upward thrust" (Galli and Rasmussen 208), moving to an opposite direction, so the energy that was supposed to end in a collision with the floor is thrown back into the space, generating another out-of-balance opportunity. This continuous flow of falls and recoveries asks the performer to endlessly look for their limits. By triggering what one could call a crisis in the body, energy is constantly being re-directed into space. Going further, we argue that this energetic re-direction—a resolution of the triggered crisis and the beginning of a new one—works as a dramaturgical practice in

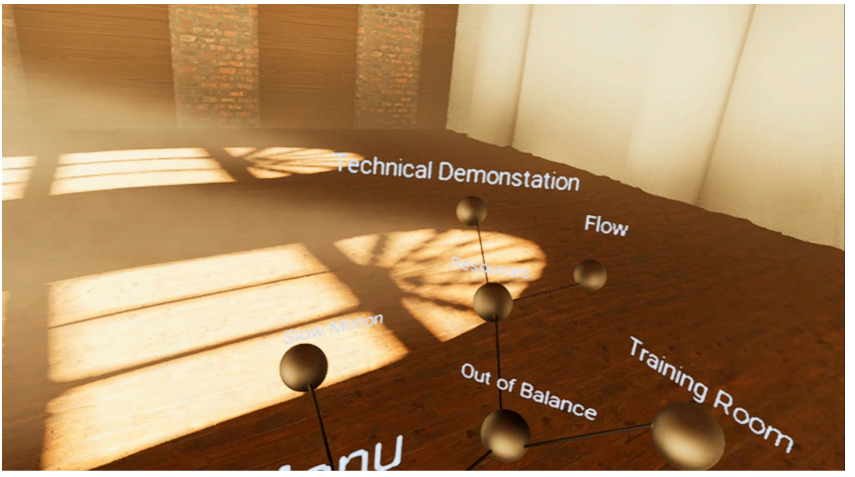


Figure 2. Screenshot from the VR Experience showing the Menu unfolding, 2023. © Ioulia Marouda and Adriana La Selva

physical training. In this sense, and following the opposite logic of slow motion, the precision of this exercise allowed us to explore how the virtual archive itself can "improvise" with the visitors, creating scenarios of energetic traces in the virtual studio.

Navigating the Scenarios[5]

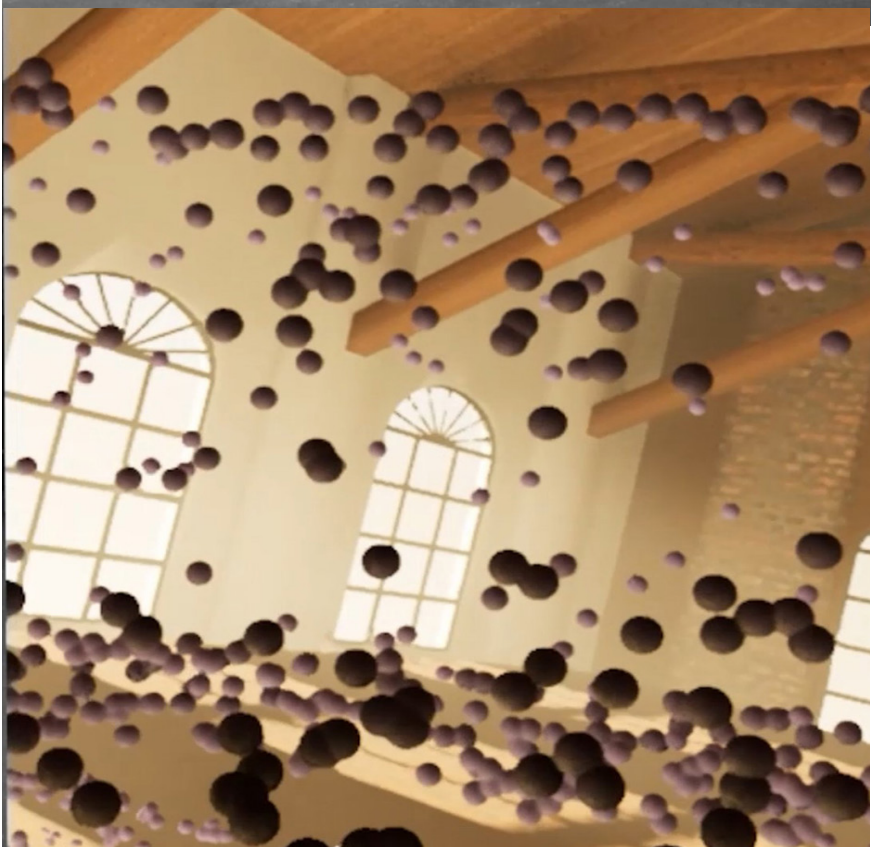
The experience begins with a brief introduction to the work by the researchers in the physical space, and a prompt to the audience to engage in the experience in any order they see fit.[6] After putting on the VR headset, the participant becomes immersed inside a spacious virtual room with wooden floors, warm hues, and plenty of light, reminiscent of a dance training space. The design of this space drew inspiration from various training rooms, notably referencing the renowned White Room, the main training hall for Odin actors at Nordisk Teaterlaboratorium (NTL) in Denmark over many decades. This serves to acclimate the participant to the subsequent physical training. During the preliminary phase of acclimation to the virtual space, participants are prompted to locate a small virtual sphere adjacent to them, featuring a *Menu* header. Upon interaction with the ball, a three-dimensional (3D) menu unfolds, presenting three additional spheres corresponding

to distinct exercises. This dynamic interface enables participants to select their desired exercise path.

Each exercise path bifurcates into two main trajectories, namely *Resources* and *Training Room*, affording the trainee non-linear navigation unrestricted by a predetermined storyline. The *Resources* path facilitates non-interactive engagement, allowing participants to observe or follow an abstract human-like avatar demonstrating specific exercises. The menu unfolds once again and they can choose between *Poetic Demonstrations* or *Technical Demonstrations,* which are differentiated by how free-flowing or precise the movement is. The full-body performances of the three exercises demonstrated in this VR environment were recorded over an extended period of motion capture sessions at the Art and Science Interaction Lab (ASIL) in Ghent, Belgium, in 2021. The actors featured in the recordings were either members of Odin Teatret or their students. The avatar chosen to represent all performers is intentionally the same; a figure that looks to be made out of roots designed to evoke the energetic cartographies inside a body. To our own surprise, it is impressive how this choice of giving all performers the same body enhanced their own particular identities. Their faceless and abstract bodies invite us to acquaint ourselves with them through their ways of moving, breathing, speaking, and singing.

When the participant selects the *Training Room* option, the menu choices vanish, allowing engagement with the exercises as an interactive experience. Each exercise undergoes a translation into an experience, using a metaphor[7] integral to its core learning, and subsequently, a distinct set of techniques is deployed for its realization in VR.[8] In Work with Resonators, the participant is prompted to utilize their voice through singing or talking in varied pitches, thereby exploring the impact of vocalization on their body and its interaction with the virtual environment. To achieve this, a ring of particles was designed to emerge at the height of the participant's core and to follow their movements within the room. Using an ex-

Figure 3. Performer Patrick Campbell singing the song Paloma Negra during his Motion Capturing Session in October 2021, and the view of the rings that the participant sees when they are in the Work with Resonators interactive exercise, 2023. © Ioulia Marouda and Adriana La Selva



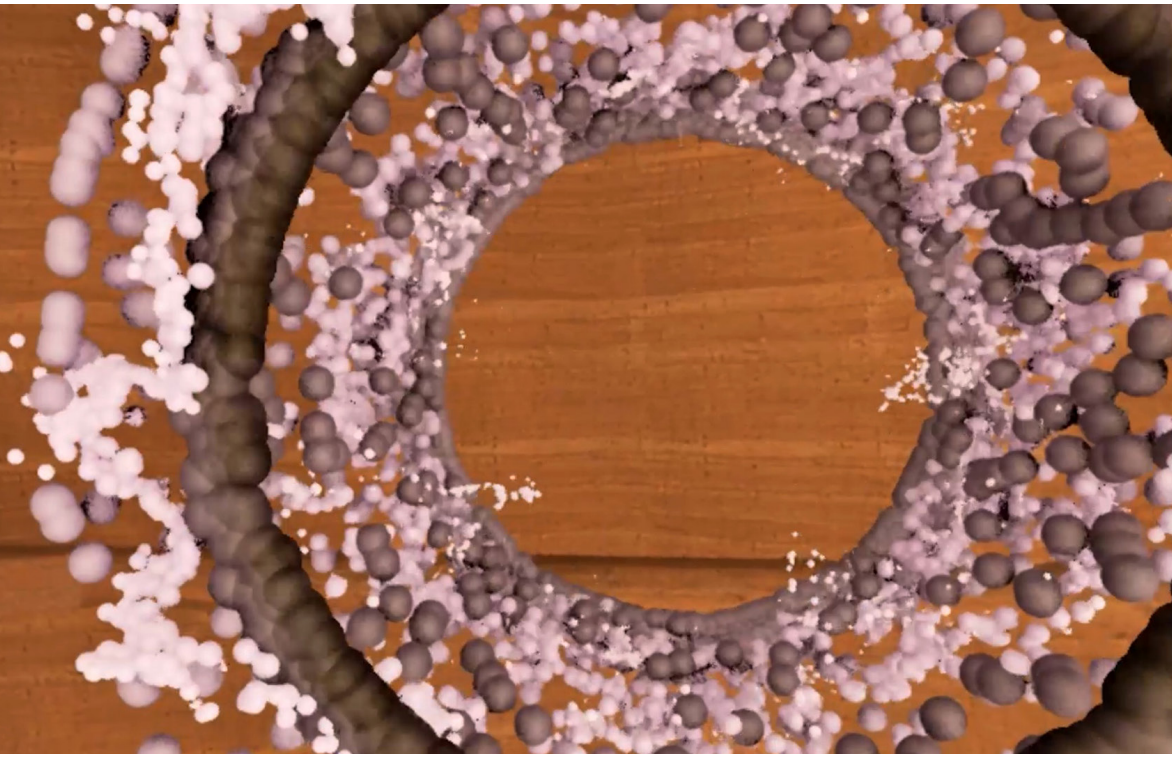


Figure 4. Screenshot of the rings of particles from below in VR, 2023.
© Ioulia Marouda and Adriana La Selva

ternal application, real-time extraction of the participant's voice pitch and volume is conducted. These particular characteristics of the voice were chosen as they are connected to the inherent quality of the exercise. These data control the particle system,[9] creating diverse forms around the participant based on the characteristics of their voice. Specifically, the higher the pitch, the higher the ring of particles ascends, and the louder the volume, the larger the radius of the ring around the body gets (fig. 3 & 4). Given the particles' three-second lifespan, they leave traces as they expand and contract, producing organic forms. These forms are characterized by their free-flowing and asymmetrical nature and envelop the participant. They serve as poetic visualizations of the measured characteristics of the participant's voice, lending an evocative dimension to the abstract qualities of their vocal expression.

For Slow Motion, our aim was to create a sense of slowness in virtual space, capturing a movement characterized by free-flowing dynamics that enable the trainee to experience their body without any tension. To accomplish this, we created a virtual forest resembling seaweed or algae, each with its own pre-baked loop animation, but responsive to the participant's movement when near. Upon entering this environment, the participant finds themselves surrounded by sixty algae of varying heights, ranging from 1 meter to 2.5 meters (fig. 5). These virtual plants move both deliberately and randomly since autonomous pre-design motion is intersected by the user's interaction.

The trainee is encouraged to begin dancing with the seaweed—or better, to be danced by the seaweed. If they choose to approach the seaweed, a physics simulation[10] is triggered in its skeleton, generating a reactive and unpredictable movement in the virtual plant

Figure 5. Screenshot of the Slow Motion Virtual Environment, 2023.
© Ioulia Marouda and Adriana La Selva

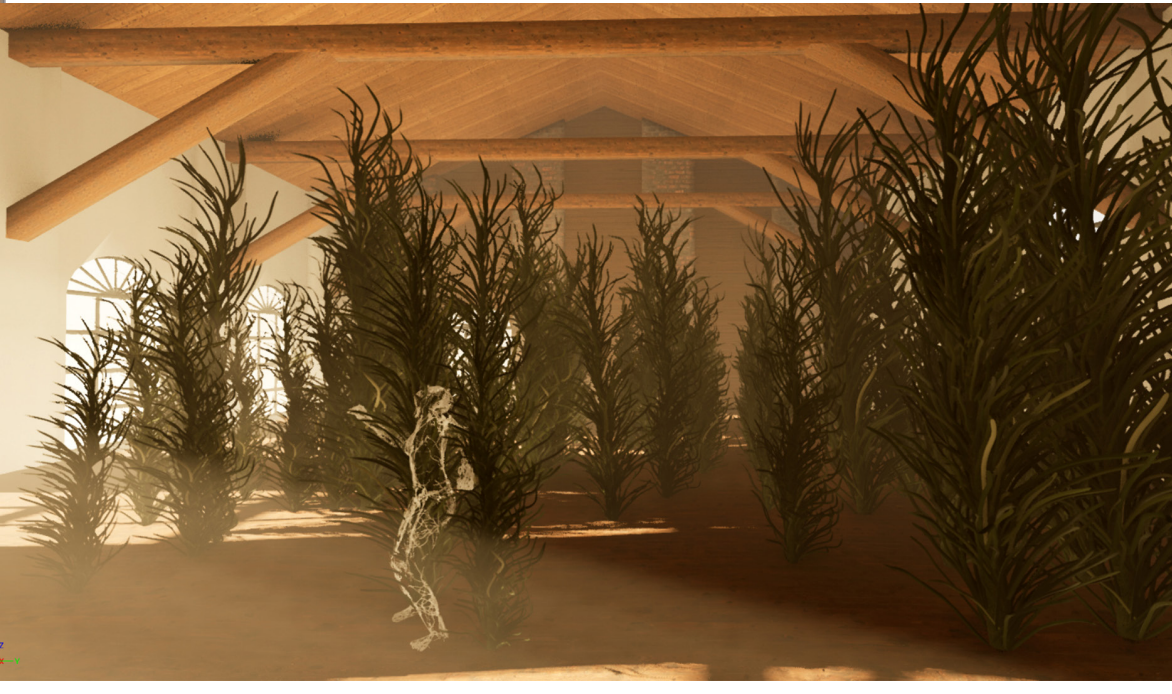
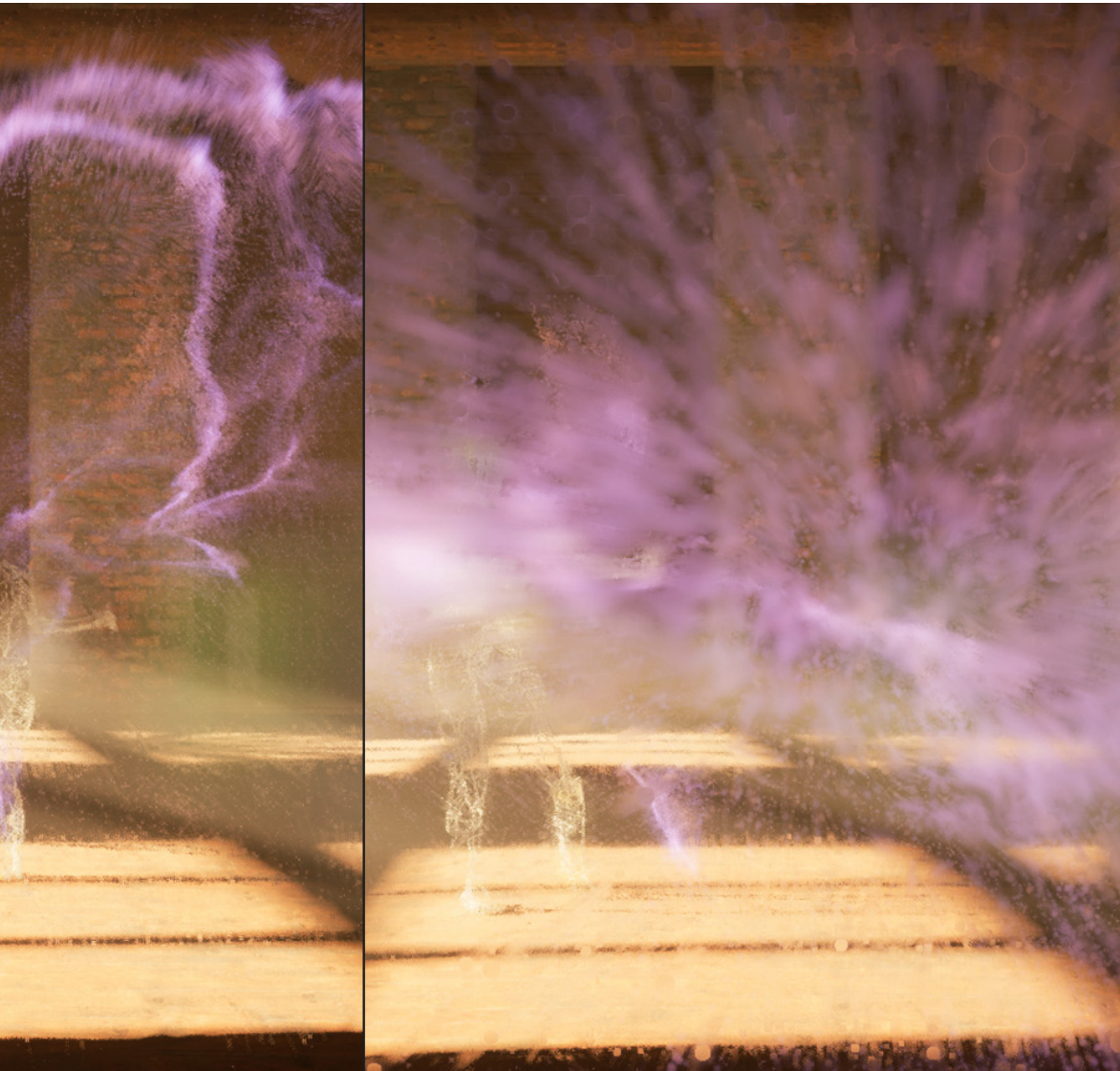


Figure 6. A participant interacting with the virtual seaweed, during the Slow Motion exercise, 2023. © Ioulia Marouda and Adriana La Selva

(fig. 6). After three seconds of this dynamic interaction, the seaweed gradually returns to its initial state, resuming its preprogrammed animation. Interactive behavior can be traced in scenarios where two algae come into contact during their movements. In such instances, both algae activate their respective physics simulations for a duration of three seconds. This interaction creates emergent effects that originate from the participant's physical presence and ripple outward to influence the entirety of the virtual environment.

Figure 7. Stills of the snapshots created as the avatar performs the actions of falling and upward thrust during the Out of Balance exercise, 2023.

For the Out of Balance exercise, our objective was to simulate the effect of internal energy gathering in the body during fall and subsequently being released in space during the "upward thrust". This effect was achieved through the utilization of a particle system applied both to the participant's body and the avatar, generating energetic tensions. When the body falls, the particles compress in the core, and conversely, when the actor creates the movement of throwing, they are sent away. This effect was particularly successful in the avatar's body, in which the whole body is being traced as a dynamic mesh. As the particles traverse space, they create a snapshot of the body, persisting for a duration of three seconds (fig. 7).



In the participant's body, technical constraints limit the realization of this effect to hand-tracking alone, precluding the creation of a comprehensive sense of whole-body energy in the current iteration. Nevertheless, it is part of our plans to incorporate full-body tracking in future iterations, enabling the recreation of the same effect for a more immersive experience. The participant retains the autonomy to initiate the experience anew at any point by interacting with the *Return to Start* ball positioned on their right side while navigating the menu or engaging in exercises.

To make this experience feasible, the coordination of various techniques and software was imperative. The main programming and real-time effects were facilitated through the deployment of the Unreal Engine 5 game engine, while 3D software tools such as Houdini and Blender were used for non-real-time models and animations. Additionally, a script was developed to extract the pitch and volume of the voice using Max/MSP. The Qualisys motion capture system (QTM) was employed in the lab for capturing movements. The project is built for Meta Quest 2 with the utilization of its hand-tracking capabilities. It is noteworthy that all effects and behaviors are bespoke, involving a combination of techniques not inherently designed for interaction in VR.

Central Theoretical Concepts

When introduced to the project, we faced two main challenges. The first problem had to do with the interdisciplinarity of the work. The designer and engineer among us did not have prior experience with physical theater or with the work of Odin Teatret. While the majority of us had experience with new technologies, none had experience working on a VR production of such scale and with the use of cross-platform data. Moreover, the meaning of terms common for one discipline was alien to or had a different interpretation from the other. One particular example is the notion of "texture", which from a humanities perspective has been interpreted by Tim Ingold as a generative weaving comprised of "fields of force and flows of material" (91), whereas for someone working with computer graphics, it is intuitively understood as a two-dimensional texture applied on a three-dimensional object to give it the illusion of realism. The

second problem we faced revolved around finding a blueprint for navigating an extensive, intangible archive and working with a medium that lacked established methods or a lengthy history of precedents. Within one practice-based project, we were called to curate a series of exercises, develop a scenario for each of them, establish a dramaturgical structure among the scenarios, provide creative direction, oversee development, and design sound elements. We sought out well-established fields of study to address the challenges at hand, from which Human-Computer Interaction (HCI) stands out prominently. HCI delves into experience design and has arguably influenced interactive art (Edmonds 11). Our approach is closer to its major paradigm considering "interaction as phenomenologically situated" (Harrison et al. 5), which resonates with the three concepts expanded below in this section. Even though such systematized theories are useful for our work, it has been argued that HCI is disconnected from actual interaction design practices, as the complexities of design cannot be reduced to objective problems, but are dependent on the context and the designer's actions (Goodman et al. 1061). Similarly, scholars who engage in practice-based research recognize the complexities of combining emerging technologies with artistic research, either by calling researchers to embrace the messiness and situatedness of practice (Sullivan et al.) or the unforeseen outcomes of a process that resembles scientific experimentation (Salter 14).

Our approach to tackling these intricacies was to establish our own set of concepts we could return to and that could serve as traveling concepts of communication, along with a design process that would fit the uniqueness of our work. Given the limited number of team members actively involved in the project, we opted for a collaborative approach, distributing practical tasks based on each individual's skill set and medium of work. It was the unique skills and limitations of each individual that shaped the focus of the work and the three concepts. The first of these, "translation", arose in response to the need for transferring knowledge into data and subsequently directing it into an experiential format, while both "agency" and "event" were connected to the challenge of scenario-making and dramaturgy within a virtual archive.

Translation

Integral to our approach in engaging with the selected exercises is the concept of "translation". Translation theorist Maria Tymoczko defines translation as a process of conveying meaning, etymologically from the Latin root of the word "carrying across" (56), while recognizing the cross-cultural and cross-temporal nature of the term (65). From the project's nascent stages, an instinctive focus emerged, centered on the extraction of inherent qualities of each training technique. This emphasis revolves around the process of translating these qualities into experiential realms, affording participants the capacity to apprehend their corporeal presence and movements within the system. Our interdisciplinary dialogues became somehow a particular training on its own. As La Selva mentions elsewhere:

> The nature of these dialogues between us reveals the layers underneath the structure of this experience with the archive, a praxis of translation which addresses the work on actions at each layer of this complex, intangible assemblage, elaborated through data, affects, energetic qualities, and intra-actions. […] A research mode, which eventually takes shape through an encounter with the materiality of the space and the other bodies, in which pre-expressivity is shaped into creation. This tangible manifestation is what allows a certain knowledge to evolve, to move and transform across bodies and cultures. (forthcoming)

This translation process has helped us shape the tangibility of the exercises in the virtual space and navigate the chain from embodied techniques to interactive principles in VR design. In Work with Resonators for instance, the sonic vibration of one's vocal sources activates a system of particles, which in turn respond to the frequency and volume of this vibration; in Slow Motion, one is danced by the movement of the seaweed; and in the Out of Balance exercise, the energetic vectors created by the change of balance in the body are displayed as lines of force in the virtual studio, creating an energetic texture into the space. Concurrently, these tangible metaphors have served as a communicative bridge among professionals with diverse backgrounds, spanning performance, design, new media, and engineering. For instance, they allowed someone not trained in performance to understand the quality of slowness, as seen in Slow

Motion, through the visual metaphor of seaweed, and translate it into an interactive or dramaturgical element. These metaphors facilitate an embrace of the multifaceted nature of VR design, encompassing unbounded and transdisciplinary modalities that draw from various fields but remain unencumbered by the boundaries of any particular discipline, as explained in the introduction.

In a project marked by complexity, there are several points of translation. The performer consents to the transfer of their embodied techniques, which are subsequently converted into a series of points in 3D space, and then mapped to a stick-figure skeleton. This process is followed by the skinning of the skeleton with an avatar. The avatar could have any form, as the recorded movement is free from its prior embodiment. On a conceptual level, as previously elucidated, exercises are translated into interactive experiences based on their inherent qualities. This conceptual translation aims to manifest the energetic tensions residing within the human body into a tangible form. From a technical perspective, an additional level of translation is introduced through the incorporation of techniques borrowed from diverse fields, including particle systems and interactive behaviors, which have found extensive application in the video game industry. The adoption of these techniques is rooted in the decades-long history of research and development within such industries, offering valuable insights for optimizing our work. However, these techniques are repurposed to foster a creative exploration of an immersive archive. Upon engagement with the created scenarios, the translation process reaches its culmination, transforming into an encounter that is unleashed through active participation. The participant, in turn, undertakes a personal translation of their virtual experience through their perception and memory.

Agency

In this project, we are called to reevaluate archives and archival practices in a world profoundly transformed by technological mediation. The notion of knowledge domiciliation, rooted in the very etymology of the word "archive" is being challenged by this project.[10] The re-enactment of the practitioners' embodied knowledge translated as virtual interactive designs challenges the idea of knowledge ownership and agency in transmission models. While traditional notions of agency imply intentional and autonomous action, the me-

diation of technology introduces complexities. Does agency remain true to its original form when mediated by technological systems or is it influenced by the constraints of the medium? How do users negotiate their agency within predetermined digital environments? By delving into the notion of intra-action, this section briefly unpacks the boundaries associated with the various agents of our proposed archive, the trainer and the trainee, the designer and the designed "thing", the human and the technological. We explore intra-action in order to consider what agency can *do*, as a traveling concept borrowed from quantum physics studies, in new transmission models for embodied work in VR.

Feminist theorist and physicist Karen Barad defines the concept of intra-action, as "the mutual constitution of entangled agencies" (33). The difference lies in the fact that in intra-action, contrary to interaction, distinct agencies "do not precede but rather emerge through intra-action" (33) and "are only distinct in relation to their mutual entanglement; they don't exist as individual elements" (33). Importantly, for Barad, what emerges from this mutual constitution of entangled agencies are primary ontological units which she terms "phenomena", interconnected and inseparable from the contexts in which they arise (333). Diana Coole's studies on phenomenology add depth to our framework when she proposes agency as a "spectrum of agentic capacities", which are constituted by phenomena rather than by individual subjects (128).

This shift from subjects to phenomena allows us to understand agency in VR not as inherent to each agent but as an emergent property of each encounter. Despite being disembodied and lacking what might traditionally be considered "real" intentionally, a pre-designed system within an art context still impacts individuals who bring their personal cultural histories and apply their own interpretations to their interactions (Castellanos and Gromala, par. 32). The evocative power of motion capture, when paired with immersive technologies, can go beyond duplicating or substituting human interaction, to uncovering elements "which have the potential to reveal new insights and new sensations" (Strutt and Cinceros 63). Within our project, this affective agency manifests through approaching the exercises as generators of energetic qualities, depicting on the one hand a more formal pedagogical transmission, but also exploration, evoking pathways from where the practices captured can transform

through the visitors' personal cultural histories. By providing the system with sets of rules, physics constraints,[11] textural forces, and vectors, we allow it to take its own shapes, which cannot be fully predicted or controlled. When designing interactivity, we design a set of simple behaviors that collectively form a more intricate one. The virtual elements interact with the participant and with each other, thus creating emergent behaviors. For example, the dancing with the seaweed scenario built for the slow-motion exercise is programmed to respond to a particular way of moving—slow, indirect, and light in weight. Such programming was designed through exhausting embodied dialogues between Ioulia and Adriana, who tested over and over again all possibilities of the designing software to respond to the specificities of the exercise. When both were satisfied with the responsivity of the program, another moment arose, where we could freely experiment with going against the system, exploring the glitches of the program by moving fast, heavily and directly by alternating all these factors and coming to realize in ourselves unexpected ways of moving and unexpected responses of the system in relation to it. There is somehow an oracular sense to these intra-actions which bring a different thickness to the resolution of agency within this project, akin to the training work in a physical studio, but engaging with different (immaterial) partners—zeros and ones craftily put together. Such an approach to the system is what allows a certain knowledge to evolve; to move and transform across bodies and cultures. In the virtual archive, we argue, this particular approach to agency through an intra-active apparatus invites knowledge to manifest: it becomes embodied knowledge in potential form.

One example of shared agency between system and designers is the extensive use of particles and point clouds[12] instead of meshed geometries, a technique that has solidified its place as a medium in art practice (Ivsic et al.) and which is also used in different parts of *Entangling Practices*. The particle systems in particular can create animated effects that simulate natural forces, such as water, smoke, and others (Hastings et al.). They are used extensively in computer graphics, as they allow for efficient representations in terms of storage and time (Linsen 1). This is crucial in the case of VR as the generation of three-dimensional content in real-time requires light geometries and effects. This need for optimization of the medium can be recognized as one of its agentic capacities, which consequently

affects the designer's choices and creates an ethereal aesthetic that is both afforded and limited by the medium.

This entanglement gives rise to the trio of designer, system, and participant; an assembly of interdependent actors and co-creators. The designer is still the one who decides on the content and the forms of interaction that are included in the experience, allowing the other actors to behave autonomously in it. The designer is, however, dependent on the abilities and limitations of technology, as well as on their own skills in using the medium. The artifact and the designer are dependent on the participant to engage in the scenarios, who takes the role of the director by choosing the way of approaching them.

Event

Many critical thinkers have developed the notion of an event, in relation to all forms of social, cultural and political frameworks. Important for us was to connect with Deleuze and Guattari's ontology in order to unfold the event as a process of becoming, reconfiguring relationships and opening up possibilities for new forms of (self) expression—that which grants a subject the possibility of shaping its multiplicities (9). What is clear in their ontological project is its intrinsic connection to movement patterns, which play out along what they term a "plane of immanence". This plane of immanence works similarly to the (virtual) scenarios of Taylor, which are rooted in the idea of reactivation instead of the replication of knowledge (31), constitute a set of "latitudes" and "longitudes" that are a determined set of speeds and "affects" that create specific energies. This configuration constitutes Deleuze and Guattari's notion of a body: the Body without Organs, a body in potential. Becomings are the actualization of this plane of immanence, called "body in relationship". The body in relationship produces intensities called affects. *Becomings are affects*. Our bodies then, finally, "cease to be subjects to become events" (Deleuze and Guattari 262). Deleuze and Guattari's ontology, therefore, is that of a *process* that considers organisms in terms of the *relationships* between them, their *movement,* and their *capacity to affect and be affected* instead of as solo creatures or stratified living beings. By proposing the construction of a virtual archive through training scenarios, where one can sweat along/through knowledge documented in the form of speeds and

affects, visitors of the VR archive are inevitably already reactivating such knowledge differently. They are involved in an event of becoming-with this knowledge, transforming and being affected by this knowledge.

Now, when working in VR, the immediate affect of the event can be reactivated through a combination of visual, auditory, and interactive modalities. In our project, the participant encounters a menu they can navigate in, choose their type of experience and level of engagement, and finally interpret the signs as they experience them through their bodies. Through our interdisciplinary designing process, we have developed a system in which the possibility for events—as processes of discovery, becoming, and interruption—can take place through intra-action. The design process places particular emphasis on the creation of an atmosphere and the impact of intra-action on the body, prioritizing these aspects over specific tasks or functions. The activation of each event and the subsequent navigation through them afford participants the opportunity to shape their own narrative within the work, forming unique scenarios that resonate within their bodies. The forthcoming iteration of the project will incorporate gestural recognition as an entry point to the project. This integration will guide the visitor to undertake a specific exercise based on their movement patterns, thereby enhancing eventness in the virtual archive, evoking that which happens through movement-based intra-action.

Despite the hierarchical tree structure, where each menu branch unfolds systematically, users can seamlessly transition from one menu section to an entirely distinct one without any compromise in coherence. An experiencer may opt for a wholly educational trajectory, while another might engage solely in the perceptual experience without delving into the exercises. The absence of a definitive endpoint underscores that the primary objective lies in exploration, rather than a goal-oriented approach. This decision allows participants to engage with the work on varying levels of interaction, depending on their perceptual response, free from the constraints of a predefined order.

Design Process

Carving out a design process in a dynamic medium has been an iterative series of actions between ideation, prototyping small samples of experience, and assessment through first-person engagement. We can sum up this procedure in the following steps:

1) The first step is the introduction to each exercise. Adriana La Selva, a professional performer, introduces us to each specific exercise through hourly movement sessions and one-on-one practice. We both reflect on the connotations it carries and the effect of the exercise on our bodies.

2) Then comes the identification of metaphors. The translation begins by identifying the intrinsic quality that the exercise elicits. This comes through video recordings, writings of the practitioners, and our subjective experience of the exercise. After this research, we decide what it entails in terms of interaction and experience.

3) Next comes the research, design, and development step. This has the form of an open-ended research on the ways to approach the chosen metaphor technically. This step allows space for multiple experiments as well as the learning of the techniques. It is a process in which we borrow concepts and tools from related fields, such as game design or animation, and repurpose them or shift them to work for a VR interactive environment. It is also very open to dead ends and failure.

4) After this process, we achieve the first prototype of the exercise. This first iteration is usually basic and focuses on one aspect of the experience, either an interactive gesture or a particular mood we want to achieve. It is a first step in order to test what functions and what doesn't. Alternatively, there are multiple variations of the prototype, if more than one approach of step (3) went forward.

5) The subsequent step is the process of feedback. We evaluate the efficacy of the experience by assessing the extent to which we have achieved the intended level of engagement or behavior. In this step, we could tweak smaller behaviors of the experience while testing, or decide to go back and reiterate the previous steps.

6) In most cases, at least one iteration will be needed. Therefore, the next step (6) is the iteration of steps (3), (4), and (5). The prototype is getting refined with each iteration, parts of it change and the whole experience could evolve into something unplanned. The number of iterations is unknown and depends on factors unique to each case. At more advanced iterations of the prototype, we invite feedback from externals with or without experience in dance.

7) Following this, we have a working prototype.

8) If the previous step is successful, we move on to integrate the prototype into the other exercises and the menu system.

9) The last step is the external presentation of the experience as an artwork and feedback through conversation with the participants. For this particular part of our work, we had the opportunity to exhibit it as a VR installation with the title *Odin Teatret: Entangling Practices* during Digital Research in Humanities and Art Conference (DRHA) 2023—Performing Cultural Heritage in the Digital Present. This was a very fulfilling experience as it introduced us to a broader audience with inspiring ideas about digital humanities and heritage.

After the Experience

Entangling Practices is a project connecting traditionally divided disciplines between art, science and technology. As we embarked on the project, it became evident that there was a notable gap in communication and methodologies within our interdisciplinary

team. To tackle this initial challenge, we first strategically divided the project into smaller, more manageable components, fostering an environment conducive to cross-disciplinary exploration. This approach provided space for team members to navigate beyond traditional disciplinary confines. Subsequently, as we gained familiarity with each other's tools and processes, we collectively established our own guiding principles for collaboration.

This methodology was implemented as a tangible project and was validated through interactions with visitors from diverse backgrounds. The design process presented was non-linear, characterized by iterative attempts to navigate the tensions between disciplines and the complexity of the task at hand. It has been the outcome of many paths that did not further evolve, failures, and anxiety of the researchers to navigate several roles within the production. The dynamic nature of technology, marked by its constant evolution and inherent instability, added layers of complexity to the process. While it opened up avenues of possibilities, it also contributed to a sense of volatility. While this affects the rigorousness of the documentation, it also creates potential for rethinking how we co-create a virtual archive and how it is transmitted to the people who engage with it. The three concepts that shaped our methodology were identified both within our design process and the reactions of participants. Presenting the artwork at DRHA 2023 provided us with the opportunity to directly observe visitors interacting with the piece and engage in discussions about their experiences. The participants interpreted the interactive environment, translating it into intuitive movements. They actively engaged with the immersive archive through an affective and personal encounter. Their involvement was richly varied; some expressed themselves through playful dances, while others delved into emotive exploration, perhaps even lying on the floor to fully immerse themselves in the experience. Importantly, participants demonstrated a remarkable level of activity and agency throughout the process, actively shaping and co-creating their journey within the virtual space.

Conclusion

In an ever-evolving landscape of technological mediation, the task of reinterpreting an archive of embodied techniques into a VR experience generated multiple challenges. With this writing, we aimed to shed light on the processual character of our concepts and experiments, while we map out the theories which accompanied our work. The three theoretical concepts functioned both as lenses from which we could craft and assess the interactive scenarios and as aids for shaping our way of working with each other and with technology. The ideas led to one another. First came the translation, the making of something analog to something virtual, the bringing forth of the intangible through interaction. Through this, the concepts of agency and event emerged through doing, planning, problematizing, prototyping, and finally allowing us to realize that our work is not a solitary endeavor. When we choose to embrace new technologies and collaborate within an interdisciplinary team, we open ourselves to the opportunity of co-creation and mutual shaping through the process while letting go of some of our control to the agential capacity of technology.

Embarking on endeavors with new technologies from our diverse backgrounds uncovered the constraints of our disciplines. These technologies lack a standardized textbook or an all-encompassing set of rules. There is no definitive formula applicable to all contexts, nor is there a singular authoritative figure prescribing the "shoulds". As designers and researchers, we have been both compelled and inspired to establish our own principles by either drawing from related disciplines or venturing into uncharted territory by breaking the principles completely. In the face of an incessant flow of information and innovation, the role of the designer requires continuous redefinition and expansion. Designing immersive and interactive artifacts necessitates adopting multiple roles, such as that of the technologist, creator, thinker, technician, and often, performer. Within our team, the researcher with a background in design took the role of the developer or was introduced to physical theater training both in theory and practice. Similarly, the performer had to get accustomed to terms from computer graphics and computing, learn to fix and tinker with technical tools or accommodate incoming practitioners. We refrain from asserting that the gaps in knowledge were bridged. Instead, they were initially magnified as we faced the

resistances imposed by our disciplines, with each one of us expressing ourselves more meaningfully through different avenues. Eventually, the differences were melded together to facilitate a co-creation process that actively incorporates the perspectives of the involved researchers. This process also allowed our permeability to unfold, as the often-unexpected directions the project took influenced our collective and personal working tactics. The transfer of knowledge from the embodied to the virtual archive gave rise to a new hybrid form of knowledge, emerging in the liminal space between what the researchers contributed to the project and the potentiality and limitations of technology. This knowledge was transfused into the content of the project, its aesthetics, the scenarios created and hopefully into the participants' engagement.

What guided us through the challenges was avoiding a strict methodological regime and replacing it with the three concepts outlined in this paper that would enable us to center our work around them. The metaphorical significance of these concepts informed our processes and gave us paths of communication where the technical jargon of our disciplines might have hindered us. Meanwhile, the flexibility of the terms allowed for diverse experimentations that were not tied to one medium, freely traversing from dancing to sketching or coding. These concepts facilitated our overcoming of disciplinary barriers and embracing the uncertainty of the situation through an intuitive understanding that, with repetition, evolved into a guiding principle for our process. The processual tactics of working we developed can be utilized as blueprints for expanding the virtual archive in future iterations, but they cannot be replicated, for they are intrinsic to the subjectivity of the researchers and the energetic qualities of the exercises chosen.

Acknowledgements
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Notes

1 For reasons of conciseness, the experience will be called *Entangling Practices* throughout this paper.

2 *Practicing Odin Teatret's Archive* is an ongoing research project funded by the Flanders Research Institute (FWO), taking place at Ghent University in Belgium. It is an interdisciplinary collaboration between the departments S:PAM (Studies in Performance and Media) and IPEM (Institute for Psychoacoustics and Electronic Music), in association with the Nordisk Teaterlaboratorium, Utrecht University, Manchester Metropolitan University and Aalborg University. Prof. Dr. Christel Stalpaert and Prof. Dr. Pieter-Jan Maes are the coordinators of the research project and PhD Candidates Ioulia Marouda and Adriana La Selva are the researchers activating the project.

3 For reasons of conciseness, the PhD project will be called *POTA* throughout this paper.

4 To read about the strands of techniques being investigated throughout the POTA project and Motion Capture data processing methodologies, please refer to Marouda et al., "From capture to texture: affective environments for theatre training in virtual reality (VR)." *Theatre and Performance Design*, Vol 9, no. 1-2, 2023.

5 The VR experience can be explored by watching the introductory video: https://vimeo.com/878224172/6da1170726.

6 This introduction is only due to the personal character of exhibiting a VR artwork, as the researchers need to be present in the space throughout the opening hours to ensure the smooth operation of the experience.

7 Metaphor is an idea further explored in the section *Translation* later in the text.

8 The description of the interactive experience necessitates a degree of technical explanation, ensuring that the interaction scenario and ambiance become clear to the reader. Efforts are made to present the design choices in a manner easily comprehensible for the reader; however, it should be noted that there are certain terms specific to the field of computer graphics, such as types of forces or properties of particles systems.

9 Particle system is a set of points in space with a set of rules which direct their behavior and aesthetic, such as color, scale, size, velocity and others (Hastings et al. 154).

10 In computer graphics and game development, it is possible to simulate physical properties in animations in real-time. This is achieved using skeletons, also

known as rigs, which structure 3D models for lifelike movement and interaction with virtual environments ("Animating Characters and Objects").

11 In Unreal Engine 5, a physics constraint is a joint which allows the designer to connect two different components together and apply forces or limits to their movement.

12 A point cloud is a set of 3D colored points in space, which is often used to represent a three-dimensional object instead of a meshed geometry (Linsen 1).

Tracing the Ouroboros' Tail: Paradoxical Politics against Necropolitical Binaries in Lukas Avendaño and Muxx Project's Theory and Practice

–– María Regina Firmino-Castillo
(UNIVERSITY OF CALIFORNIA-RIVERSIDE)
ORCID: 0000-0003-1446-6242

Necropower often relies on taxonomic distinctions between self and Other, a binary structure that is associated with gender binarism, digital dualism, and negations of life's entanglement with death. This essay discusses deployments of paradox against these necropolitical binaries by Lukas Avendaño, a Binni Zaa (Zapotec) and *muxe* (nonbinary gender) artist and anthropologist, and Muxx Project, an artistic collective founded in 2020 by Avendaño and multimedia artists EYIBRA, Óldo Erréve, and Nnux. The essay's "dialogical body" traces Avendaño and Muxx Project's understandings of how their body-based and digital performances attempt to disrupt gender binarism and digital dualism, to then focus on Avendaño's paradoxical view of life and death forged through artistic practice, and, most importantly, his experience as an activist confronting the complexities of necropower in contemporary Mexican politics. Following Avendaño's theorization of the ouroboros as an embodiment of life's paradoxical entanglement with death and the artist's prioritization of action over theory,

the essay concludes by reflecting on the potential of an ouroboric, or *para*-paradoxical, ontopolitics that might undo emergent necropolitical dichotomizations, such as that between the digital and the virtual, as they occur, potentially laying the ground for living, and dying, outside and beyond the binaries that undergird a violent world.

Key words: necropolitics; digital performance; digital dualism; coloniality of gender; paradox; Zapotec.

DA CAPO: FROM THE SERPENT'S HEAD

Introduction: Corpo-Digital Muxeidad as Paradox

The first time I saw Lukas Avendaño, it was in digital form: a cluster of liquid-crystals twisted into helix formations through which binary signals choreographed light to produce an image upon the computer's vitreous screen (fig. 1).[1] Next to the digital image were these words:

> What you will not find about my people in the codices, the geographic surveys, the letters of relations, nor in the ceramics, the sculptures, the reserve funds, the museums and in the libraries with their doctoral theses, you will find here in my body. (Avendaño "Lukas Avendaño")

Choreographer, performance artist, and anthropologist Lukas Avendaño, the author of the Facebook publication cited above, is socially enunciated as *muxe* by the Zapotec—or Binni Zaa (Didxazaa; *binni*, "the people" and *zaa,* "from the cloud")—community in the Isthmus of Tehuantepec that Avendaño is a part of.[2] When asked if *muxe* can be understood as a Zapotec third gender,[3] Avendaño answers that this is not "a simple yes-or-no question" (para. 23). Refusing such oversimplification, Avendaño ("Queer: No") conceptualizes "*muxeidad,*" which has been deeply rooted in Binni Zaa culture "since pre-Colombian times" (pars. 11-15), as a "'total social event'" that paradoxically

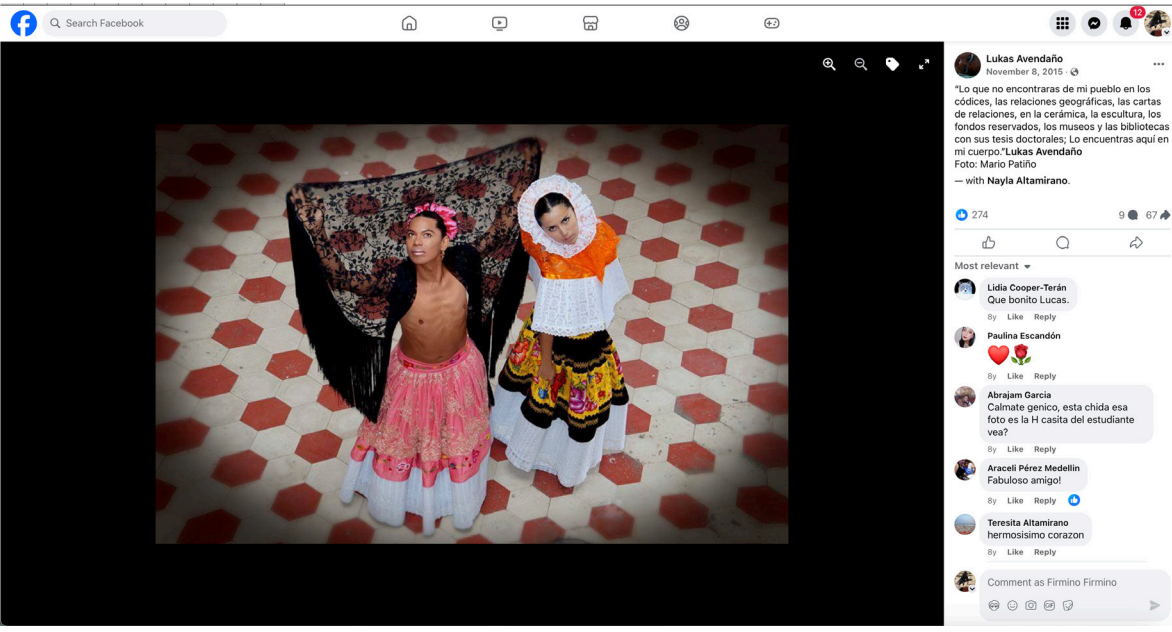

Figure 1: Screenshot of Facebook post by Lukas Avendaño (2015); digital photo of Avendaño and Nayla Altamirano © Mario Patiño.

encompasses a plurality of masculinities and femininities (para. 20) without seeking to resolve their apparent contradictions. Similarly, Avendaño's pronouns, in this essay and beyond, oscillate between the feminine and the masculine, also paradoxically.[4]

Paradox is likewise present in the digital image where I first saw Avendaño (fig. 1). Avendaño stands next to artist and collaborator Nayla Altamirano, who is read as woman within a colonial ontology imposed through force, but also installed hegemonically through consent.[5] Her position next to Avendaño—who outside of the Binni Zaa context is hegemonically and colonially read as male and queer—is neither oppositional nor an equivalence. The juxtaposition is intentionally ambiguous, as reflected in their sartorial choices: they both wear the long skirt and *enagua* (lace slip) of Tehuantepec. Altamirano's face is framed in starched white lace, and her body is fully covered. Avendaño holds open a black lace shawl, her arms raised in a "V" above his head. Shirtless, she reveals a flat and well-toned chest. Through these and other details,[6] this image becomes more

than an image; it becomes a digital and corporeal performance of a politics of paradox that contests gender binaries, digital dualisms, and other dichotomies that undergird the necropolitical formations of an enduring coloniality.

The potential of paradox to disrupt colonial impositions of binary gender and other dualist taxonomies, such as the distinction between the materiality of the analog and the virtuality of the digital, is present in the image above and its accompanying caption. As the juxtaposition between image and caption suggest, the virtuality and intangibility of bodies rendered through the digital image depend on fleshy, material bodies existing in specific spatiotemporal coordinates. At the same time, Avendaño uses both his digital body (existing as pixels of light) and her physical body (as flesh, bone, blood, and all else that constitutes a person) to signal, simultaneously, the archive as instrument of domination, the ephemeral nature of historical memory, and the enduring mnemonics of the flesh, despite the flesh's mortality, decay, and eventual physical disappearance. Furthermore, Avendaño invokes, through his own physicality and her own words, the embodied memory of the non-normative *muxe* body, which is subject to erasure and misrepresentation, but not only through the colony's archival procedures; it is also absented from the codices, the ceramics, and the sculptures often relied upon to trace—and sometimes to regenerate—that which colonialism and other forms of power attempt to destroy. Therefore, Avendaño's *muxe* body and embodied knowledge surface the need for paradox in *any* politics capacious enough for such multiplicity.

In this essay, I trace the paradoxical in Avendaño's work and in Muxx Project, an ephemeral collective founded in 2020 by composer and multimedia artist EYIBRA (formerly known as Abraham Brody), digital and performance artist Óldo Erréve, sound and performance artist Nnux (Ana López-Reyes), and Avendaño. Through dialogical engagements with the artists, I discuss the intentions behind their digital and body-based performances—namely, critiques of gender binarism and digital dualism—to then trace the relationships between such dichotomizations and the necropolitical tools of colonial domination. I pay particular attention to Avendaño's performance-based research on the non-dichotomous relation between the physical ouroboros and the abstract lemniscate (∞), the mathematical symbol for infinity and a metaphor for the cyclical continuity between living and

dying. I characterize this as the "dialogical body" of the essay. This is followed by a discussion of how Avendaño's theoretical findings are grounded in his practice as a *muxe,* as an artist, and as an activist who has had to navigate the complex terrain of a contemporary Mexican necropower that configures her as killable in multifarious ways. I place Avendaño's experiences and ideas in conversation with critical analyses of the paradoxes that have historically shaped contemporary Mexican society, especially the reformulation of Mbembe's necropolitics by R. Guy Emerson, who argues that the indeterminacies of a violence that is so multifarious and that is no longer the monopoly of the state complicate the dichotomizations between death and life that have long been mobilized for necropolitical ends. These strands of thought and practice are woven together to tentatively propose a politics *lived* paradoxically in relation to the ubiquity of death. I conclude by cautioning against the instrumentalization of paradox as a utopian formulation, proposing a *para*-paradoxical, or ouroboric, politics that regenerates by eating itself, continuously unsettling its onto-epistemological certitude as an antidote to novel necropolitical dichotomizations.

I will return to the topic of paradox, and specifically to how a *para*-paradoxical politics might disrupt normativized binary ontologies, but first I will discuss how taxonomic either/or distinctions undergird worlds produced through separation and destruction. Starting with gender, as *muxeidad*—an ontological paradigm incommensurable with Western gender categories (Mendoza-Álvarez and Espino-Armendáriz 132-133)—reveals, and as María Lugones argues, the violently imposed "Modern Colonial Capitalist Gender System" (21) based on a rigid male/female binary is not universal, necessary, or even desirable.[7] It is an epiphenomenon of historically specific constructions of onto-political categories—such as the masculine, the heavenly, the abstract mind, and the human—construed to be in opposition to other likewise invented categories—such as the feminine, the earthly, the material body, and animality—in order to legitimate violence and domination.

Historian and political theorist Achille Mbembe associates this dichotomizing activity with the production of "*death-worlds,*" which he describes as "new and unique forms of social existence in which vast populations are subjected to living conditions that confer upon them the status of the *living dead*" (92). The conferring of this status

and the "subjugating of life [or more precisely, *specific lives*] to the power of death," which Mbembe terms "necropolitics" or "necropower" (92), are ontologically productive acts catalyzed by processes of taxonomification. For the living to become killable, they must be socially constructed as ontologically Other, and even always-already dead. But because both the living and the dead are trans-corporeal entities in a web of inextricable entanglements, there are no ontologically separate others.[8] As Mbembe puts it, "since this object [the ontologically separate being] has never actually existed—does not and never will exist—desire must continually invent it" (43).

Mbembe calls the space of inclusion constructed through necropolitical exclusion "*this enchanted circle*" (43; my own emphasis). Each word in this phrase is heavy with meaning: "this" indicating that the death-world is the dominant contemporary social order; "enchanted" describing it as a world produced through the conjuring of the other; and "circle" pointing to its exclusionary circularity, and to a circular, and even solipsistic, logic within which the imagined objects of ontological exclusion may change, but the self-replicating structure remains. As Mbembe notes, "Yesterday, 'Negro' and 'Jew' were the favored names for such objects. Today, Negroes and Jews are known by other names: Islam, the Muslim, the Arab, the foreigner, the immigrant, the refugee, the intruder, to mention only a few" (43).

This circularity is described by dramaturge and social theorist Sylvia Wynter as an "autopoetic, cosmogonically/sociogenically induced closure" ("The Ceremony Found" 222) formed by ontologically constitut*ed* and constitut*ing* dyads—such as "symbolic *life/death*" (211)—which "served to charter the secular West's two sociogenic replicator codes" that performatively enact, Wynter explains, "*Man* (as the incarnation of *symbolic life*)" and "*Human Others* (as the embodiment of *symbolic death*)" (229). This process has resulted in material and social consequences that, historically, have not been conducive to life for the great majority of beings on the planet (230), for "these codes were/are then performatively enacted only on the basis of the West's negation of its human subjects' equal co-humanness with all other (originally non-Western) members of humankind" (229).

These acts of othering are "socio-technologies" productive in the "*positive/negative representations* of the specific order of knowledge"

that compel "perspectives of 'otherness' as abnormal anomalies" (212). Such projections of binary taxons onto multiplicitous being fabricate the normal and the natural, while violently configuring those outside such arbitrary and solipsistic parameters as abnormal and "*contra natura,*" colonial classifications through which *muxe* and other individuals not adhering to sexual and gender behavioral norms were criminalized and therefore rendered killable (Tortorici "Against Nature" 169).

Dichotomizing processes of normativization by negation are applied to living beings (including people), as well as entities and phenomena, and they have long undergirded violent colonial territorializations, imperialist expansions, and economies of extraction. Furthermore, they now generate death-worlds through the binary structure's continued iterations of itself in new forms. A relatively novel dichotomization is "digital dualism," which social media theorist Nathan Jurgenson defines as a "bias to see the digital and the physical as separate" (para. 2). As a corrective, Jurgenson proposes "an alternative view that states that our reality is both technological and organic, both digital and physical, all at once. [We]...live in one reality, one that is augmented by atoms and bits" (para. 7). Another critique of the digital/analog divide traces it to a long-standing Cartesian ontology splitting spirit from matter and mind from body, which is premised upon "a view of the brain as a computing machine whose logic and data can be abstracted from its physical manifestation" (Carr para. 3). What kinds of social orders do these emerging dichotomizations support? If they are iterations of the same structuring dichotomies that Mbembe and Wynter critique, what are their corresponding practices and technologies? Might these dichotomizations offer ideological legitimization for the deployment of digital technology for mass state violence?[9] Given the autopoietic persistence of necropolitical dichotomizations and their emerging iterations, is it strategically viable to base theory, politics, and artistic practice with anticolonial intent on the same onto-epistemic models undergirding colonial and imperial death-worlds?[10] Finally, if dichotomy structures the death-world, then what might paradox make possible?

In what follows, I trace the presence of paradox as politics in Avendaño and Muxx Project's performance processes, focusing on the lived experiences and intentions behind their practices as well as

their own understandings of the critical interventions that their digital and body-based works make, especially in regard to the coloniality of gender, digital dualism, and a life/death dichotomy associated with necropolitical configurations of social reality. The body of this essay intentionally unfolds dialogically, not only as a rhetorical form, but as a method akin to the onto-political possibilities of paradox suggested by theorist and physicist David Bohm's definition of dialogue:

> "Dialogue" comes from the Greek word *dialogos*. *Logos* means "the word," or in our case we would think of the "meaning of the word." And *dia* means "through"—it doesn't mean "two." A dialogue can be among any number of people, not just two. Even one person can have a sense of dialogue within himself, if the spirit of the dialogue is present. The picture or image that this derivation suggests is of a stream of meaning flowing among and through us and between us. (6-7)

Following Bohm and the trans-corporeal nature of memory and knowledge expressed by Avendaño's pronouncements, may this dialogue also reach the reader and involve them, perhaps becoming part of their flesh in the sense conveyed by Wynter ("The Pope") when she wrote: "Human beings are magical. Bios and Logos. Words made flesh, muscle and bone animated by hope and desire, belief materialized in deeds, deeds which crystallize our actualities" (35).

Before proceeding to the dialogical body, I will trace the movements across space and time through which the writing of this essay occurred.

Dialoguing Across Time/Space and Bodies

In February 2022, I witnessed Muxx Project's *Bardaje*,[11] a performance installation consisting of live music by Nnux and EYIBRA, virtual reality and 3D video by Erréve, and Avendaño's durational interactive performance (fig. 2). *Bardaje* was performed at Laboratorio ArteAlameda in Mexico City, formerly a colonial convent, and in the vicinity of a mural painted in 1948 by Federico Cantú depicting Bernardino de Sahagún's Nahuatl informants who pro-

Figure 2: Lukas Avendaño performing in *Bardaje,* with holographic projection of Avendaño by Óldo Erréve, Laboratorio ArteAlameda, Mexico City (February 13, 2022) © Lukas Avendaño and Muxx Project.

vided the ethnographic knowledge that Spain used to control its colonial subjects. Set in this context, Avendaño's intention was to invoke in and through her body the transhistorical presence of the *muxe* and other sexual dissidents that the Virreinato de la Nueva España (present-day Mexico, Guatemala, the U.S. Southwest, and the Philippines) violently persecuted as "sodomites" who violated Christendom's strictures against non-reproductive sexuality and threatened the "natural order."[12]

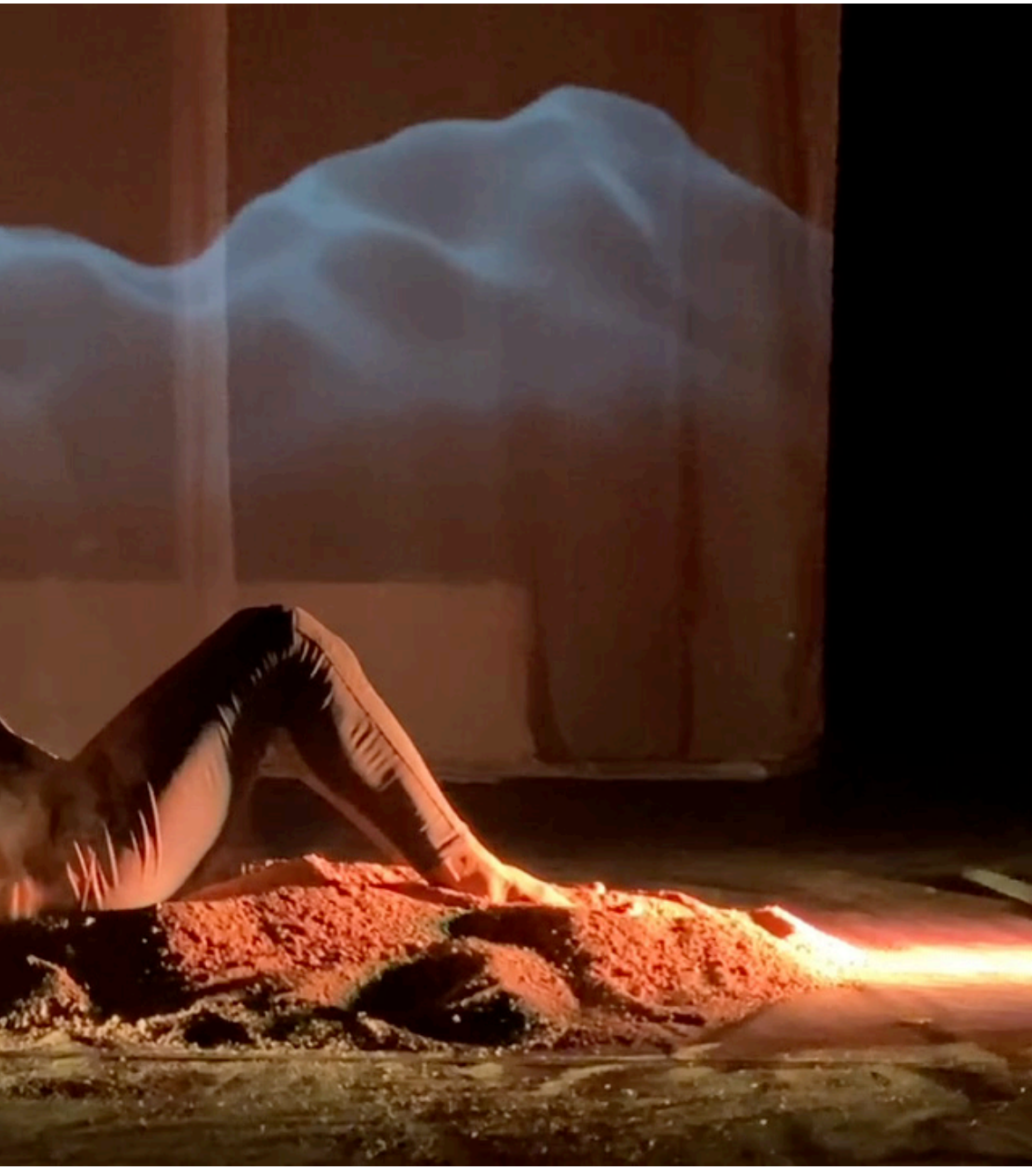

Figure 3: Lukas Avendaño during a rehearsal of *MUXX: **una presentación escénica des-generada,*** with digital topographic projection by Óldo Erréve, Centro de las Artes de San Agustín (February 2022) ©María Regina Firmino-Castillo.

Figure 4: Lukas Avendaño in *Biguidiribela*, Los Angeles Dance Project (September 16-17, 2022) ©Lukas Avendaño and Muxx Project.

In late March of 2022, I traveled to San Agustín Etla in the state of Oaxaca, Mexico to accompany and support the development of *MUXX*, which the collective described as a "de-gendered/degenerate performance."[13] Exploring otherwise imaginaries of gender and sexuality—again through 3D video, live music, and performance—*MUXX* centered Avendaño's chimerical presence, spanning the holographic, through Erréve's 3D video, to the telluric, through an immersive set centered around a mound of earth under which Avendaño was buried, and from which she emerged, evoking the bodies of thousands of forcibly disappeared persons who are disinterred by those who refuse to accept such necropolitical annihilation.

In September of the same year, I witnessed an iteration of *MUXX* at Los Angeles Dance Project. Retitled *Biguidiribela*, (Didxazaa; "butterfly made of flesh"), the performance built on previous themes and structure, while tracing the sidereal origins of terrestrial life. It explored the "ouroboros-consciousness," as Avendaño terms it after Blanca Solares (2007), in which binaries such as life/death, animal/human, male/female, and digital/analogue are revealed to be more paradoxical than dichotomous.

Biguidiribela and *MUXX* were informed by Avendaño's preparatory research for *Lemniskata*, a dance work commissioned by the Conjunto Santander de Artes Escénicas y Cultura, in Zapopan, Jalisco

Figure 5: *Lemniskata,* Conjunto Santander de Artes Escénicas (July 8-9, 2023) ©Jaime Martín and Lukas Avendaño.

and the Kampnagel theater in Hamburg, Germany. *Lemniskata* was choreographed and directed by Avendaño for fourteen male-identified dancers and one woman-identified. The project originated in Avendaño's "concept of '*Mujerismos = Muxerismos,*'" which was informed by the artist's encounter with "the multiple symbols, territories and dances of the State of Jalisco that are enunciated from the feminine" (Avendaño "*Lemniskata*").[14] *Lemniskata* centers woman not as one side of a biocentric idea of gender, but as "the creative and destructive *power of the whole* that resists a country dominated by necropolitics, exploitation, and the disappearance of bodies." Avendaño's concept of the feminine is "unearthed from [colonial] syncretism" to reveal that the "the paradigm of time has carved into stone an irreverent and rebellious goddess who does not inhabit the heavens—quoting Eduardo Galeano—because she lives in the depths of the world, lying in wait for us" (Avendaño "*Lemniskata* Program" 2).[15] Avendaño applies this "unearthing," which she has often described as an "*arqueología de la memoria,*" to the territory itself.[16] While tracing Jalisco's living historical memory of Nahuatl origins and an enduring matriarchal social structure, Avendaño uncovered the recurrence of the serpent as a symbol of the infinite present in the region's dance, architecture, popular culture, and local discourse. This led Avendaño toward the lemniscate, the mathematical symbol for infinity (∞), and its relationship to the ouroboros, the Greek name for the serpent that eats its own tail, which Avendaño interprets as the *mater/*matter which gives birth to herself.[17] I was unable to attend live performances of *Lemniskata* and was only able view video documentation. However, it is not my witnessing, whether live or virtual, that forms the core of this essay, but the artists' embodied understandings of their processes. As such, in the next section my voice oscillates between their voices in a dialogic tracing of paradox.

THE DIALOGICAL BODY[18]

Axcan quema: tehuatl, nehuatl.

> **Firmino**: Thank you for sharing your time and space, Lukas [Avendaño], to speak about *Lemniskata* and its connection to Muxx Collective.

Avendaño: Yes, yes: as you rightly mention, the projects with Muxx Collective are the immediate result of fieldwork in the state of

Jalisco. In the first place, the research process provided me with a different perspective on the municipalities I visited, such as Acatic, Tuxpan, Tonalá, Zapotlán, Huichitlan, Amatitán. My first surprise was that all these names are in Nahuatl. The second surprise was that the feminine figure recurrently appeared as a figure of authority, as a figure of power, as a figure of organization, as a figure of resistance.

And yet another thing that struck me was the use of Nahuatl expressions in many of the communities we visited, expressions such as *"¡Axcan quema!"* which translates into Spanish as *"Ahora sí"* ("Now is the time"). Many of the dancers we interviewed told us that this was the war cry with which Santiago Tenamaztle would go into battle.[19] The complete phrase is "*¡Axcan quema: tehuatl, nehuatl!"* which in Nahuatl means "Now is the time: you or me!" In other words, "your life or mine."

And it seems to me that the people we interviewed in all the different municipalities, they are always saying *¡Axcan quema!* due to the agrarian conflicts from centuries ago which remain unresolved. Just recently, the communal authorities of a Wixárika (Huichol) municipality in the highlands of Jalisco walked from their place of origin, crossing Zacatecas and several states, before arriving in Mexico City to request an audience with the then-president of the republic, Andrés Manuel López Obrador. One of the demands of the Huichol authorities, of the Wixárika (which is how they recognize themselves), is the return of their communal lands.

So, that phrase *¡Axcan quema!* is still in force; it is like saying: "Now there will be justice. Now is the time for our ancestral rights to be recognized. Now is the time for us to have our full existence and full enjoyment of our fundamental rights." This phrase is not limited to the romantic expression of the war cry of those peoples who fought for their sovereignty and autonomy against the entire administration of the viceroyalty of the new Spain. To me, "The time is now" is a concatenation of events that reaches us in the present with the same force and the same demands.

> **Firmino:** I am intrigued by the recurrence of this phrase and wonder if it resonates with what you call "the archaeology of memory."

Avendaño: The phrase comes to us as an archaeological vestige, just like the teeth and eyes of Tlaloc that are embedded in the church in Tuxpan. This is a tangible, and material, vestige, unlike memory which is intangible and immaterial in the conventional sense. The archaeology of memory is precisely the short circuit through which memory comes to us in other ways.

So, yes, I think that this phrase is the semantic expression made tangible or embodied in the sound of *¡Axcan quema: tehuatl, nehuatl!* as an exercise of memory which, despite conventional archaeology's denial of an objectual or analogical relationship, does not cease to be true, does not cease to be relevant or contemporary, and does not cease to be a way of evoking memory as a gesture that generates knowledge, that generates identity, and generates dignity in those who enunciate it and embody it.

The Ouroboric Relation Between the Digital and the Analogic

> **Firmino:** Can each of you speak to your roles in the three interconnected projects (*MUXX, Bardaje, and Biguidiribela*)?

EYIBRA: The project mainly explores nonbinary gender and queerness through the lens of Lukas' identity as *muxe*. We bring in Lukas' research and our own investigations, which also influence the ritual, the presentation, the imagery, the direction, and intention of the project: that the origin of the world is nonbinary, that the origin of the world is gender fluid, and that the lifecycle can be looked at in that way.

Almost every moment of the performances has symbolism behind it, even if it's not so obvious. Not everyone knows, for example, that the part where we're making a statue with our bodies is a reference to the Mexica, or Aztec, deity Coatlicue (fig. 6), who is like the mother. She's related to serpents. She's also the mother of the God of War. Not everyone will get that, but if you see the movements of our hands (fig. 7), it references this famous statue of her.

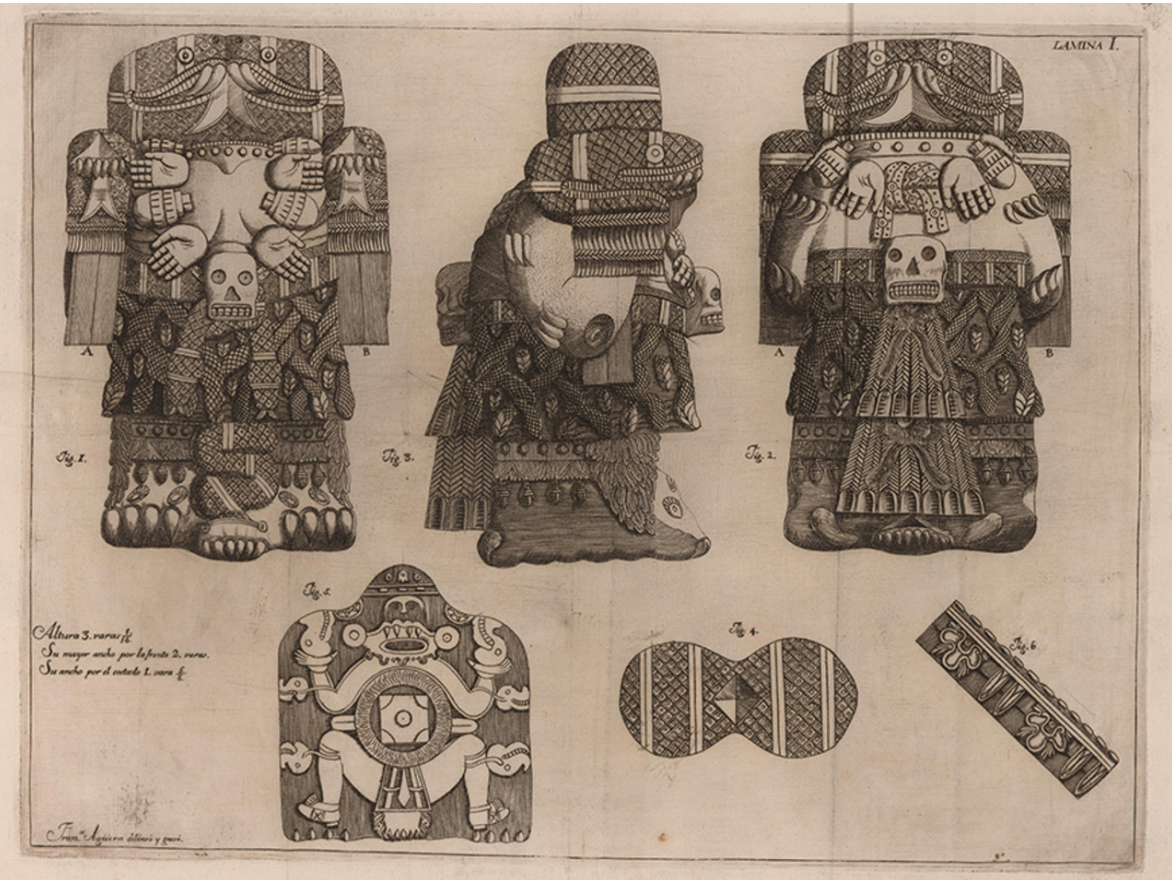

Figure 6: "The Great Coatlicue," from Antonio de León y Gama, *Descripción histórica y cronológica de las dos piedras que hallaron en la Plaza Principal de México,* plate 1. (1792) ©John Carter Brown Library at Brown University.

Avendaño: A few years ago, I read *Madre Terrible,* by Blanca Solares (2007). She develops a theory of the stages of the psyche through an analysis of the archaeological record. Her thesis is that there was a stage of the psyche that she called "matricial." She doesn't call it matriarchal; the matriarchal is a stage of society, a politically organized society in the sociological sense. However, in the anthropological sense there is a stage of the psyche that is matricial. And this matricial stage appears again and again in the pottery, in those material vestiges that we can still

Figure 7: EYIBRA and Nnux in *Biguidiribela,* Los Angeles Dance Project (September 16-17, 2022) ©María Regina Firmino-Castillo.

recognize as part of our culture's past. And it is this matriciality, this matrix-reality, that, in the case of Mesoamerican culture, contributes to an affinity towards the earth, because the earth is conceived of as the great *mater,* or matter.

During my fieldwork in Guadalajara, when the ouroboros appeared as the analogic reference for the lemniscate, as synthesis in the virtual, as synthesis or abstraction par excellence of algebraic mathematics, I was compelled to search for my notebooks and I found my notes on Blanca Solares' ouroboric conscious-

ness.[20] I suspect that this ouroboric consciousness is the reason why the Coatlicue (fig. 6), this giant monolith at the National Museum of Anthropology and History in Mexico City, was so disturbing. After its excavation [in 1790], it was buried again. Then German geographer and naturalist, Alexander von Humboldt came; he wanted to study it, and they unearthed it again for him to draw it, but eventually they had to bury it again because Indigenous people began to worship the monolith, to offer flowers to this monolith covered with skulls and serpents.[21]

The curious thing about this monolith is that at the base, on what would be the soles of her feet, there is a bas-relief of the teeth of Tlaltecuhtli (fig. 6; lower left), who is the earth. Coatlicue is the totality of existence, but the origin is the earth. That's why she's grabbing the earth with the teeth on the soles of her feet.

These references appear in Solares' work, and as recently as last night, I saw them while rewatching *Pedro Páramo*, the film (Velo) inspired by Juan Rulfo's novel which takes place in the cultural ecosystem of Jalisco, Nayarit, and Colima. In one scene, Susana, one of the main characters, is about to die. The priest arrives to accompany her as she is dying. The priest says to her, "Repeat after me." She starts repeating the priest's words: "My mouth is full of dirt. I swallow frothy saliva. My mouth caves in, contorting into a grimace, lacerated by gnawing, devouring teeth."[22]

All this made me remember a conversation I had with my mother a few months ago. I told her that if I were to die first, I would not want to be buried. I would want to be cremated. My mother said that it would not be fair to deny the earth the sustenance of my body after I had received sustenance from the earth throughout my entire life. In other words: the earth gave birth to me, and now the earth eats me, and from my flesh others will be birthed and others will be eaten.

Nnux: [During production] Lukas talked to us about how we come from the earth, and we go back to it, and about the repeating cycles of life and death. And we also talked about how those cycles are represented in mythology, and that's also something that we brought into the process. The whole piece is a representation of the origin of life and the origin of the world, not only of human

life, but the life of a plant and the life of the universe. Lukas starts the performance with his whole body covered in earth (fig. 9), and he comes out of it (fig. 3), and then EYIBRA and I are embracing each other in this kind of womb (fig. 8), but it's also a seed and we're germinating, and then blooming.

EYIBRA: Lukas being buried is a reference to the origins, but it's also a more contemporary reference to disappeared persons in Mexico, including Lukas' brother who was kidnapped five years ago.[23] And that's a reference that I think most Mexicans looking at a body buried under a mound of earth for fifteen minutes (that part of the piece is almost twenty minutes long) will understand. And hearing Lukas say, "My mouth is full of earth, my mouth is full of earth…" over and over would probably make them connect to that. I'm not sure an American audience would, but of course it's going to provoke discomfort, making them think about death.

We've been trying to relate these ideas to the sound design, so that the music also coincides with the concept. For example, there's a part where I'm playing the violin, and I'm hitting the strings with the wood of my bow. This section is referencing the Catholic Church burning queer people and others considered socially deviant. And so, I was thinking a lot about wood sounds. And the sound, for me, of hitting the violin strings with the wood of my bow is a more abstract way of thinking about, for example, how a pyre sounds. How do I get people to feel this wood burning, this crackling type of sensation?

Nnux: In my case, I'm a musician. I've never expressed myself with my body in this way. It's a very interesting thought process, because the way Lukas thinks about movement or action always comes with symbolism, and that changes everything. It changes the way you interact with the world. I'm thinking about the sound and the symbolism attached to sound and asking: How can we correlate sound and movement?

EYIBRA: There's a part at the beginning where Nnux and I are connected in this twin dress that has magnets and then it pulls apart. In that section, we're referencing origins, amoebas, cells separating. And in that part, we're singing. My background is Lithuanian, and we decided to adapt this Lithuanian ritual song,

Figure 8: EYIBRA and Nnux, with Avendaño, and with topographic projection of Avendaño by Óldo Erréve during a rehearsal for *MUXX: una presentación escénica des-generada*, Centro de las Artes de San Agustín (February 2022) ©María Regina Firmino-Castillo.

a really ancient ritual song, to take out the words and kind of mess with this song that is kind of, for me, connecting all these timeless, primordial sounds. Those songs are pre-patriarchal, pre-Christian, they date back to a matriarchal time. Traditionally they're only sung by women.

And so that was also an interesting connection, because we're trying to look back to this time while connecting the future through the digital visuals that Óldo [Erréve] creates. Really, we're trying to demonstrate that in the length of human history, queerness has survived much longer than Christianity and Catholicism; queerness has existed before and hopefully will exist after.

Figure 9: Lukas Avendaño and stage assistant during a rehearsal of *MUXX: una presentación escénica des-generada*, with holographic projection of Avendaño by Óldo Erréve, Centro de las Artes de San Agustín (February 2022) ©María Regina Firmino-Castillo.

Erréve: The vision I want to forward in this project is that of genderless digital entities, or otherworldly supernatural avatars, which allow for the total transformation of human and spiritual presence as they coexist in a series of metadigital ecosystems that give life to science fiction flora and fauna as well as ancient symbols.

From the digital end, my duty is to create a virtual record of history and build a bridge to preserve the traditions that are important to us as a community of queer artists. It is like capturing the roots in a cloud that is always moving towards the future.

> **Firmino**: Óldo, I would love to hear more about the image of the cloud. It opened my imagination and made me think about how "The Cloud" (the digital cloud) has become this kind of icon for our times. And I'm especially thinking about "The Cloud" as a repository of information, or even as a kind of ontology. What does that mean for space-time in the body?

Erréve: Well, what I mean is that it feels like capturing a root within a cloud that embraces the future, precisely because of what a cloud means now: it is a space where you can store a tremendous amount of data, a lot of information. So, it's like rescuing this cultural heritage that we have as Mexican persons, to be able to have this record of the ancestors and allow it to remain through time. It's as if I could travel in time through this cloud to preserve ideas. But it is a very big challenge to connect two totally opposite extremes: the culture of our ancestors and the digital opening to the virtual world in which we are immersed at this moment in history.

> **Firmino:** Lukas, I want to ask you about the analog and the digital, terms you've used in relation to *MUXX*, *Bardaje,* and *Biguidiribela*. In all three performances, there was a contrast between your digital presence, your holographic presence, which was immaterial—yet simultaneously very material, because, as we've discussed, the digital presence depends on the materials that the machines are made of—and your bodily presence, your telluric corporeality.

Figure 10: Lukas Avendaño crossing through the projection screen that divides the stage in two, with a holographic projection by Óldo Erréve on Avendaño's torso. Rehearsal of *MUXX: Una presentación escénica desgenerada*, Centro de las Artes de San Agustín (February 2022) ©María Regina Firmino-Castillo.

In *MUXX* and *Biguidiribela*, you are a telluric force emerging from the earth. One can see your muscular effort, your pain, your discomfort, and then your corporeal transformations during the performances, which were very dependent on your flesh, your movement, and your life force. And then you return to the earth and interact with it, again, in a very dynamic way at the level of the body. And while this is going on, the space is divided by a screen upon which your virtual holographic presence is projected. And there were other virtual elements projected on this screen, like the virtual topography that Óldo Erréve designed, and that digital collage of genitalia. I am struck by the contrast between the corporeality, which is

very organic, coexisting with the other corporeality, one that is digital and virtual. So, in that contrast between the virtual and what you've referred to as the analog, what are you looking for? How are you conceptualizing this?

Avendaño: I think that until that moment, as an experiment, that was our point of departure: the relation between the digital and the analogic. You and I have been in dialogue about this, and I have also been engaging with the Muxx Collective about it, asking what each of us could contribute in terms of the ouroboric. The importance of these encounters is that they allow us to summon different subjectivities, from those that are analog—of performance for performance's sake, where the body is present—to those that are more digital.

We talk about virtuality, and we are led to believe that virtuality does not have an analogical reference. But I hope that I can contribute to the understanding that the virtual also has a physicality. For example, insofar as light intervenes, light, has a physicality. Hence, the light of the stars reaches us thousands of years after their journey. In reference to the physicality of light, during the production of *MUXX* we had a big discussion about the number of lumens needed for the projector, because the projection's distance distorts the journey of those particles of light that eventually impact the screen to produce an image.

Firmino: Light, if I'm not mistaken, is a particle and it's also a wave. There is that experiment—I'm not sure if I remember—Heisenberg? But there is an experiment in which light sometimes appears as a particle and sometimes it appears, or allows itself to be seen, as a wave.[24] It's like a being, we could say, that is very mischievous, very chimerical: "Well, right now I want to be a particle; now I want to be a wave."

Avendaño: Yes.

Firmino: Óldo, are you interested in your project coexisting with what Lukas calls the analog?

Erréve: Creating a bridge between ancestors and descendants is akin to making a meta-spiritual representation of Lukas. So, what I am doing, what I see in Lukas, is his spiritual and digital representation, and the connection that exists between the two.

> **Firmino:** Lukas, now that the Lukas hologram has been birthed by Óldo from the analog Lukas, is one of the purposes of Muxx Project to make visible the necessary relationship between what you describe as analog, or the material, and the digital, or virtual?

Avendaño: On the one hand, yes. But on the other hand, I am aiming to challenge the idea that Indigenous art must necessarily be deprived of these other tools or these technologies, especially in these curatorships of contemporary art, where it seems that what "smells" analog or "smells" of native peoples seems to be, by default, already relegated to a certain genre. And so here my game is to insert into the spaces of the contemporary scene these remnants of tradition, these short circuits of memory, that coexist in these two formats: the analogic and the digital. But that does not mean that one format is less contemporary than the other.

> **Firmino:** Related to this relation between the digital and the material, another thing that I've been thinking about is that since the pandemic we've been using these machines more and more to do virtual work. And there is now this metaverse, and we can inhabit a supposedly digital reality.
>
> But there are workers in giant warehouses and factories building the devices we use, and people mining the earth for minerals, with their bodies. And there are also workers who are processing the algorithms, people behind screens, sitting there all day. These are physical acts that are invisiblized in the virtual space.

Avendaño: Yes, yes, this is invisibilized labor. I think that this is the narrative about virtuality or digitality that intends to alienate us, to expropriate our consciousness.

But can virtuality or digitality dispense with analog existence? I

think not. The digital and the virtual exist as long as there is the analog. The analog, in contrast, *can exist* without virtuality or digitality.

This brings us to the topic of women. In so far as a woman can impregnate herself, she can exist without the male other.[25] But what is difficult for us to recognize is our finitude as "macho, male, alpha, silverbacks," and so we invent a superiority because we are very afraid to recognize our finitude.[26]

> **Firmino:** I want to talk about chaos. There is some Freudian and post-Freudian literature—for example, Julia Kristeva's book, *The Powers of Horror: An Essay on Abjection* (1980)—that talks about chaos, which is associated with the womb, and order, which is associated with the phallus. All that you are sharing makes me ask myself why there is such a fear of the origin? What does that division construct? Is it that a fear of the origin is associated with a fear of death?

Avendaño: I don't know if it's an anxiety about the awareness of our finitude and our insignificance. And that's why we try to justify our existence, constructing stories and feeling indispensable. I don't know….

Lemniskata: The In/finite

Avendaño: Several elements appeared and were repeated over and over again during the research in Jalisco, such as the dances evidencing a pre-Columbian syncretism with rituals and deities dedicated to water, fertility, and multiple feminine beings. All this information was synthesized in the project's name, *Lemniskata*, which has an earlier referent: the ouroboros, which is commonly associated with the snake that bites its own tail. But it was precisely during the fieldwork in Jalisco that we found that the figure of the serpent was a constant. And that's why the lemniscate (∞) was synthesized as this algebraic figure.

That is, the reference of the lemniscate is a virtual reference, insofar as it is a mathematical abstraction, but the analogical reference is the ouroboros, the snake that we are told bites its own tail.

The choreographic work is titled *Lemniskata* because the theme of life's continuity appeared recurrently in our research: this recognition of who gives life and where life comes from.

I already knew that snakes molt, that is, they change their skin; but it was precisely this fieldwork that made me reconnect with that memory, and that's when I realized that the serpent molts by emerging from its own mouth. That's why the skin it sheds remains intact. This led me to make a connection to pre-Columbian pottery, those pieces with women's bodies squatting and a person's head emerging from the genitals.

Conventional archaeology recognizes these as representations of fertility or femininity. But I had the impression that these sculptures represent something like the act of the serpent emerging from its own mouth; consequently, the being that they are birthing is the continuity of their own corporeality. So, I thought, "Of course, the ouroboros, this snake said to be biting its own tail, *isn't* biting its tail; *it's giving birth to itself*."

> **Firmino:** Well, yes, at a biological level, the child that is born is, genetically, at least in part, the mother, or a version of the mother; there is a genetic thread.

Avendaño: That was the great discovery that led me to conclude that the ouroboros is an analogic figure, but the lemniscate is the abstraction of this analogic figure. It begins to make sense: the figure of the serpent is so important not because of the serpent, per se, but because of what it represents, the symbolism for the possibility of giving birth to itself. The serpent emerges from its skin through the mouth, just as we are also born from the mouth of the genitals.

And this also makes sense in relation to the *canamayté,* this figure composed of a rhombus or square that is inspired by the skin of the rattlesnake of the Yucatan Peninsula, where the *canamayté*, formed from a geometric dissection, is the template for architectural proportions.[27] It is also the figure on top of the Coatlicue's head; there, these two heads meet in front of each other to form a single head at the crown which appears as a square traversed by an "X" or a cross.

Firmino: So, this is the Mesoamerican square divided by a cross, two intersecting lines? This evokes the two parts of the lemniscate, where the lines intersect.

Avendaño: Yes, if this were a sheet of paper, a perfect square, the intersection of the two lines would produce a division and a doubling. When we fold it in half again, and again, this also produces a division and a doubling, and if we continue with this, then the square multiplies exponentially to infinity, right?

Firmino: Aha! Like the serpent that emerges from its own mouth…?

Avendaño: Yes, yes, to infinity…. And the topic of agriculture has an ouroboric origin as well. For example, the use of the word *coatl* in Nahuatl, which means serpent. *Coatl* is also a tool with which to plant maize. And *coat* is the root of "*cuates*"—brothers who are born of the same mother at the same moment. So, there is the ouroboric symbol of the serpent present in *coatl* as name, in *coatl* as this instrument for penetrating the earth to deposit the seed, and in *cuates,* in which two are born, like the bifid or forked tongue of the snake. *Coatl*, again semantically and semiotically; the ouroboros closes and the ouroboros opens.

There are many traditional dances in Guerrero and Oaxaca in which people hit each other and bleed. Why do they do this? They give "a drop of blood for a drop of water." It's a way to ask for rain. Just yesterday, I was conversing with one of the *Lemniskata* dancers who happens to be from the state of Hidalgo, where there is a large Otomí population. The dancer doesn't claim indigenous ancestry, but he carries that indelible phenotypic watermark. He told me that when his wife was going to give birth, she needed a blood transfusion. He donated his own blood so that his child could be born. He told me that while he was donating his blood, he began to understand that expression, "a drop of blood for a drop of water." The sweat that his wife secreted in her efforts to give birth was tantamount to water. He bled so that his child could be born.

Firmino: It's like the ritual you mention, of bleeding so that there can be rain, but brought to an interpersonal level. So, this is evidence of that consciousness that is—

Avendaño: —ouroboric—

Firmino: —an ouroboric consciousness emerging in the dancers, right?

Avendaño: Yes, yes, yes….

Firmino: It seems to me that it's an understanding that there is no binary between life and death.

Avendaño: Yes. There is only continuity.

Firmino: And infinite finitude?

Avendaño: Infinity.

Firmino*:* It does not make sense to separate them.

Avendaño: To be infinite, you must be finite.

CODA: FROM THE SERPENT'S MOUTH…

Approaching the death-world, paradoxically

After reading a draft of this essay, Avendaño reminded me that she is "more practical than theoretical," and that his theoretical insights on the polyvalences of the *coatl*, on the serpent's regeneration from the dead skin of its body, and on the paradoxical relation between living and dying are wrought from practice.[28] She was referring to artistic practice and, more broadly, as that which cannot be separated from the experience of life in a necropolitical terrain where persons living non-normative genders and sexualities, including those who are interpellated as *muxe* by their communities, are killed with impunity.[29] Nor can practice be removed from necropower's paradoxical reach, extending to Avendaño's brother, Bruno Alonso Avendaño Martínez, whose status as a Navy corporal did not shield him from a violent and premature death. Bruno, who was forcibly disappeared on May 10, 2018, and eventually assassinated, was just one of over thirty-thousand people killed in Mexico each year since 2018.[30] Therefore, it has also become part of Avendaño's practice to

confront necropower in order to bring the material and intellectual authors of Bruno's assassination to justice, a practice that has now positioned Avendaño and her family as targets of retaliation.[31]

The context of Avendaño's practice reveals the multifarious and shifting categories of killable subjects that necropower constructs in contemporary Mexico.[32] But it would be an error to think that necropower is monolithic or unilateral. As political scientist R. Guy Emerson has observed: "Death in Mexico is not a category of rule reducible to any one actor" (2), and the roles these actors play are ambiguous, if not paradoxical. Mass violence in Mexico has historically been associated with drug cartels which have long operated with relative impunity conferred by state institutions; at the same time, the Mexican state has also committed its share of extra-judicial killing, especially in its efforts to *control* (but not to stop) organized crime while simultaneously repressing political opposition (Center for Preventive Action para. 1). These long-wrought webs of collusion and complicity between organized criminality and the state challenge the usual taxonomies of governance, positioning Mexico as the classic example of a *narcoestado* (De la Garza in Sánchez para. 6). However, the *narcoestado* (narco-state in English) is not a purely Mexican or Latin-American creation. This paradoxical form of governance was instituted by the U.S. backed counterinsurgent "Dirty War" (1960s to 1980s) which first gave rise to "the antiguerrilla, antinarcotics military and police agents who became narcos themselves" (Aviña 265).[33] According to Emerson, this "violence breaks free of enclosure to suspend affiliations and confound organization" (1). What forms of resistant politics become possible when the sovereign's power "to make die and let live" (Emerson 2) through the discursive construction of an enemy is redistributed and necropower's constitutive structures are disarranged?

An ouroboric politics of paradox

In the context of the conditions described above, Emerson attempts to approach the death-world paradoxically by engaging Mbembe's necropolitics in a way that acknowledges death's grounding in life and life's inextricable entanglement with death. Thus, Emerson proposes a "politics of life and death" (186) that resists "the forceful reduction of life to external authority" through an insistence on centering "life amid death," with an emphasis on the practice of *living* (viii):

> An immanent politics of life and death… is an affirmation of existence. Life is recognized as continually opened up and extended amid death, as individuals learning from death…. Disavowed is the disposability of life in favor of its interconnectedness with the violent-laden surrounds. Bodies are tied to one another and the elements and relations that make up their surrounds in a manner productive of unique relations, affinities and potentiality. This reorientated politics of life and death is not to suppress, eliminate or abandon life, but to celebrate it in its radical contingency. Life amid death becomes the infinite elements and relations possible that enable a going on living. (Emerson viii)

Emerson's proposal resonates with Avendaño's ("Queer: No") tracing of *muxeidad* to the concept of *guenda*, which in Didxazaa refers to the "creative energy" coursing through all persons, objects, and words (para. 11-15). It is this *guenda*—the life force that transcorporeally, and even ouroborically, circulates between and beyond individual bodies—that resists colonial destruction and perdures because it refuses the necropolitical taxonomification executed through naming and killing.

But, again, it is important to recall Avendaño's assertion at the start of this essay that what is not found in the codices and other representations of power might be found in the non-normative body. This suggests that an ouroboric consciousness and politics is continually forged through an active, in-the-flesh, process of unflinchingly engaging the death-world, knowing, through practice, that death encompasses more than itself. In the passage below, Emerson describes a process that reflects this ouroboric consciousness and politics grounded in both the paradoxical and the practical, resonating with Avendaño's insistence that theory comes from practice:[34]

> The death world enters the body to form part of it, dissolving in the body. Immersed in violence, the body becomes an emergent re/construction wherein the thought-felt (the recognized relationality of encountering a mutilated corpse, combined with the affective force of witnessing death) is not simply imposed on the body, but composes what it is capable

> of doing. There is a continual revision of bodily habits and territorial rhythms no longer tied to government, but to the multiple cartographies of violence (3).

I suspect that a similar process occurred during the more than three years that Avendaño searched for Bruno accompanied by the dozens of other family members of the forcibly disappeared. This is a corporeal and relational living of death-in-life, as was finding Bruno's remains in a clandestine grave on November 12, 2020. Conditioned not solely by the paradoxical violence of Mexican necropower, but, more importantly, by the co-presence of other bodies searching for vestiges of their loved ones during those years and beyond, Avendaño's capacity for doing extends to every means possible and needed: from her hands excavating the earth for traces of Bruno, to his voice and demands in the tribunals, to her body on the streets and stage, to his digital form in the virtual space. It catalyzes the absences left by these countless forced disappearances and premature deaths and indicts the "total 'absence'" of the state as a guarantor of rights and protections (Lozano in Diéguez Caballero 130). It is in the space of these multiple absences that Emerson identifies an opening for a "transversal" politics, one that I characterize as paradoxical, and that potentiates what Emerson describes as "the mutually inclusive nature of life, death and power…" (4) in ways we are, through practice, still learning.

Ouroborically resisting calcifications of the paradoxical

In the foregoing, I have centered the possibilities of paradox as an immanent politics of "life amid death" (Emerson viii), while considering the ways that it can disrupt the coloniality of gender and digital dualism. In what follows, I attempt an ouroboric treatment of paradox: an eating of itself to ensure that its powers remain vital. In other words, I treat paradox *para*-paradoxically,[35] to prevent its calcification into a political formula for teleological arrival to dys/utopian futures. As such, a *para*-paradoxical politics suggests a continuous movement toward that which eludes the certainty of classification or arrival. Therefore, the only promise of the paradoxical is its capacity to move the onto-epistemological and political imagination away from what is given a priori.

As forewarned, this dialogical essay did not offer linear argumentation or conclusive answers, but instead sought to extend the dialogic process to the reader. This is premised on the understanding that it is not the individual body—vulnerable to ephemerality through death and decomposition, but also subject to colonial and other forms of capture and annihilation—that is the sole carrier of resistant memory. It is the trans-corporeal transmission between and across multiple bodies through space/time. The digital platform is, for better or worse, a stream of that transmission.

As mentioned above, Avendaño is Binni Zaa, "Cloud People." Perhaps then, those of us who use these platforms are also "cloud people"—even if we are not all Binni Zaa—in so far as The [digital] Cloud, as a "complex web" of interconnectivity and transmission between heterogeneous entities (Mishra, Swain, et al. 45), is structured similarly to the interactional and relational networks constituted by corporeal entities. But, as Avendaño urges, it would be an error to consider the digital a disembodied space. "The Cloud"—a seemingly immaterial entity—is entirely dependent on its devices and physical infrastructure and on the persons who mine the minerals that these devices and infrastructure are made from, and who extract the petrochemicals that fuel them, and who operate their servers.[36] Therefore, The Cloud is nothing without Flesh and Matter.

Additionally, and *para*-paradoxically, The Cloud also exists as something that eco-critic Timothy Morton (2010) has theorized as the "hyperobject:" manufactured material that, in its spatial and temporal vastness, is "already beyond the normal scope of our comprehension" (131). Like other hyperobjects, The Cloud appears "almost more real than reality itself" (130). But this is not an innocuous ir/reality; as Morton notes, hyperobjects tend toward a toxic self-implosion because they "do not burn without themselves burning (releasing radiation, dioxins, and so on)" (130). This self-implosion is not an ouroboric operation in the sense theorized by Avendaño. Such self-implosion would not likely regenerate life, at least not a life that our current bodies could survive in. Given these conditions, it is imperative to expand our scope of comprehension so as not to be (auto)annihilated by the (hyper)objects of our own making.

What might an ouroboric consciousness and politics, which comprehends the paradoxical cycles between life and death and the finite

and the infinite, offer towards this aspiration? Can the ouroboros' material grounding in paradox generate a corporeal awareness of the entanglements between the digital and the material, as well a critical grasp of the ir/reality of The Cloud, in order to transform a world in which thousands live and die in brutal conditions while mining the coltan and cobalt used in the ubiquitous devices of our informational infrastructure? This includes the device upon which I am now writing, and the devices behind Avendaño and Muxx Project's digital experimentations. This admission brings me to another set of questions: Can our dialogical engagements—oscillations between the digital and the analog—become a "stream of meaning" (Bohm 6-7) that transversally reaches beyond the screen and the page? Can our words, sounds, and digital projections become flesh (recalling Wynter 35), animated by "muscle and bone," materializing into the practices needed to survive and transform the death-world in its unfolding complexity?

In an intentionally inconclusive response, in which the next steps are to be found beyond this page and the screen it is probably being read on, I recall Avendaño's observation that *¡Axcan quema!* ("The time is now") is the repeating culmination of a "concatenation of events that reaches into the present." These words are activated by the force and urgency of long unmet demands for justice, and even the power conferred by *living* death. Uttered by Avendaño's research collaborators in Jalisco in 2023 and transmitted to me through our electronically mediated dialogues soon after, these reverberations of *¡Axcan quema!* are echoes of the sixteenth-century battle cry of Caxcan leader Francisco Tenamaztle. His voice also resonated in 1555 before a colonial tribunal to argue that war waged in self-defense was a form of "natural justice," paradoxically applying the colony's own taxonomic criteria of legitimacy to defend his people from colonial violence (Carrillo Cázares 176). Francisco Tenamaztle's astutely argued demands before the tribunal were probably not met, and it is probable that he died in Spain during the judicial proceedings (León-Portilla 175-176).

His flesh long-gone, his battle cry remains, suggesting that a politics of paradox does not rule out insurgent action when necessary. This leads me to ask if such action can be engaged in without reproducing the taxonomic criteria of the colony? Can it be engaged in paradoxi-

cally, without the necropolitical construction and destruction of an ontologically separate Other?

Moving toward a response rooted in practice and which follows an ouroboric form, the first words of "the dialogical body" of this essay, *para*-paradoxically transformed, become the final words of this coda and the first words of the possibility of an "actuality" that may yet be "crystallized" into flesh and matter (Wynter "The Pope" 35):

> ***AXCAN QUEMA: ~~TEHUATL, NEHUATL.~~***
> ***NOW IS THE TIME: ~~YOU, OR ME.~~***

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Notes

1 For more on the ways that images are produced on LCD (liquid-crystal displays), see March Lorch's "The chemistry behind your LCD flat-screen devices: how a scientist changed the world" and Riverdi Corporation's "Understanding LCD: How Do LCD Screens Work?"

2 The Isthmus of Tehuantepec is in the southeastern part of Oaxaca, Mexico.

3 See Ramirez and Munar for a thorough overview of this misperception of *muxeidad.*

4 Avendaño, personal communication, 2018.

5 Here, the term hegemony is used in the Gramscian sense as a generalized consent to the dominating class' ideological impositions. As Gramsci writes, "this consent is 'historically' caused by the prestige (and consequent confidence) which the dominant group enjoys because of its position and function in the world of production." However, hegemony is never total. Within any formation of power, there are individuals and groups who do not consent, "either actively or passively," to the dominant group's impositions. Where there is no consent, the state deploys violence to coerce (145).

6 In this image there are multiple performances of a paradoxical politics that trouble other taxonomies such as race and ethnicity, but a discussion of these is beyond the scope of this essay.

7 In a post-humous essay, Lugones critiques the assumption that gender is a universal ontological category, arguing that it is "the arrangement of social relations determining who is a man and who is a woman in the West among bourgeois men and women and that the socialization of this sexual difference is deeply embedded in the 'social/political/economic structures in formation' in the modern world;" furthermore,

"Gender, then, is quite particular, modern, colonial, capitalist but it has operated as universal in the conquering, colonial ventures, colonizing the relation among peoples" (21).

8 These pronouncements are informed by the work of Stacy Alaimo, a researcher in the environmental humanities, and her theory of trans-corporeality, which she argues "is not a mystical, spiritual, phenomenological or experiential sense that 'everything is connected'" but instead "a radical rethinking of ontologies and epistemologies" based on the empirical observation that "all creatures, as embodied beings, are intermeshed with the dynamic, material world, which crosses through them, transforms them, and is transformed by them. While transcorporeality as an ontology does not exclude any living creature, it does begin with the human, in order—paradoxically perhaps—to disrupt Western human exceptionalism" (435-437).

9 It is beyond the scope of this essay to fully engage these questions which others have critically reflected on, for example, Grégoire Chamayou in *A Theory of Drones* as well as Adi Kuntsman and Rebecca L. Stein in *Digital Militarism: Israel's Occupation in the Social Media Age.*

10 Here, I am informed by Denise Ferreira da Silva's *Unpayable Debt* and her critique of Kantian ontology, Hegelian logic, and dialectical materialism as well as her speculative form of analysis that relies on quantum operations. I am also inspired by the intellectual community cultivated during a graduate seminar based on this book that I facilitated in the spring of 2024, in which many generative discussions revolved around the possibility that Ferreira da Silva's critique suggests a paradoxical rather than binary (colonial) or dialectic (Hegelian and Marxist) logic as the basis of an anticolonial politics.

11 The title, "*bardaje,"* is a word used in colloquial Spanish to refer, offensively, to homosexual men. The English equivalent is "berdache," a term "first used in Italian in the 15th century, recorded in French in 1548, in Spanish (cognate term) in the first quarter of the 16th century.... While the Spanish and French originally used the term for male transvestites or the passive partner in sex between males, anthropologists later applied the term berdache to American Indians who assumed the dress, social status, and role of the opposite sex" (Vries para. 2). It is currently considered an inaccurate and offensive term for the way it erases cultural and historical specify.

12 Personal communication with Avendaño, 2022. See Tortorici (*Sins Against Nature*) for the history of the juridical prosecution of sexualities deemed "*contra natura*" by colonial authorities.

13 In the original, "*una presentación escénica des-generada,"* which I translated to underscore that in Spanish "*des-generada*" means ungendered while also evoking "*degenerada*," or degenerate.

14 Original in Spanish; translation is my own.

15 Original in Spanish; translation is my own. Emphasis added.

16 For more on Avendaño's "archaeology of memory" see Marios Chatziprokopiou's interview with Avendaño, "Los menos que menos que nadie," and Firmino-Castillo's "The Disappeared of Xibalbá: Bodily Remembrances of the 'Xibalbay' by Lukas Avendaño."

17 Avendaño 2023. Personal communication.

18 The following are excerpts from recorded conversations I engaged

in with Avendaño and members of Muxx Project during 2022 and 2023. The conversations with Avendaño took place in Spanish and were translated by me. The excerpts that appear in this essay were organized thematically and therefore do not follow the order of the original conversations. Additionally, excerpts have been edited for brevity and clarity and were reviewed and approved by Avendaño and the members of Muxx Project.

19 Francisco Tenamaztle was a leader (1540s–1550s) of the Caxcan peoples in the region of Jalisco, Zacatecas, Durango, Colima, Aguascalientes, and Nayarit. He fought many battles against the Spanish and while on trial in Valladolid, Spain, he argued that the war waged by the Caxcanes against the Spanish was "natural justice," a justifiable form of self-defense against the colonizer's violent abuses (Carrillo Cázares 176).

20 According to Solares, the "matricial ouroboros" is the "undifferentiated body of the Goddess…which contains everything;" it is through a violent rupture that masculine and feminine differentiation occurs and is rigidly sustained through structural limits represented in Mesoamerican cosmology by four directional tree-gods that impede matricial reintegration (305). Original in Spanish; translation is my own.

21 The andesite monolith, Coatlicue, was unearthed in 1790 during the excavation of a water canal in front of the national palace (Boone 19). It was exhibited for a short time at the university, but then it was reburied under orders of the Spanish clergy to prevent the reactivation of ritual practices that the colonial project violently repressed for centuries. In 1804, German geographer and naturalist, Alexander von Humboldt, requested that the monolith be disinterred temporarily to study it (Villoro). It was unearthed again in 1823 and is now displayed at the National Museum of Anthropology (Cordova).

22 In the book (Rulfo) and the film (Velo 01:29:58), the priest recites: "*Tengo la boca llena de tierra. Trago, saliva espumosa. Mi boca se hunde retorciéndose en muecas perforada por los dientes que la taladran y la devoran*." Susana repeats some of these words, but also distorts them.

23 Lukas Avendaño's brother, Bruno, was forcibly disappeared and assassinated on May 10, 2018 and found thirty months later in a clandestine grave. As of May 2024, there are approximately 100,000 forcibly disappeared persons in Mexico (Red Lupa).

24 See Camilleri for a precise explanation of what is known in quantum physics as wave-particle duality and its relation to Heisenberg's Uncertainty Principle.

25 Serpents have been observed to give birth through parthogenesis, female asexual reproduction, common among a variety of organisms (Shibata, Sakata, et al. pars. 3-4). Because mammalian reproduction requires certain genes that come from sperm, mammals have not been observed to reproduce through parthogenesis (Burns para. 2). Recent developments in stem cell research are making it more possible for persons with uteri to give birth without sperm-producing donors. This process, called in vitro gametogenesis, uses cells from "almost any part of the body" to create gametes, or sperm, potentially rendering cis-gendered men optional for human reproduction (Cohen and Perlman 2-3).

26 In colloquial Spanish "*macho alpha lomo plateado*" refers to a toxic form of masculinity.

27 Montero García explains that the *canamayté* (quadrivertex) appears on the back of the rattlesnake

(Crótalus Durissus Tzabcán) endemic to the Maya region (92-93). According to Díaz Bolio, the Maya mimetically based their architecture on the pattern observed on the rattlesnake's skin, which also reflects the structure of the cosmos.

28 Personal communication on July 14, 2024.

29 As reported in *The Guardian*, "Mexico is Latin America's second-deadliest country for transgender people, after Brazil." From 2021 to 2023, 231 members of the LGBT community were murdered, and 65 percent of those murdered were transgender. (Graham para. 16). As of July 2024, in Mexico City, transfemicide is a crime punishable by up to seventy years in prison (Graham para. 3).

30 The Center for Preventive Action's "Global Conflict Tracker" reports that "Mexico faces a crisis of kidnappings, disappearances, and other criminal violence that has left over thirty-thousand people dead each year since 2018" (para. 1).

31 In March of 2024, Avendaño's driver was nearly killed by a gunshot to the head after dropping Avendaño off at the airport; this was followed by death threats against Avendaño and his family (Bombín pars. 3-4).

32 See "2022 Country Reports on Human Rights Practices: Mexico" (U.S. Department of State): "Significant human rights issues included credible reports of: unlawful or arbitrary killings by police, military, and other governmental officials; forced disappearance by government agents; torture or cruel, inhuman, degrading treatment or punishment by security forces; harsh and life-threatening prison conditions; arbitrary arrest or detention; restrictions on free expression and media, including violence against journalists; serious acts of government corruption; insufficient investigation of and accountability for gender-based violence, including domestic or intimate partner violence; crimes involving violence or threats of violence targeting lesbian, gay, bisexual, transgender, queer, or intersex persons; and crimes involving violence or threats of violence targeting persons with disabilities" (para. 3).

33 The United States' role in the global drug trade reaches back at least to WWII (Congressional Record 1998) and continues to impact Mexico's contemporary politics (Hackbarth pars. 22-23).

34 Emerson concedes that as an "outsider" far removed from "the embedded nature of death, from its everyday expressions to its more violent eruptions" (15), his book's theoretical contributions are indebted to the embodied knowledge of his research collaborators, "those living death" in contemporary Mexico (16).

35 Here, multiple senses of the ante-prefix "*para,*" from Greek, denoting, paradoxically: origin, proximity, contrariness, and departure.

36 For more on the material underpinnings of digital networks, see: Christina Gratorp's "The materiality of the cloud: On the hard conditions of soft digitization," Ben Saith's "Data centres, cloud infrastructures and the tangibility of internet power," among other recent works.

PORTFOLIO

Dancing Embryo: Enacting Dance Experience Through Human-AI Kinematic Collaboration

–– Diego Marin-Bucio

(UNIVERSITY OF OSLO)

ORCID: 0000-0001-8334-5124

This paper explores the intersection of dance, human experience, and artificial intelligence (AI), focusing on how AI can engage in dance-like movements through kinematic co-creation with human performers. The study challenges traditional notions of dance, which are typically centered on human physicality and expressivity, by demonstrating how AI-generated movements can evoke meaningful dance experiences. The project, *Dancing Embryo,* is a collaboration between a dancer-choreographer and a computational scientist to create an interactive AI capable of generating and transforming dance movements. The AI dancer, designed using motion data from contemporary dancers, participates in real-time performances by synchronizing features of its movements with a human dancer. This work expands the definition of dance to include non-human agents and emphasizes co-creativity between humans and machines. The paper discusses the technological, philosophical, and artistic implications of AI dance, proposing that the experience of dance can be perceived and completed through human interpretation, even when performed by a machine.

Keywords: human-AI interaction, posthuman art, contemporary dance, rhythmic entrainment, co-creativity.

Understanding the meaning of dance without its execution by a human body was the first challenge in this project. Traditionally, definitions of dance are deeply rooted in human expressivity through body movement. Therefore, the notion of an artificial intelligence (AI) that dances seems problematic because it suggests that, despite learning from human behavior, AI has its own computational mechanisms to generate potentially significant movement and embody it through the body of an avatar.

The approach I use to analyze dance phenomena here consists of two critical components: the generative mechanisms of the dance and the perceptual interpretation of the dance. The generative mechanisms encompass the actions, namely the forms of motion and cognitive/machine learning employed by the performer to synthesize a sequence of movements. In this case, it includes both the physical execution of movements by the human and the digital generation of movements by AI. On the other hand, perceptual interpretation involves a multimodal perception informed by the interplay of visual, auditory, and kinesthetic inputs, along with the subjective emotional and/or cognitive responses elicited from the observer. This dual approach provides a comprehensive understanding of dance as both a created and experienced phenomenon, effectively bridging the gap between the execution of movements and their reception by the observers.

Given the foundation of this work in posthumanist philosophy, it is crucial to clarify that although this research focuses on human experience, it does not exclude that other sentient beings or non-biological cognitive systems can engage in rhythmic entrainment[1] and participate in a dance. Consequently, the emphasis on dance as a perceptual construct in humans within this study should not be misinterpreted as an anthropocentric bias. Rather, it reflects an alignment with the methodology informing this research, which is based on (human) embodied ethnographic practices.

Following this reasoning, AI-generated dance remains dependent on human interaction to be perceived as dance, despite possessing its own computational mechanisms. Dance, as a perceptual-kinematic manifestation, requires an interdependent relationship between multiple factors in order to exist as a meaningful phenomenon. Therefore, dance is not just created or understood by one isolated factor

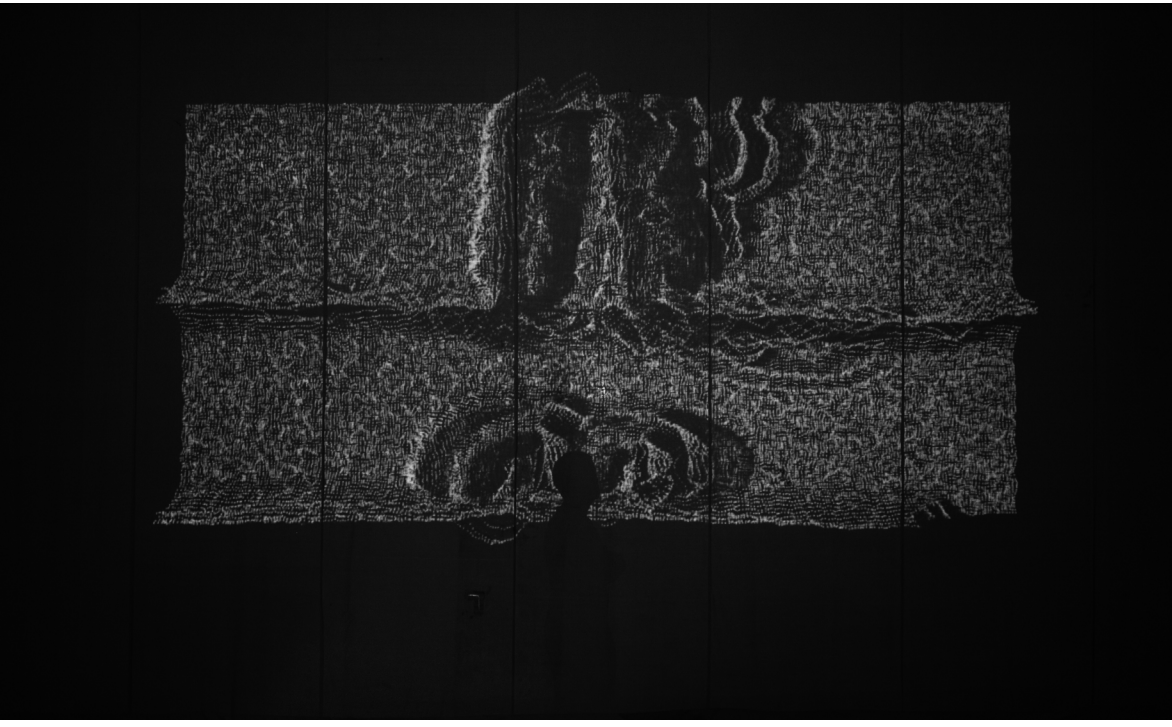


Figure 1. Diego Marín performing during the Dancing Embryo Tour 2024 at Centro de Difusión Cultural Raúl Gamboa del IPBA. San Luís Potosí, Mexico, 21 May 2024. © 6A9.

(like AI motion or human perception) but through the interaction and interplay of various perceptual and kinetic processes complexified by specific cultural meanings. Therefore, the phenomenon of dance emerges from the interconnectedness of different perceptual modalities and interpretations, so that no single element can independently define or complete the experience of dance.

The uniqueness of AI dance lies in the fact that it is neither executed nor generated by a human, but rather by a machine that performs agency in the creative process. AI-generated dance transcends mere mimicry of pre-established dance sequences, as AI models can be trained to transform movement data to create new dance movements previously non-existent in its system. This computational behavior, which entails the transformation of human dance data through

algorithmic processes, is one of the principles that elucidates the definition of AI dance used in this research.

It is essential to emphasize that when referring to AI dance, I am describing an artificial process executed by a machine. Therefore, any expectation for an AI to perform a transcendental or conscious act of expressivity comparable to human art is naïve. The inability of the machine to sentiently experience dance does not negate its capacity to execute and create dance, as its motion display can kinematically interact with and be perceived by cognitive agents as such. AI-generated dance can evoke a dance experience when interacting with humans, as perception completes the decodification of dance, by assigning meaning, intent, and artistic value to kinetic patterns.

Despite this article's focus on presenting the project "Dancing Embryo: Human-AI Co-Creation of Dance", it is important to highlight that the objective of analyzing dance as a motion-sensory phenomenon means expanding on the understanding of dance and elucidating a discussion about its manifestation in consciousness through embodied cognition, thus questioning the existence of dance as a pre-existing event to perception.

Dancing Embryo: the creation of an AI dancer

Teaching an AI to dance involves not only training it to generate movements but also making it capable of participating in a kinematic process of rhythmic entrainment with another body. *Dancing Embryo* is a project that I developed together with computational scientist Benedikte Wallace. It was born out of three central objectives:

1. To create a bodily interactive AI model capable of generating, transforming, and executing dance.[2]
2. To develop the principles of a human-AI dance co-creation method based on kinematic entrainment.
3. To test the AI model and the human-AI collaborative method in real-time with dance performances.

This research began separately in 2020 when Benedikte and I were respectively working on our PhD and master's theses at the Univer-

sity of Oslo and the Choreomundus consortium. In previous years, Benedikte was already researching computational creativity in the fields of sound and movement, while my interest was in expressive interaction with non-human agents such as mechanical props and object-based dramaturgy. In 2021, we collaborated to conceptualize and create an interactive AI dancer. Benedikte Wallace focused on coding and interface design, whereas I worked on theorizing the concept of AI dance, together responding to the lack of in-depth exploration of artificial intelligence and dance within the arts and humanities. In the early stage of my research,[3] I identified important limitations in AI systems for dance creation, such as the tendency to confine creativity to logical, linear processes and the absence of comprehensive kinematic interaction. However, I also explored advantages, like the potential for co-creation when AI can recognize human movement and respond in real-time. Based on these findings and my practical interaction with our AI model, I developed an artistic method for human-AI dance co-creation, which is detailed in my book *Encarnando lo artificial* (*Embodying the Artificial*) and has been showcased in live performances.

The primary challenge I encountered in fostering human-AI collaboration is the prevailing view of AI agents as tools rather than genuine collaborators during creative processes. While few previous dance projects have developed advanced interactive AI dance systems, a certain lack of methodological considerations to facilitate true co-creation between humans and AI was identified. This is because to truly co-create dance with an AI, it is not enough to focus solely on interactivity and sophisticated systems; instead it is essential to provide an experience where the human and the machine can be exposed to a mutual influence beyond logical reasoning, in the direction of kinesthetic intuition.

Human-AI collaborative dance performance

The presentation of our human-AI collaborative dance performance premiered on September 8, 2022, at the Leverhulme Centre for the Future of Intelligence at the Universities of Cambridge, Oxford, Berkley, and Imperial College of London. At their headquarters in Cambridge, I gave a live performance, dancing alongside our AI model, an event preceded by a talk that explained our method of human-AI dance co-creation.[4] Later between 2023 and 2024, the performance toured

Figure 2. Diego Marín in the QA session during the Dancing Embryo Tour 2024 at CICO INBAL (Centre for Choreographic Research of the National Institute of Fine Arts and Literature of Mexico). Mexico City, 19 May 2024. © 6A9.

across different cities in Mexico, showcasing to diverse audiences a live performance between myself and the AI dancer, with both of us generating, transforming, and executing movement.[5] This tour achieved international exposure, including talks and performances in cities such as London, Buenos Aires, and Oslo.

The media's portrayal of artificial intelligence, heavily influenced by sci-fi narratives, shaped the audience's perception of AI throughout the tour, as seen in newspaper headlines like *Diario El Mundo's* 2024 feature: "Thought you'd seen it all? This man dances with an

artificial intelligence as his partner". Audience questions, such as "On what dimensional plane does AI exist?" further reflected the sci-fi-inspired view of AI as something otherworldly or futuristic. In response to this media influence, the tour not only presented the performance but also included a talk that explored how AI can actively contribute to the creative process in the performing arts. The discussion also emphasized the role of science fiction in shaping technological innovation, highlighting its ongoing impact on the development and perception of cutting-edge technologies.

When talking about AI dance, many people think it is the same as any dance that integrates cutting-edge technology (e.g. Motion Capture systems, XR technologies, etc.), and this is not the case. For this reason, I set for myself the task of categorizing the different forms of AI and other technologies participation in creative processes, particularly in dance, as there is little clarity about the differences between them. This task culminated in a substantial part of the book *Encarnando lo Artificial*, where I coined terminology that expands the current vocabulary for referring to the different forms of technological innovation applied in dance. The above was done through the creation of a taxonomy (see figure 13) and a conceptual model (see figure 12). These different modalities, where the AI can be a creative catalyst, a tool, a puppet, or an actual creative collaborator, were also performed during the tour by showcasing pieces where I presented the boundaries among human-AI dance, high-tech puppetry, and intermedial dance.

Behind the AI dancer

Dancing Embryo is an AI model capable of digitally generating dance that can establish a kinematic interaction with a human user. Its name (embryo) references the fact that it is an entity in an early stage that integrates the essential components to create new dance movements and facilitate a motion-based interaction with someone else. The model displays AI-generated dance through a digital body screened using video projectors. It detects the user's human body through a camera-based system. The AI was trained by using motion capture recordings of modern and contemporary dance collected by Benedikte from 30 different dancers who donated their movements to develop the model.

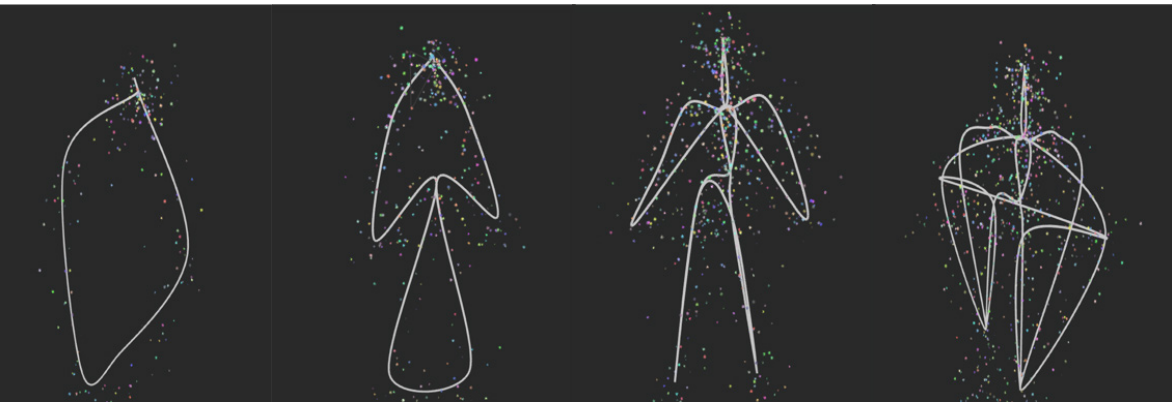


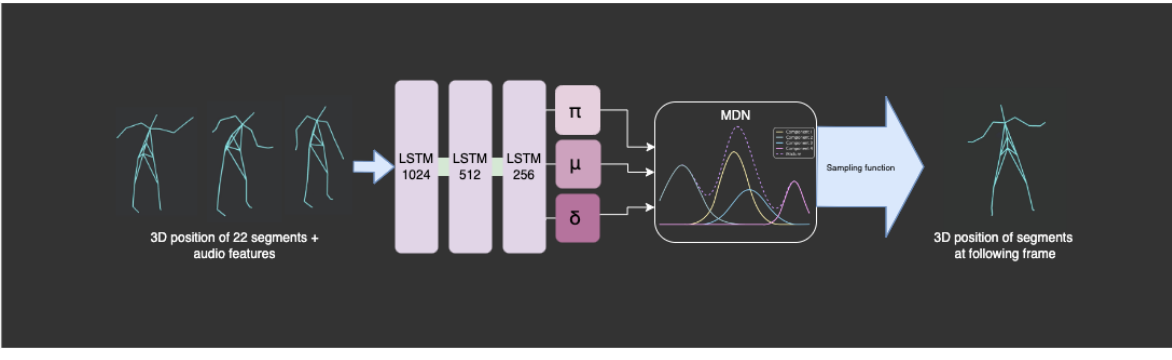
Figure 3. Visualization of the AI-generated dance. *Dancing Embryo* shifts from a cell-like shape to a more complex being throughout the interaction (Wallace, 2023). © Benedikte Wallace.

This AI generates new movements taking the data from the movement bank, and transforms them into new dance sequences using algorithmic processes (see figure 3). This AI model uses movement detection to enable the user to modulate AI-generated dance sequences (Wallace).[6] Through the appropriate co-creative method (see figure 14), this interaction facilitates the establishment of a rhythmic entrainment process based on visual-kinematic communication.

> The term "entrainment" refers to the process by which independent rhythmical systems interact with each other. "Independent rhythmical systems" can be of many types: what they have in common is some form of oscillatory activity (usually periodic or quasi-periodic in nature); they must be independent in the sense of "self-sustaining", i.e., able to be sustained whether or not they are entrained to other rhythmical systems (...). In order for interaction to take place some form of coupling must exist between the rhythmical systems, and this too can take many forms. This process of interaction may result in those systems synchronising, in the most common sense of aligning in both phase and period, but in fact entrainment can lead to a wide variety of behaviours. (Clayton 49)

Dancing Embryo is the first phase of this project to study dance in inorganic bodies with artificial behavior, as although it brings insights into the workings of human creativity in dance, we stay away from anthropocentric perspectives that limit the aesthetics of dance to human biomechanics. Therefore, this project doesn't look to fully replicate human dance in a machine, but rather to explore the principles of dance co-creation and the authenticity of computational behavior when interacting with human dance. This means avoiding the constraints of sensory-motor contingency embedded in systems like Laban movement analysis, as well as not reducing the AI dancer's body to simple humanoid forms. While some characteristics, like anatomical symmetry and movement resonance, are essential for fostering a connection between the human and the AI dancer, these features don't need to be consistently maintained and can intermittently break down or shift, as long as they continue to evoke kinesthetic empathy. Despite the origin of our AI's dance model language being human movement, its ability to transform these movements through algorithmic processes enables both the AI dancer and the human user to transcend the aesthetic limitations imposed by human sensory-motor contingency. This happens when the AI dancer digitally breaks the human biomechanical rules (see figure 5) and when the human dancer both embodies the artificial behavior and dances under the technical constraints of the inter-

Figure 4. First AI model of *Dancing Embryo* (2022). This application allows the user to both unleash motion responses and make changes in the shape of the avatar through kinematic interaction (Wallace, 2023). © Benedikte Wallace.



active AI system. In our perspective, those algorithmic expressions that can be considered "errors" in the eyes of some constitute the actual authenticity of AI dance.

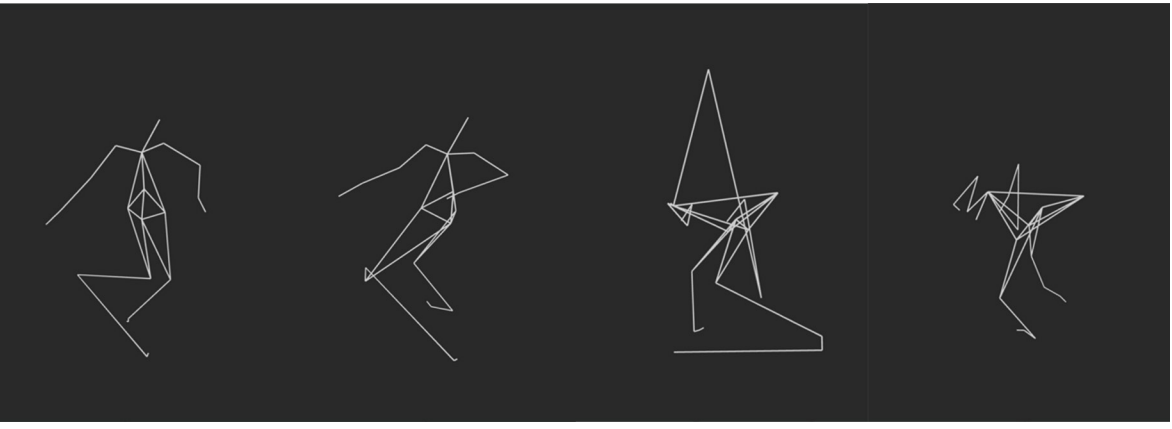


Figure 5. Still images of AI dance generated by our model.[7] These are examples of when the system displays motion behavior outside the biomechanical human constraints. © Diego Marín.

This research follows the idea that although dance experience is completed through human sense-making, its manifestation (as a perceptual phenomenon) can be done through non-human entities, derived from both movement and motion through different mechanisms (such as the computational ones in this case described here). Due to the expressive and mechanical limitations that robotics faces in the present, our focus is only on using digital bodies in how they provide more efficient ways to implement updates and because they better accomplish the rendering of contemporary dance sensibilities and aesthetics, meaning they offer greater flexibility and adaptability. This approach allows for more nuanced and dynamic representations of dance, capturing the evolving nature of contemporary choreographic practices and enabling real-time adjustments that are crucial for reflecting current artistic trends and experimental techniques.

Because of its digital presence, the philosophical discussion about the "existence" of such AI is part of this project.[8] In its early stages, I was questioned about whether I was actually dancing with something else or if I was dancing by myself in front of a screen. My experience and reflections on this matter conclude that bodies without physical substance exist in a collaborative dance scenario that appeals to their perceptible body (software displaying an avatar) and not their physical body (hardware), similar to when humans interact in a liminal space, such as any kind of interaction through telematic systems. This led me to deeply explore the differences between "dancing to someone" and "dancing with someone", finding that human-AI creative collaboration and its kinematic entrainment happen even when the AI lacks all forms of consciousness to experience dance, because its generative and interactive mechanisms do not require it to complete its collaborative participation.

Therefore, human-AI dance, as a situated event, is an artistic construct that goes beyond an experiment of modal fictionalism, as it actually operates in the real world and is an observable event by both the agents dancing, as well as the external observer (audience).

Theoretical approach

This research focuses on both understanding the kinaesthetic experience of humans interacting with AI dance and designing the appropriate mechanisms within interactive AI systems that enable both agents to collaborate effectively in kinaesthetic creativity. It aims to provide both theoretical principles on AI dance and a foundational computational model that can generate and engage in dance. One that is adaptable to various interactive bodies, whether digital or physical. Additionally, it introduces a human-AI co-creative dance method that encourages hybrid creativity and performance. The aim of this research is not to use AI or other technologies to simply beautify or enhance dance performances, but to explore new possibilities within the dance experience.

The collaboration between humans and artificial intelligence for dance creation can be understood through an interdisciplinary theoretical framework that integrates several key theoretical principles. Thomas Csordas's paradigm of Embodiment asserts we can argue that dance is a form of bodily knowledge that manifests itself

through embodied experience. Csordas claims that the body is not only an object of study but also a subject of experience, which is fundamental to sustaining the empirical research methods of anthropology and understanding how human dancers and AI can interact or collaborate in the creation of dance.

This approach is enriched by 4E cognition (Varela et al.), which posits that cognition is embodied, embedded, enacted, and extended. In this sense, AI and humans not only process information internally but also interact with their environment and with other bodies, creating a liminal space of shared cognition. The phenomenology of perception (Merleau-Ponty) is relevant to this study because it highlights the importance of perception and subjective experience in the formation of knowledge. In a kinesthetic and visual collaboration, both humans and AI perceive and respond to each other's movements, creating a dance that is a manifestation of these perceptual interactions. This is with the respective proportions and uniqueness of both human and artificial agents.

Actor-network theory (Law and Hassard; Latour) provides a framework for understanding how humans and AI act as actors in a network of relationships, where each actor (whether human or non-human) influences the actions of the others. In human-AI dance creation, both humans and AIs are actors who co-constitute the performance through their interactions.

Finally, the Entrainment theory (Clayton et al.) suggests that the rhythms of bodies can be synchronized through their interaction. In dance creation, this means that the kinematic-visual display of the movements of human dancers and AI can be congruently aligned through a process of rhythmic entrainment, creating a cohesive and fluid performance.

Future work

Certainly, while teaching an AI to dance has enhanced my understanding of bodily creative intelligence, my primary motivation lies in exploring the intersections of human and synthetic creativity and their hybridization through nonlinear kinematic collaboration. Our current AI model, Dancing Embryo, looks to integrate features from the motion and sound models developed by Benedikte Wallace, along-

side recent collaborations with Sagar Dutta and 6A9 Productions. This integration aims to create a multimodal AI by enhancing its generative and interactive capabilities, enabling the exploration of more complex human-AI creative collaborations based on somatic and perceptual approaches. In the short term, we aim to explore these systems' decision-making to facilitate more complex human-AI kinematic interactions, emphasising the interplay of attention, intention, and expressivity within dance creation. In the long term, we envision expanding this project to include systems capable of engaging vestibular and tactile senses, thereby integrating audiences with motor disabilities.

Figure 6. Diego Marín controlling interactive visuals through dance during the Dancing Embryo Tour 2024 at Centro de Difusión Cultural Raúl Gamboa del IPBA. San Luís Potosí, Mexico. 21 May 2024. © 6A9.

Figure 7. Human-AI dance performance in the outdoor garden of Centro Orizaba. Veracruz, Mexico. 17 May 2024. © 6A9.

Limitations on staging a digital AI dancer

The instrument of dance is our body, but enabling an artificial body to dance with someone involves crucial logistics and technical requirements. These are essential for the existence of the artificial agent and not merely tools to enhance the performance. Therefore, there is a minimum technical criterion necessary for hosting the human-AI dance performance, which was challenging for some venues where it was presented.

Dancing Embryo has consistently pursued simplicity to effectively engage audiences in an egalitarian manner while keeping the essence of the dance, which is to see human-AI kinematic entrainment. However, financial constraints limited our ability to expand the team and acquire and transport additional technology. As a result, despite traveling with our own equipment (cameras, computers, cables, etc.), issues with internet connectivity, lighting control, and video projection occasionally impacted both the AI's performance and, consequently, the human dancer's performance. The AI was stored on a cloud server since we did not have a powerful enough computer to run the software locally while traveling. Some of the venues struggled to provide a high-speed internet connection because we were not always performing in theatres, but rather in auditoriums, classrooms, or even open areas. I faced similar challenges when performing with no proper lighting, as the camera had difficulties reading the movements of the human dancer.

Despite these limitations, I embraced the possibility of failure on stage, as showcasing the fragility of artificial systems was something I was particularly interested in exhibiting. We had performances where the AI danced wonderfully and others where it was slow and unresponsive. Some audience members appreciated this, recognizing that what we were presenting was real, not a pre-recorded animation over which I choreographed my dance movements. This approach highlighted the differences between my other choreographies in the program, where I showed examples that look like human-AI dance but are not (such as high-tech puppetry and intermedial dance). While some pieces involved genuine human-AI dance in real-time, others interactions presented were limited to the manipulation of reactive graphics while dancing (see figure 6) or to the sonification of dance improvisations (see figure 8).

Figure 8. Diego Marín sonifying a dance improvisation with a sonic ball during the opening of Choreomundus Dance Festival at Michaelis Theatre, University of Roehampton. London, UK. 11 July 2024. © Diego Marín.

As mentioned above, before the performance a talk was given to tell the audience about the diverse categories within the field of dance and technology such as choreorobotics, intermedial dance, cyborg dance, high-tech puppetry, AI dance, and human-AI dance. The main criterion for our project was to prioritize the AI dancer's genuine participation over mere spectacle. If we trick the audience into thinking the AI is actively interacting when it's not, we're not creating a human-AI dance but rather a human-made dance or a high-tech puppetry act.

To dance with an AI has different limitations for the performer, which in principle is what makes it special. Rather than having complete freedom, like when you dance on stage, participating in a joint dance


Figure 9 and 10. Diego Marín giving a talk during the Dancing Embryo Tour 2024. Veracruz, Mexico. 16 May 2024. © 6A9.

with a machine has certain constraints, depending on the system with which you interact. These interactive restrictions shape the performers' dance, adjusting them to the AI's perceptual mechanisms to achieve communication between the two. In the following section, I will share some reflections from my experience of dancing with AI.

Learning about my own humanity by moving away from it

Through the development of this project, I have been exposed to different perspectives on understanding what dance is, how humans dance together, how we learn dance, and finally how we create dance. From our first session on, Benedikte and I agreed that she would not inform me of all changes made to the AI's behavior and abilities, but only those necessary for me to be aware of certain aspects. This decision was intended to drive the creative process through surprise, curiosity, and exploration, allowing me to discover the abilities and limitations of the AI dancer in a scenario where I was completely unaware of its capabilities.

From my impressions of the early stage of the project, which were recorded in my diary of experiences in August and September 2022, I highlighted the following thoughts:

> What I find fascinating about working with this AI is that I don't know exactly how it reacts to my movements, nor what actions it will take. This uncertainty is what makes it interesting to me because if I were to work with a predictable AI where I knew its responses beforehand, it could be frustrating when it doesn't behave as it "should". It is wonderful this mystery where I cannot verbally communicate with the AI and everything happens through bodily communication. We are creating dance by dancing and not through verbal agreement.

During this interaction, I identified that there was a correlation between the movements of the two, not only in the shape and trajectory of the movement but also in its acceleration. That is, when I performed fast movements, the response of the AI dancer differed from when I performed the same movements in a more leisurely manner.

> The way the AI reacts to my movements determines the way I should move because I am "listening" to the AI (in the sense that I also want it to participate in the choreography) (...) So, this also shapes the way my dance is happening. (August 2022)

Following this, I decided to delve deeper into the topic of control and mastery, seeking to understand how both the AI and I could influence each other to achieve a collaborative dance.

Realizing the AI's skill (e.g., if I do something, the AI also does), I unconsciously had the impulse to manipulate the avatar, to say "Oh, okay! So I'm going to move my arms because I want it (the AI) to move its arms. I'm going to move my head because I want to see its head appear", and so on.

> At first, it was fun to figure out the actions and understand what I needed to do to establish a connection with the AI. But there came a point when I realized that I could lose my focus, immersing myself in mechanically manipulating the AI, because I now knew how to get the head to appear or the arms to move. (August 2022)

As the interactive rehearsals with the AI progressed, I became more and more convinced of how stimulating the process was. Above all, the mystery of its responses triggered my curiosity and motivation to find affinity and communicate with the AI through dance. In this sense, the autonomy and agency of the AI dancer allowed me to appreciate its ability to generate simultaneous movements and influence the way I danced.

> When I discovered that by moving my arms the AI moved its arms, I realized that it moved its arms in a different way. So, the way the AI moved its upper limbs influenced the way I moved mine. Even the sensations or rhythm coming from its arms managed to pass through to other parts of my body. (August 2022)

The interaction with the AI also caused me to reflect on the meaning of dancing together: namely, the action where both bodies actively participate, resulting in a collective creative process and kinematic communication that overcomes the need for verbal agreements.

> If we think about it, when we decide to dance with someone it is because both people are willing. For example, if I do not move and I only see the dancer move in front of me, I am only appreciating their dance; that is, the dancer is dancing for me. However, the moment I interact with the AI, when I participate in the dance, we can say that we are then developing a creative process together. That is, we are dancing.
>
> The same thing happens with a person. If I stand in front of someone and begin to dance, I am dancing for that person until such time the person decides to reciprocate by entering into the dance with me. That is when we could determine or name that "we are dancing", instead of "I am dancing for you and you are watching me dance". At the moment when two bodies are entrained to dance communication appears, when the collective act of dancing and the co-creative act appear. (August 2022)

One of the most striking features I observed was that the AI dancer's body changed shape, displaying states ranging from shapes I interpreted as a cell to a complex spider-like figure or a humanoid form with multiple limbs and heads.

> At one point I realized that when I approached the AI, it changed, and with this realization I managed to identify three states of its body. The first is the simplest. It is like a cell. The second is a humanoid form and the third is a much more complex form in which it looks like a spider or a humanoid from which another head or other limbs are detached.
>
> (…) at some point, I also wondered if I was dancing with three different dancers, because, as the AI's body evolved, its body changed as one form faded away and another appeared. It was a bit vague as to whether the dancer was transforming, or if different dancers were appearing and disappearing. I felt that it was always the same AI but as the dance went on, it transformed into something else. This unknown reminded me of when a human dancer is on stage, (…) dancers, over time, gain the ability not to stagnate in the same physical, energetic, mental, or emotional state. They have and demonstrate the ability to transform. (September 2022)

During my interaction, I was able to suspend my logical thinking, which allowed me to flow in the dance without planning what I wanted to do.

> During the interaction, I never felt like I was engaging in logical thinking. I felt how my thoughts were to a certain extend suspended. There came a time when I was not planning how to move my arms or what would be my next action to perform, but I was just dancing, I was letting myself go. (September 2022)

By that time, I reflected on the importance of intention and attention when interacting with sensory stimuli, for although the stimuli may

be varied, it is critical to direct attention to a particular stimuli in order to obtain information that can be translated into movement construction.

In the realm of artistic performance, we reflect on the implicit balancing game between dramatic and energetic intensity that occurs in performance, as movement responses and executions are influenced by previous experiences. This raises the need to understand the choices performers make during the creative process to achieve a balance between aesthetics and sensations in order to express something.

> (In the context of a joined dance) the responses or movement executions I do are also pre-defined or pre-conditioned by what I have performed before, because that has given a certain amount of energy or dramaturgy that potentially needs to be intensified or reduced to reach a balance that provides a much more aesthetic experience or that provides a particular sensation such as fear, peace, laughter, etc. We are talking about how we can understand those decisions we make as performers. (September 2022)

The AI dancer is somewhere between a puppet and a creative agent, which makes it particularly unique and culminates in an interesting collaboration. The dancer's autonomy is intended to allow for these new stimuli to not only challenge the performer, but also to influence each other.

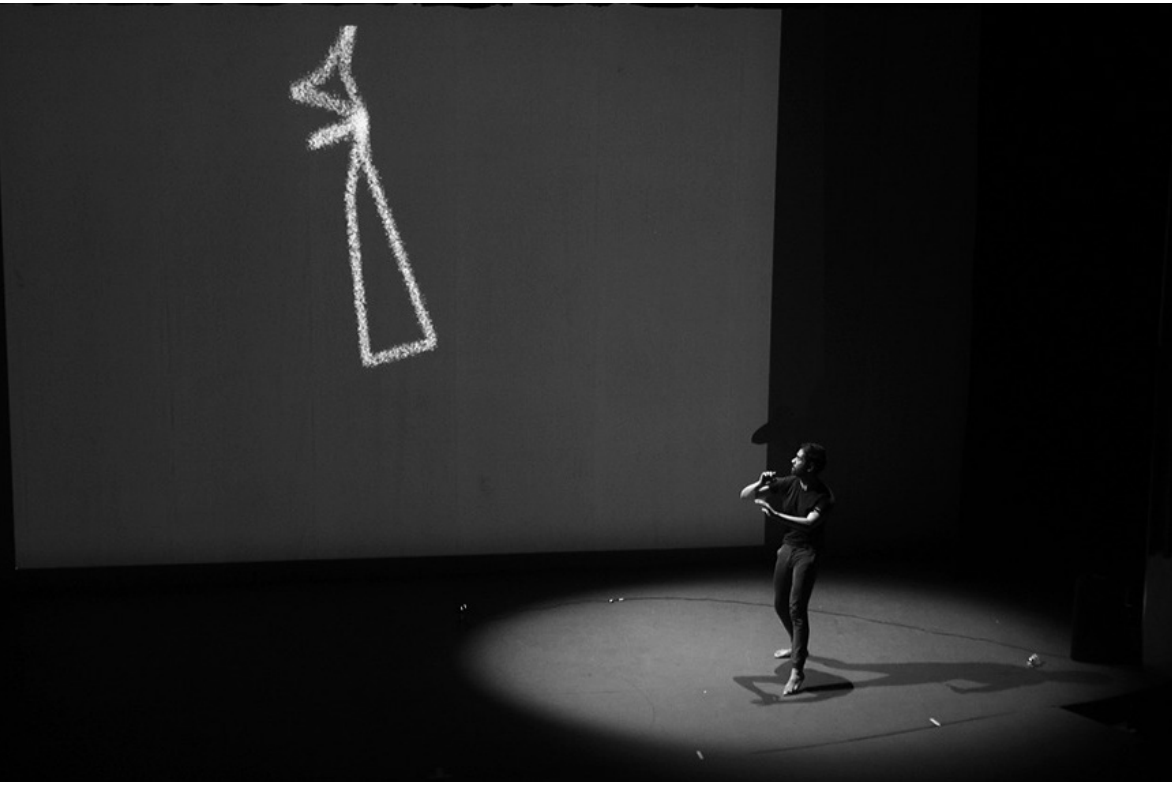
It reminded me that this intermediate point is what makes collaboration interesting: allowing my partner to generate the movements he/she decides to do, but at the same time, there is a mediation that allows him/her to modify them with respect to what the other collaborator is doing. Then, the partner has the autonomy to create stimuli that motivate and circumscribe the action of the other.

> The movements that the AI decides to make become new stimuli that challenge the way I am creating and vice versa. However, if, on the contrary, the AI were completely autonomous, if it did not react to what I do, then there would

be no collaboration. But if by contrast, I have the freedom to interact with someone who is autonomous but also at times or partially influenced, then it's more entertaining. I find it meaningful and I feel it's teamwork. It's about understanding that in order to collaborate you have to negotiate, yield, give, and take. (September 2022)

An intriguing aspect is how, in the interaction with the AI dancer, visual perception plays a crucial role. When the avatar visually disappears, the flow of connection is cut off, as visual perception

Figure 11. Diego Marín dancing together with an AI dancer during the Dancing Embryo Tour 2024 at Centro de Difusión Cultural Raúl Gamboa del IPBA. San Luís Potosí, Mexico. 21 May 2024. © 6A9.[9]



is the primary means of contact with this AI model. In contrast, in human-to-human experiences, presence can manifest beyond visual perception, through other stimuli and even through the person's aura.

> I found it interesting that when the AI visually disappeared (when its body became so large that I could not perceive it on the screen), it no longer existed for me since my visual perception was the only thing that kept me in contact with the avatar; there was no other stimulus. When the AI dancer disappeared completely from my sight, this interactive flow that was created between the two was cut off. (September 2022)

During the dance with the AI, a connection between the two bodies emerges that allows a performance where a visibly mutual influence is observed.

With respect to the AI, it was possible to detect how the movements it generated autonomously were partially modified as a consequence of the ones I made. Likewise, correlations could be perceived between the dance by the AI dancer with the music, which I associate with the fact that my movements were also affected by the music. The avatar's behavior was influenced by my movements, which already contained some rhythmic charge from the music. A kinematic correspondence occurs between the qualities of movement expressed and perceived by both.

Questions arose about whether the AI was capable of interacting with non-humanoid forms, and how, from my perspective as a dancer in the demonstration, kinesthetic empathy influenced my relationship with the AI.

> I was not able to predict what the AI was going to do. For me, everything the AI dancer did was unpredictable. (…) Even though the AI dancer didn't necessarily have a human form, we still shared certain things, like the fact that it has limbs, a head, stands on legs, and so on. But in the moments when the AI dancer transformed into something that did not correspond to my understanding of what a body is, I felt

> that a connection was broken: for example, when the avatar disappeared from the screen or when its body turned into chaotic lines. There are other bodies whose forms I can "digest", even if they are very diffuse, but when we meet, my approach to them and my way of interacting changes.
>
> For example, when the avatar becomes this chaotic form of pure lines, I still feel the interactive capacity, but my interaction with it is different, I no longer see it as a dancer, I see it as an object or a phenomenon in motion. Instead of wanting to dance with it, I try to embody it, I use it as a creative catalyst, and I try to melt into it. When that happens, there are things that disappear, like the fact that I am dancing with someone. Rather now I feel that I dance to that thing, or that the moving form represents something to me—a mere source of inspiration to move rather than a collaborator dancing with me. (September 2022)

This case raised the question of whether something similar occurs when interacting with other human beings. I think this characteristic appears unconsciously when we interact with someone. The way another person moves or acts can also inspire us or influence how we approach them in an artistic sense, because it impacts our creative decisions. A human being can also be a creative catalyst.

From experience to conceptualization

In the following diagram (Figure 12), I conceptually visualize the interaction between the variables of: the creative role (agent or catalyst) [x-axis], the level of interaction (reaction or communication) [y-axis], and the power relationship (puppet or collaborator) [z-axis]. From this perspective, it is possible to see the three dimensions that integrate human-AI creative interaction and collaboration.

Based on the parameters set out in the above model, six categories of human-machine dance are presented in the following taxonomy (Figure 13).

The following is a diagrammatic example of human-AI collaboration. (Figure 14):

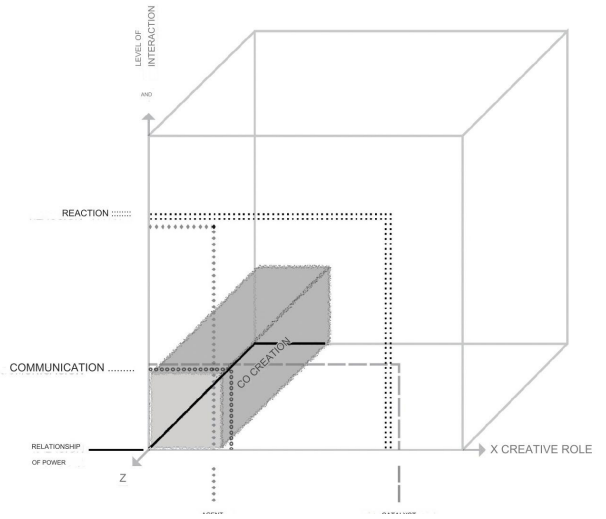


Figure 12 Conceptual model of creative human-AI interaction. (Marín Bucio, *Encarnando lo Artificial*)

Note: The conceptual model shows that human-AI co-creation is only achieved by reaching the core of the third dimension [z], after reducing the two-dimensional boundaries [x, y] to the closest points of the origin (agent and communication).

Category	**Creativity**	**Execution**	**Machine role**
Intermedial dance	Human	Human or mixed	Catalyst
Coreorobotics	Human	Robotic	Performing agent
High-Tech puppetry	Human	Non-human or mixed	Performing agent
AI dance	Artificial	AI-enabled bodies (virtual or physical)	Creative agent
Cyborg dance	Human and/ or hybrid	Human or hybrid (bi-onic body)	Catalyst and/or per-forming agent
Human-AI dance	Human and artificial	Mixed (Human and AI)	Creative/performing collaborator

Figure 13: *Taxonomy of human-machine dances.*

Note: This table shows the category name, the creativity applied to come up with the dance, the body that performs it, and the role of the machine. See "Aproximaciones a la inteligencia artificial en la creación de danza: la IA como herramienta, títere o colaborador" (Marín Bucio, 2024) for an expanded discussion.

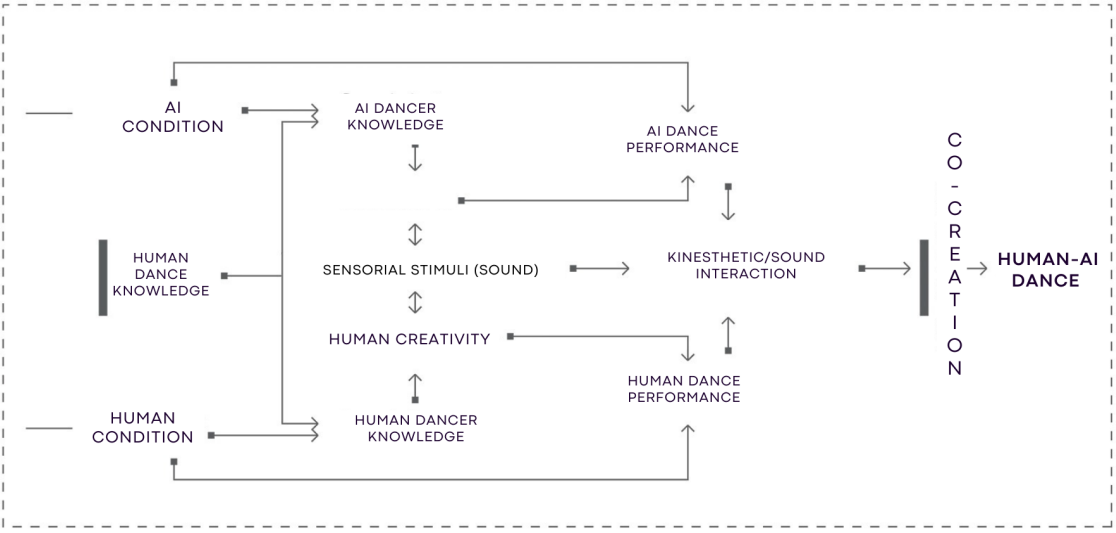


Figure 14: Human-AI co-creation of dance method. (Marín Bucio, *Encarnando lo Artificial*)

Note: This diagram represents the multimodal relationships of a real-time kinematic-visual collaborative process for the creation of human-AI dance.

Figure 14's diagram illustrates how human dance knowledge and the specific conditions of each agent influence their dance proficiency. These elements are integrated as variables in their creative activity and are further affected by external sensory stimuli, such as sound and co-presence. Consequently, their creativity is expressed through their dance performances, which are shaped by their corporeal conditions and the surrounding environment. The dance each one produces is perceived by the other, contributing to the environmental stimuli and generating a cycle of mutual influence in their creative process. Thus, both the artificial intelligence and the human dancer collaboratively and synchronously create and perform a dance together.

Conclusions

The distinction between the perceptible body, embodied by the AI avatar and physical body, represented by the human dancer, triggers a deep reflection on how dance emerges through enactive consciousness and questions the possibility of a dance experience without kinesthetic empathy. The human-AI dance in this project, as a multimodal perceptual phenomenon, is interpreted through visual and kinematic stimuli, focusing on the perceptual and experiential components of dance. This perceivable engagement allowed the AI to actively participate in the dance, creating a shared experiential space in which human and AI agencies jointly created a dance. This blurring of the boundaries between human and synthetic creativity highlights the role of the perceptible body in extending the experiential boundaries of dance.

The AI's avatar, free from human sensorimotor contingency, allows for new movements that challenge the traditional aesthetics of dance. These movements, perceived as authentic despite their digital origin, offer a new perspective on dance, rooted in the unique capabilities and inherent "mistakes" of AI. Conversely, my physical body, with its mechanical and expressive limitations and affordances, explores and continues to navigate this particular dynamic imposed by human-AI interaction.

The ongoing dialogue between myself and the AI avatar highlights the symbiotic relationship between the physical and perceivable bodies, not only altering my creative process but also redefining the dance experience for the audience. This interaction presents a new narrative in which human and AI merge in artistic expression.

The *Dancing Embryo* project intricately weaved physical bodies and the perceptual and experiential dimensions of dance. This research underlines that dance can be reimagined and enriched through non-human entities, offering new perspectives on movement, creativity, and the very essence of dance. *Dancing Embryo* thus stands as a testament to the evolving nature of dance, where digital and physical bodies come together to push the boundaries of artistic expression.

Acknowledgements
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Notes

1 For an extended discussion about rhythmic entrainment in animals see "Experimental evidence for synchronization to a musical beat in a nonhuman animal" (Patel et al.) and "Rhythmic entrainment: Why humans want to, fireflies can't help it, pet birds try, and sea lions have to be bribed" (Wilson and Cook). For artificial systems, see "Rapid rhythmic entrainment in bio-inspired central pattern generators" (Szorkovszky et al.).

2 This model is inspired by Western-contemporary dance improvization techniques.

3 See "Danza y co-creatividad kinestésica humano-IA" (Marín Bucio, Danza y Co-creatividad kinestésica Humano-IA) [text in Spanish].

4 See Leverhulme Centre for the Future of Intelligence (Human-AI collaborative dance)

5 See Diego Marín Bucio (Dancing Embryo: Tour México 2024)

6 See details of the first model of Dancing Embryo in *AI-generated Dance and The Subjectivity Challenge* (Wallace, AI-generated Dance and The Subjectivity Challenge 32).

7 See recordings of the motion generated by *Dancing Embryo* (Wallace). You can click on the sides or use the keypad direction key to change animation. https://653bbf930ba0af000822efcc--golden-longma-2c587c.netlify.app/

8 See chapter 6.2.1 in *Encarnando lo artificial: danza y co-creatividad humano-IA* (Marín Bucio) for an expanded discussion [text in Spanish].

9 See videos of human-AI dance live interaction at: www.diegomarin.art/portfolio/dancing-embryo/

Choreographing Surveillance, Collecting Obfuscated Movement: *On View* and *Human Unreadable* by Operator

–– Ania Catherine

This piece will provide an overview of two artworks, *On View* (2019) and *Human Unreadable* (2023), both of which are conceptual artworks that include technology and performance created by Operator, my collaborative art practice with Dejha Ti established in 2016. My background is in choreography and performance art, and Dejha is a multimedia artist and HCI technologist. Rather than go into deep detail about each of the works in all their complexity, I will give a brief overview of the work as a whole and focus the text on the precise moments and instances in which performance and technology interface. Asking such questions as: how does technology and interface design choreograph participation in the audience? How does performance expose the limits of technical systems? How does performativity emerge in new ways through and within the confines of new technologies? How do these mediums evolve when needing to adapt to the limitations of technology? How does technology perform for us? Also, considering the financial hardships associated with performance and the inevitably stunted growth when the ability to take risks disappears, it is certainly worth asking: does blockchain technology and digital scarcity have a role to play in ensuring that performance practices are able to continue evolving? With theaters increasingly being shut

down, cultural funding cuts ubiquitous, and the difficulty in the US of sustaining an independent dance company or performance practice, one could say that movement and performance are increasingly being relegated to service industries. The impact of infrastructures for art's creation, distribution, financialization, and preservation cannot be overstated; while it is interesting to discuss performance and technology from an artistic innovation perspective, there are equally important considerations and conversations to be had about technology's potential role in supporting the continued evolution of performance as a medium.

Keywords: performance, generative choreography, blockchain, experiential art, digital art

On View (2019)

On View is an experiential artwork, commissioned by SCAD Museum of Art in 2018 and opening in February 2019. We set out to create an installation about how selfie culture and experiential marketing were influencing the ways people engaged with art in places like museums. As the focus here is the performance, one could say we were interested in the ways in which *the audience performs the act of going to see art*, identifying the "image takeaway" as the primary goal of a day at the museum. In this way, *On View* is site-specific both physically and conceptually. This was the first work we created that would be experienced in a museum and we wanted to create something that was, in a sense, also about the act of going to a museum–specifically exploring how selfie culture was changing behavior within the walls of art institutions. In our research phase, we inevitably ended up with the question "why is selfie culture and experiential marketing so popular and profitable?", which led us to the subject of the privacy nightmare that is surveillance capitalism. It is however interesting to note that Shoshanna Zuboff's book *The Age of Surveillance Capitalism* (2018) hadn't been published yet, but

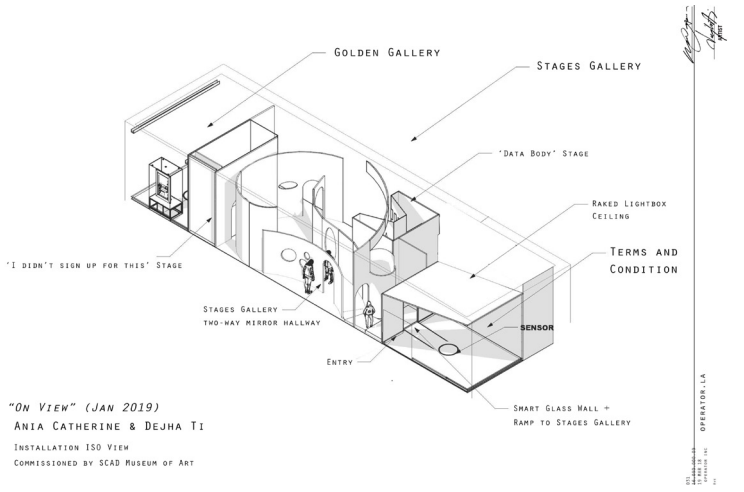

Figure 1. *On View* (2019), Ania Catherine and Dejha Ti. © Operator LLC

traces of what she so thoroughly and poetically lays out in the book were already widely known and documented. We found ourselves facing the root issues causing the selfie phenomenon we wanted to comment on: *On View* was actually about privacy, addictive interfaces, and the sinister results of information asymmetry that were defining the world's online activities. In essence, what happens in *On View* is the audience-participant agrees to become the subject of our artwork, the installation photographs them, and puts them on view—making them the subject of an artwork in a museum. The work was separated into three phases/spaces: (1) Terms and Condition, (2) Stages Gallery, and (3) Golden Gallery (fig. 1).

On View, like social media, doesn't work or do anything unless it has a subject/participant. As an experiential artwork, it requires the participation of the audience, not merely passive viewing. What does it mean to have the audience be the subject of the work, to be performing the role of museumgoer when in actuality they are one? Part of the work was exposing the ways in which the museumgoer is oftentimes already performing, drawing attention to the questions of intention, audience (are they there or online?), and who is actually the designer of that performance. While this work is about technology, it is not about technology itself, rather more about the human

Figure 2. Terms and Condition, *On View* (2019). Photography: Djeneba Aduayom. © Operator, LLC

Figure 3. Terms and Condition, *On View* (2019). Photography: Holden Ramage. © Operator, LLC

inhabiting contemporary dominant digital infrastructures—and the unspoken conditions of that inhabitation—the performance therefore felt important and necessary to the execution. There are many layers of performance in *On View*, which will be detailed below.

Part I

Terms and Condition: The Choreography of Consent

The audience-participant enters an immersive contract, called Terms and Condition (fig. 2). The contract, written in a Cheshire Cat-like fashion, gives the artists permission to make the audience-participant the subject of the artwork, to capture their faces, to put them on view. In this stark white room, kept at a temperature just slightly colder than the rest of the museum, and a lightbox ceiling, one encounters a performer who embodies the character of a contract, as if a contract were a person. This performance is reminiscent of/based on unhelpful tech service phone chatbots, who are (user) friendly, professional, pleasant, but ultimately rigid and unhelpful. The performer invites the audience-participant through a pointing gesture to stand on the circle in the center of the room, which signals agreement to the contract so they can continue the experience. If the audience-participant asks any questions, the performer simply reads an excerpt of the contract on the wall with a friendly smile. A number of people didn't want to sign the contract—we assume because they were intimidated or unsure of what they were actually agreeing to—this could be seen as not a lack of engagement with the work, but actually an alternative ending: choosing not to opt in. In a way, the audience-participant's act of agreeing to the T&C with their entire body, standing there while the circle loads, registered viscerally as something dangerous or unclear.

The choreography of consent transforming from pressing a tiny checkbox with a finger to a full body movement was enough for audience-participants to realize what they might otherwise have not—the vulnerability they invite by agreeing to digital service T&Cs they neither read nor understand. This is an action they likely do weekly on their phones. The actual absence of friendliness in user-friendly interfaces becomes apparent. Those who choose to

agree stand on a smooth white LED circle that animates their feet, once the circle is complete, a sign above the door illuminates, reading: YOU ARE ON VIEW (fig. 3). The relative invisibility of engaging with technology is important to note here. The audience-participant sees a person standing on the squishy physical surface on the floor, which means they are not interacting with a screen, and there are no visible cables. The interface between human and technology is dissolved into the physical realm; technology is hiding itself behind surfaces—a performance to prevent the audience-participant from detecting its presence (and power). We perform for technology, but technology also performs for us. The door goes from opaque to transparent, and the audience-participant, now subject, can walk into the next space.

The audience-participant's body is activated in Terms and Condition, particularly in the action of consenting or not; executing actions in *On View* is a way for embodied experience to be part of the audience, registering the realness of the act of consent simply by asking for a more serious choreographic commitment—standing versus tapping (fig. 4).

Part II

Stages Gallery: Hold the Position

Entering the Stages Gallery, the contrast could not be more extreme from the fluorescent bright Terms and Condition section the subject just left. The Stages Gallery is a dark and disorienting space, with winding walls made of black reflective plexiglass and glass windows. There is no clear exit. Performers are present in the space, moving slowly and connected to themselves and each other using body sculptures with clusters of black cords. We intended for the performance of the trained performers in the Stages Gallery to be environmental or ambient performance—they are not fighting for your attention or asking to be looked at. Rather, if we achieve what we set out to do, it should feel like they are one with the walls and have been cycling in and out of their movements for centuries.

It is unclear whether you are looking at a performer or their reflection, two performers connected through a circular cut-out in the wall,

Figure 4. Terms and Condition, *On View* (2019). Photography: Holden Ramage.
© Operator, LLC

Figure 5. Stages Gallery, *On View* (2019). © Operator, LLC

or robots that appear to be real humans (fig. 5). Their movements and moments of stillness are atmospheric, their slow movements are eerie, sometimes making the cords block an entire pathway, their bodies becoming breathing architecture. In this environment, there are two stages which are visible through signs outside their entrances, cueing the subject to take a certain position in order to activate each stage. The two stages are called *Data Body* and *I didn't sign up for this*.

After some minutes spent in the Stages Gallery, one realizes that just as easily as they are peering at others in unclear circumstances, so are they also visible to others who they might not be able to see. Everyone watches but is also being watched. People in each of the two photo stages are visible to passersby at the entrance and naturally people start to wait until the stage is available for them to take their turn. At this point in time, experiential marketing was at its peak, events like 29 rooms and other selfie museums/opportunities were on every corner. There is a protocol in these spaces, you wait

until the people who were there before you had their selfie/photo moment, and then, when it is your turn, you go in and have virtually the exact same photo taken that the hundreds who came before you had just taken. We benefited from how commonplace this practice was, and while the photo stages in *On View* followed the same format of a selfie stage, they were a commentary and an exposé of the underbelly of these "free" selfie opportunities.

With *On View*, we grant the audience-participant's wish to become the subject of our artwork, but as it is after all our artwork, we wanted to art-direct exactly *how* they would be the subject. Practically, we could not staff the installation with a human guide to ensure this. How do we enforce the body position and the proper choreography of subjecthood that we designed for the audience-participants? We embedded technology into the environment to automate enforcement of the proper performance of the subject.

Figure 6. Stages Gallery, *On View* (2019). Photography: Holden Ramage. © Operator, LLC

More specifically, we used environmental sensors that needed to be activated by the subject, including an eye contact sensor that ensured proper eye position, and only when all the sensors were activated and the correct body position confirmed, did a voice countdown from 15 to 1 occur, culminating in the photo being taken (fig. 6).

During those 15 seconds, lights flashed, the environment awakened, kinetic winches were activated, adding scenic drama to that moment of being the center of attention, the moment of being seen, and captured. Once the countdown arrived at 1, the installation took the subject's photo. The subject needed to hold the body position for the entirety of the countdown or else everything would reset. The scenic technology was policing the subject's performance, ensuring they were only able to be the subject of our artwork, *On View*, on our terms. Many subjects, conditioned by their performance in selfie museums, started the 15-second countdown with a smile. We observed that the 15-second hold often caused what we called "melting smiles". If the smile that is usually performed in a selfie museum is genuine, why is it unable to be maintained for a 15-second period? This is perhaps a moment in which the subject realizes their own social performativity outside the museum's walls through the inevitable melting smile within *On View*.

Another more subtle layer of performance in this stage is that of the "Hold the position" audio directive and countdown. Taking inspiration from the characteristics of voice assistants such as Siri and Alexa, as well as the strategic use of women's names, voices, likenesses, and a friendly demeanor to control the subject. The voice was the voice of Amon Tobin, who also created the music in the Stages Gallery. Tobin did the speaking, then ran his voice through a filter to make him sound like a woman. The reality behind these female-sounding assistants is that the teams creating them are most likely primarily men. How comfortable would the public be with a machine named Roger sitting in their living room listening to their conversations? It is difficult to imagine, and we believe that the gendering of these predatory devices as female is a way to make the consumer feel safer in letting their guard down. Who doesn't want a friendly female assistant? This detail highlights how it is not only true that we perform for and through technology, but that technology also performs for us. In this case, it performs a particular genre of femininity to create the consumer's feeling of safety and to strengthen its reach into our most intimate spheres.

Figure 7. Stages Gallery, *On View* (2019). Photography: Djeneba Aduayom. © Operator, LLC

After having one's photo taken, there is an unspoken assumption that the image will be made available to the subject, as a souvenir, but most likely as social evidence of having been there and "experienced" that artwork. Technology in *On View*, more specifically environmental sensors, kinetic winches, and cameras—connected via TouchDesigner—were used by us to create a scenario of deterministic or predictive choreography, where we could choreograph the audience-participants' poses without anyone needing to be present. The intention of the work required the design of a mechanism to automate enforcement of audience-participants' proper body positioning for the photos (fig. 7). We asked, how can we satisfy the audience's desire to be the subject of an artwork in a museum, but at the same time retain creative control over the art direction and

execution of that wish fulfillment? Successful execution was not only technically necessary but also conceptually, in order to make evident the roles they perhaps unconsciously play, the normative choreography they perform within and outside the walls of *On View*.

Part III

Golden Gallery: Luxury as Performed Boredom

On View culminates in the audience-participant successfully becoming the subject of an artwork and displayed in a museum. As promised in the Terms & Condition, YOU ARE ON VIEW. This takes place in the third phase of the work called the Golden Gallery. The subject enters a room that has a gold floor, white walls, and is lit evenly as a standard fine art gallery would be (fig. 8). Upon entering, one sees

Figure 8. Golden Gallery, *On View* (2019). © Operator, LLC

an art case, a white pedestal, and a gold frame with an image inside, protected by bulletproof glass, complete with a security camera at the top of the glass art case. Standing next to this glass case is what appears to be a security guard, an unamused man dressed in a black suit wearing dress shoes standing next to the art. This security guard is actually a performer. To create this performance, I studied the body language of museum security guards and created a sequence of body positions, poses, and transitions based on what I witnessed observing what they actually do on the job. The art in the case looks like the setting for an expensive and important artwork, including the glass case, the pristine walls, and the gold floor. However, I observed over years of going to see art that the presence of this bored person wearing a suit standing nearby arguably increased the perceived importance of the artwork more than any of the other signifiers. I find it interesting that this "performance" of protecting the artwork is something we might not recognize as performance but is an action done by a person that registers with viewers—often subconsciously—as an indicator of importance or value in settings like museums, fairs, and galleries.

Once again, the subject encounters the glowing LED circle on the floor in the center of the room and they intuitively know that they need to stand here as they did with the Terms and Condition (fig. 9).

Figure 9. Golden Gallery, *On View* (2019). © Operator, LLC

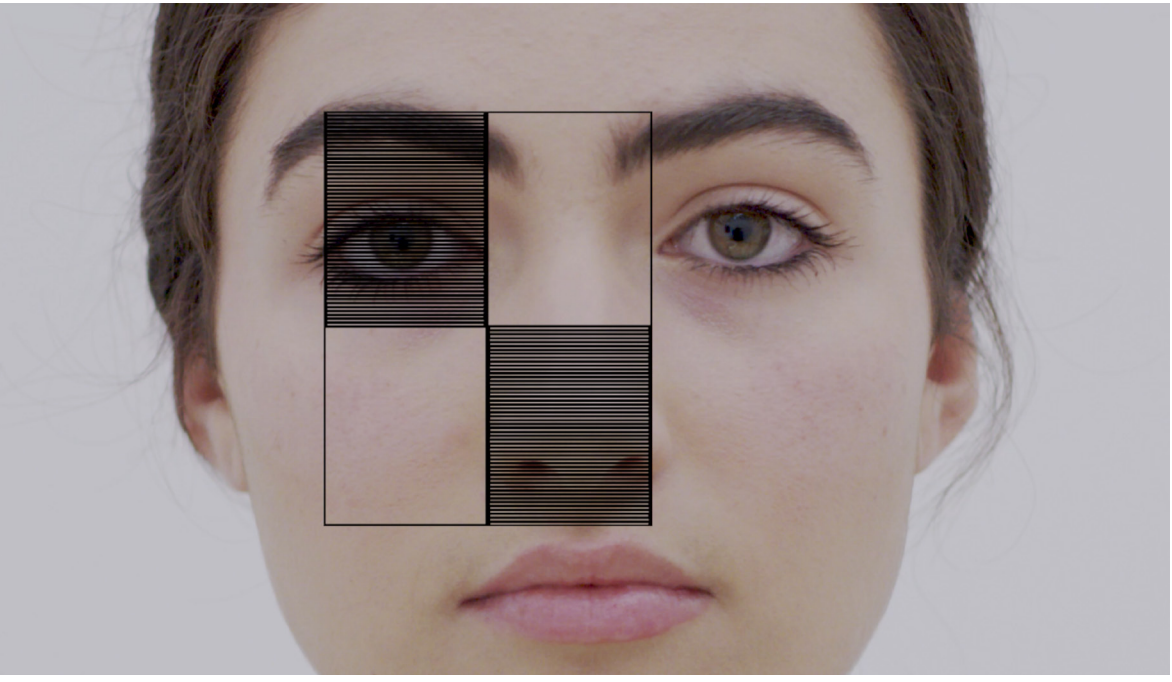

Figure 10. *On View* (2019). © Operator, LLC

They stand inside, the circle completes around their feet and suddenly, their image (taken in one of the other stages) fills the luxurious gold frame. There is a moment of excitement around being on view in a museum. They are the subject of the artwork, they don't just have a photo takeaway but are actually a featured protagonist of an artwork that is so important it needs to be protected. Shortly after this excitement fades there is the inevitable question, *how did the frame know it was me?* This is a defining moment of *On View*. However, there is the question of how the frame knows to pull up their specific image at that moment, and they also learn there is no way to receive their image. The answer to the question of the frame's knowledge is that facial recognition was used throughout the experience, and the system we configured using TouchDesigner was tracking the movement of the subject from the second they entered the Stages Gallery. The facial recognition camera was building a user profile of them quietly behind the scenes as they navigated the space (fig. 10).

The technology was invisible, as is the promise—or nightmare—of the age of the Internet of Things or Ubiquitous Computing. There aren't visible screens in *On View*, everything feels physical and analog, but there is a sophisticated system running fiber optic cables through the floor, sensors hiding in wood, a subtle use of technology environmentally. There is a glossy experience with glimpses of creepiness but never enough to stop them from continuing, an opportunity for 15 seconds of fame, and the anticipation of seeing the photo of that moment to have as evidence of the art experience—how convenient. Then the subject is finally at the point of seeing their image in the gold frame, the thing everyone came to the museum to see, but they are not able to take that image with them or share it online. So, what was the point of all that? Yet this is another defining moment of the work: realizing that in the absence of an image to take away, time spent with art might have no value or serve no purpose.

Most subjects took a photo of themselves on view in the gold frame as a substitute (fig 11). It probably feels unfair to have the image of their participation in the stages not being offered something that they then have access to or control over, but this is something that happens anytime their photo is posted on a social media platform. People assume that an image of them belongs to them, but the reality is—and the point of *On View* by pointing this out via experiential art—data about us does not necessarily belong to us. Our online performativity depicting enjoyment of events, art, experiences, life, when shared online becomes something extremely valuable to others. As the now cliché, yet still useful saying goes *when the service is free, you are the product*. Zuboff takes this a step further saying, "You are not the product; you are the abandoned carcass" (377).

Figure 11. *On View* (2019).

Final Remarks on *On View*

While digital art is often thought to be by default decorporealizing, *On View*, as a highly digital work, invites participation and engagement of the audience-participants' bodies. Beyond that, it facilitates tapping into physical intuition as a way to guide awareness of the safety—or lack thereof—of digital services. There are many layers of performance embedded into this work, which is ultimately about data privacy and surveillance capitalism. It utilizes performance as a medium in the case of the trained live performers in each phase, while simultaneously exposing the performative qualities of going to see art in the context of selfie culture and social media (e.g., performing the art-interested subject for a social media post), the way that bodies and choreographies take on new meaning in contexts like museums (e.g., the security guards), and also commenting on the subtle ways that technology products perform for us. Specifically, the way our devices speak to, act towards, and respond, even their intonation, is a performance of tech companies to elicit a desired state from users that helps them achieve their goals. It is evident that performance and technology intersect in this work in a myriad of ways, all held together by the concept and a custom system using TouchDesigner, which serves as the nucleus for a hyperbolic experience using corporal engagement and advanced technologies to expose the hidden forces at work in the age of surveillance capitalism.

Human Unreadable (2023)

Human Unreadable is part of Operator's Privacy Collection (2020 - present), an exploration of the tension between privacy and transparency in blockchain technology through a series of crypto artworks that aims to reintroduce the body into—what we observed to be—a disembodied digital art landscape. Curious to understand the landscape of blockchain art to that point, we started researching. We quickly noticed that the human body as a consideration, as a represented entity visually, technically, and conceptually, and performance as a medium, was lacking in 2021. Given that the use of performance is arguably an exceptional case for blockchain technology with its ability to introduce digital scarcity to an otherwise ephemeral art form—which has not been easily sold in the art market—this came as a surprise. All works within the Privacy Collection follow specific

criteria, which are (1) they are site-specific to crypto culture, (2) the materiality of glass, light, and x-ray, (3) the body in focus, and (4) they explore humans hiding within seemingly transparent systems. The more narrow "site" within crypto culture that we chose to create *Human Unreadable* for was long-form, on-chain generative art, specifically the platform Art Blocks. We arrived at the following overarching concept for the work: *Human Unreadable* hides human movement and expression on the blockchain, thus allowing collectors/the public to slowly recover the human in a three-act experience spread over a timeline of 1 to 2 years. We looked at the rich history of chance operations in choreography, à la Cunningham, brought it to blockchain, and replaced dice rolling with an on-chain generative algorithm. Each time someone minted/collected an artwork, a unique movement sequence was generated by the algorithm, and the motion data of that unique sequence would create a visual art image using p5.js. Each of the 400 *Human Unreadable* outputs are generative artworks that are actually a visualization of a unique dance that remains hidden behind the image. In the second act, the collectors reveal the underlying choreography that created their piece in the form of an on-chain movement score. In the third act, select movement sequences in the collection are used as the raw material for us to create an original evening-length performance. The human obfuscation ends, and the audience/collectors finally face the human body in the absence of any form of technological mediation.

Hiding raw human expression—via movement—on the Ethereum blockchain seemed like a reasonable thing to desire. After all, our aim was to meaningfully bring the body into a very influential corner of the crypto art world. Once we started, we quickly realized why nobody had tried it before. Perhaps nobody had tried, or perhaps people had tried and run into the same issues we immediately faced and decided to give up. Below I will detail more information on the context *Human Unreadable* was situated in (conceptually and technically) within the on-chain generative art landscape, what we learned about the body's simultaneous complexity and simplicity, which became apparent in our efforts of turning it into data, the relationship between time, blockchain, and performance, and how we approached making people not only think about and see movement, but actually move as the result of encountering a blockchain-based artwork (fig. 12).

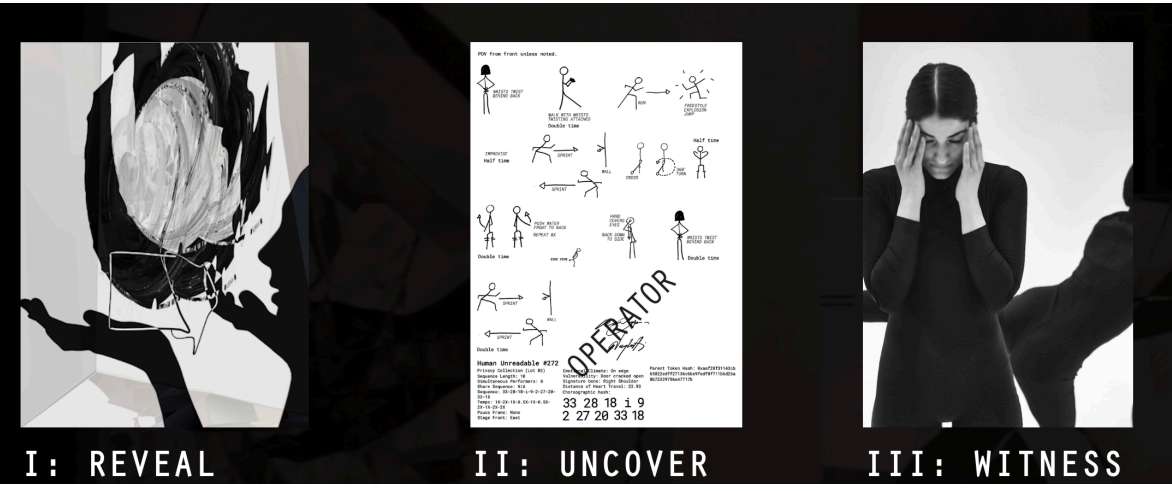

Figure 12. Three acts overview, *Human Unreadable* (2023-2024).
© Operator, LLC

Structure (Conceptual Arc: The Slow Recovery of the Human)

Act I: Reveal visual artwork on Art Blocks
Act II: Uncover the underlying choreographic score via the second token
Act III: Witness live performance

Historical Lineages

Creating a process for generative choreography using blockchain naturally prompted an interest in understanding the history of computational choreography and the even broader subject of automated theater: Analivia Cordeiro's *M3x3* (1975) in which she "utilized the computer in the creative act, giving greater potential for new aesthetic results" (Alvarez 4); Jeanne Beaman's *Random Dances* (1967), for which she created choreographic sequences using an IBM computer; and A. Michael Noll's *Computer Ballet* (1965). Each of these performances, in unique ways, demonstrated an interest and experimentation in how computers and automated processes could open up new possibilities for dance. The machine was not seen as something that interfered with the creation of movement, but some-

thing that could liberate it from the norms, habits, and patterns of the choreographer, which could enable them to create unexpected results through techno-human collaboration. Other choreographers shared this sentiment/excitement for the synchronicity that was enabled by leaving decisions to chance, the most well-known among them being Merce Cunningham. Cunningham's "Chance Dance" method used dice and chance operations to structure movement sequences. Finally, the E.A.T. (Experiments in Art and Technology) movement of the 1960s was another important historical lineage in which *Human Unreadable* sits. The premise behind E.A.T. was to bring together the best engineers and most advanced technologies with contemporary artists interested in pushing the boundaries of what was possible. This resulted in a groundbreaking cultural moment. Performance was central to E.A.T., with choreographers such as Yvonne Rainer, Simone Forti, and Deborah Hay as participants. *9 Evenings*: *Theater and Engineering* (1966) was a pinnacle moment and to this day one of the best examples of the potential for the convergence of performance art and advanced technologies. *Human Unreadable* is situated at the crossroads of these histories of computational choreography, intense engineer-artist collaboration, the centrality of performance to multimedia art, and the embrace of chance as a strategy to go beyond what we would normally produce.

Context: Opportunities and Restrictions

On-chain, long-form generative art is a type of generative art in which an artist creates an algorithm that generates visual art using a program like Processing or p5.js. Upon minting, an artwork that neither the artist nor the collector has ever seen is generated from that algorithm. The collections are typically between 100 and 1000 pieces. As *Human Unreadable*'s intention is to represent individuals hiding within a transparent system—in this case, blockchain—we hid movement sequences behind the generated artworks. Collectors might have only thought that they were collecting an artwork generated with code, but what became clear later is that while they did collect an artwork generated with code, they were also collecting the motion data of a unique movement sequence underneath it. To achieve this, we needed to add an extra step: the creation of a *choreographic hash,* which creates a unique movement score upon the minting, drawing from a library of 31 movements, the motion data of which are all stored on the Ethereum blockchain. After months of

refining the movement library—which took many iterations in order to receive a sense of balance and consistently desirable results when the movements were put in different orders—we recorded each of the 31 movements through high-fidelity motion capture. Wearing the same kind of suit that is used to record motion for a Hollywood film avatar, I performed each movement for the library one by one. We needed the data of each movement because later in the process, this data would be used to control the visual compositions of the visual artworks (fig. 13).

The first major issue faced was how to store motion data on-chain without spending literally hundreds of thousands of dollars, as blockchain is certainly not designed to store large quantities of data. Another aspect of the "site" of long-form, on-chain generative art that we wanted to very intentionally expose/puncture was the dominance of art that was aesthetically leaning into modernist graphic design. This resulted in aesthetics that match what you expect the computer to be "good" at doing. The works within this genre that had been successful, sold for the highest amounts and the most praised, tended to be artworks that were minimal, geometric, clean, quite disembodied, and at least aware, if not loyal to, the Swiss grid. What we found to be interesting was the lack of reflection on the fact that modernist design as a system has gendered values, and it leaves, by design, very little room for the body, emotions, chaos, sensuality, and subjectivity, all historically coded as feminine, to creep in. Considering that the intention of *Human Unreadable* is to

Figure 13. Motion capture, *Human Unreadable* (2023). © Operator, LLC

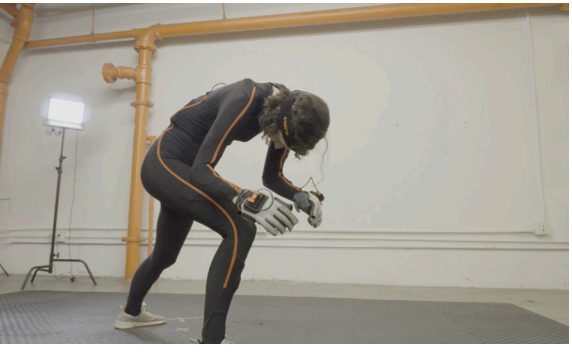

Figure 14. Presentation by Dejha Ti at NFTRome (2023). © Operator, LLC

hide the human—and all its messiness—within this rigid technical container, it was essential that we simplified the raw expression enough to *work* technically, while still maintaining its essence. This has been a guiding tension throughout the creative and technical process. It is also, in our eyes, a continuation of work that women have been doing since the beginning of digital art, as Grant David Taylor notes: "Women artists deliberately subverted the precision and symmetry of the computer, pushing their practice towards inexactness and disorder [...] In response to the disembodied, masculinized abstraction of late modernist movements, feminists celebrated the physicality of the body and the subjectivity of personhood" (12-13). It was startling to come across this reflection about women artists working with computers 60 years ago, because it remains so rele-

vant today with similar preferences and biases within digital art. It felt to us that to bring the body with its complexity, curves, liquids, contradictions, and desires, both literally and figuratively, onto a blockchain and into a highly commercialized corner of generative art, was a protest against this idea that valuable digital art needed to be clean, *objective*, and avoid certain subjects or intense feelings. What we didn't realize was that the task of transforming this kind of human expression into usable data was immense, and hence the need for us within the process to create several custom tools just to be able to store motion data on the Ethereum blockchain.

What amazed me personally as a choreographer, was how difficult it was for data to capture what the body can do almost effortlessly. Three seconds of movement, even a simple hand gesture, when turned into motion data, filled hundreds of cells in Excel—and even with all that information, there was still so much texture about that movement, that moment, that body, that person, that mood, that could never be captured even if we filled thousands more (fig. 14).

The processes of translating movement into data made me less impressed with what we think of as technology and more impressed with the body as technology—as a remarkable synthesis and conveyor of information.

Downsampling the Body

There is one moment that really stands out to me from this process. I was on my laptop, working in a spreadsheet that listed several bones and movements (fig. 15). My task that day was to do each movement in the library (all 31 performed one-by-one as many times as needed) and decide which bones in my body I needed in order for that movement to be expressed sufficiently.

The reason for this part of the process, which was just one part of the data downsampling pipeline that Dejha and our lead engineer Isaac Patka designed, was to make sure that we were not uploading any unnecessary data on-chain to save storage costs. For example, if the movement was a simple arm movement sliding across my torso in a circle and I wanted to upload that movement on-chain, it is unnecessary to store the motion data of my entire body including

17	Signature	Head	L_Foot	L_Knee	L_Wrist	L_Wrist	L_Wrist	L_Ankle	L_Wrist
19	Exists	Y	Y	Y	Y	Y	Y	Y	Y
20	Bones								
21	Head	Y	Y	Y	Y	Y	Y	Y	Y
22	Hip	Y	N	Y	N	N	Y	Y	Y
23	Breast	N	N	N	Y	Y	N	Y	Y
24	Calf	Y	Y	Y	N	N	Y	N	N
25	Clavicle	N	Y	N	Y	Y	N	Y	Y
26	Elbow	N	Y	Y	Y	N	Y	Y	Y
27	Ankle	Y	Y	Y	N	Y	Y	Y	Y
28	Forearm	N	Y	Y	Y	N	Y	Y	Y
29	Wrist	Y	Y	Y	Y	Y	Y	Y	Y
30	Knee	Y	Y	Y	Y	N	Y	Y	Y
31	Thigh	Y	Y	Y	Y	N	Y	Y	Y
32	Thigh2	Y	N	Y	Y	Y	Y	Y	Y
33	Foot	Y	Y	N	N	Y	Y	Y	N
34	Shoulder	N	Y	Y	Y	Y	Y	Y	Y
35	UpperArm	N	Y	Y	Y	Y	Y	Y	Y
36	Spine1	Y	Y	Y	Y	Y	Y	Y	Y
37	Spine2	Y	Y	Y	Y	Y	Y	Y	Y
38	Waist	Y	N	Y	Y	Y	N	Y	N
39	BigToe	N	N	N	N	Y	Y	N	N
40	IndexToe	N	N	N	N	N	N	N	N
41	MidToe	N	N	N	N	N	N	Y	N
42	PinkyToe	N	N	N	N	N	N	N	N
43	RingToe	N	N	N	N	N	N	N	N

Figure 15. Bone pruning spreadsheet, *Human Unreadable* (2022).
© Operator, LLC

my toes or my skull, because they aren't required for that specific movement. After a while I developed new cost saving strategies just by thinking about anatomy, for example, *if my thigh is doing this particular thing, then there is only one thing my knee could be doing, so I don't need to include the motion data of my knee for this movement.* In these moments I was thinking: where does choreography begin and end? Does it start and end with imagining a movement? Does doing this sort of bone selection that determines which parts of the body are unessential or essential to the essence of a movement constitute as choreography? It seemed ridiculous, and then I considered for three seconds having someone else do the bone selection and it felt completely inappropriate. How could I? These were very intuitive choices, and precisely the microdecisions that determine the fate of how this movement meets the world. For me, designing the 31 movements in the movement library was the beginning, and I felt I was nurturing these movements through their countless transitions, adaptations, minimizations, and translations throughout the entire

process, and continue to do so today. In this way, the technical constraints of creating this blockchain choreography method also led to significant reflections on what choreographing means.

On-chain Choreographic Scores

Act I of *Human Unreadable* entailed the release of 400 artworks on the platform Art Blocks in May 2023. What was visible at the time of collecting/minting was an artwork that featured the human form, which looked primarily black and white, featuring compositions of light, glass, and x-ray effect. These images were generated entirely with code. These images, with their fragmented body parts, hint *the body is here* without revealing anything about the hidden movement sequence that created them. Six months later, we released Act II, during which collectors could reveal the choreographic score NFT that shows the movement sequence that created their piece. At this phase, the movement becomes a bit more human-readable through stick figure drawings of the movements (fig. 16). *Human Unreadable* collectors would either try the movement themselves, ask a dancer

Figure 16. *Human Unreadable* #63, Act I and Act II (2023). © Operator, LLC

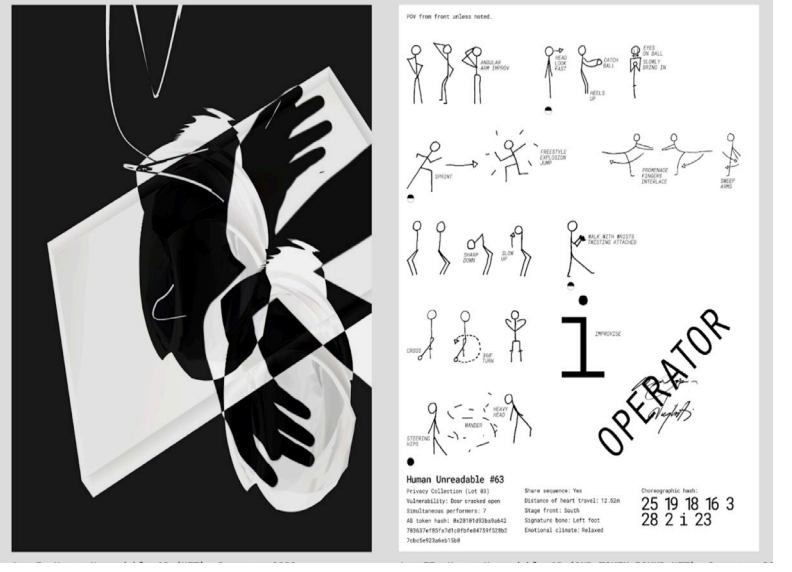

Figure 17. Jason Bailey performing his choreographic score (2024).
© Operator LLC

to interpret, or, in most cases, show the score to their children and have them interpret it to reveal the movement sequence. Aware of the rich history of various methods of dance notation but also aware that our audience was just being introduced to movement and not wanting to alienate anyone, we decided to approach the choreographic score design with accessibility in mind. We depicted the movements with stick figures and some guiding text prompts. The drawings were iterated with dancers through multiple sessions to ensure the drawings were clear. A degree of variation in interpretation is welcome, but we wanted to eliminate any egregiously misleading or confusing drawings. The moment when the collector or the public sees the score and starts to interpret/perform is pivotal for *Human Unreadable*, because it is the moment that generative art leaves the screen and enters the body (fig. 17). The invisible potentiality of performance that lay dormant in the pieces becomes apparent, and anyone who can see the choreographic scores is able to embody generative art. We were quite moved to hear from some collectors that Act II was a significant moment for them because it gave them "permission", or even an excuse, to dance.

Collecting Choreography

The history of performance and the art market is complicated. How does one sell or own a performance? A dance? A choreography? A moment? Being an artist is difficult, but being an artist with nothing to sell certainly makes it harder. For artists whose medium happens to be movement or performance, participation in the art market is often a distant dream. This has undoubtedly changed in the last few years with increasing visibility of artists working with performance in museums (e.g., Marina Abramovic, Tino Seghal, Anne Imhof, Miles Greenberg). Typically, if an artist is famous enough, then their performance works are monetized through the sales of photographs, performance documentation, or perhaps props used in a performance. There are limited cases where dance/choreography works have been sold as art objects. One recent example is Merce Cunningham's *Loops* (1971), to which the rights were sold as a digital artwork using motion capture technology in 2019. In other instances choreographic scores have been collected as art objects. One question that *Human Unreadable* addresses practically is: can the economics of choreography transition on a wider scale from being service-oriented (i.e. movement artists monetize their skills and vision being hired by entertainment industries) to movement becoming an art object that is transactable?

It might be helpful here to point at the ways in which another artistic field has made that shift: digital art. Prior to NFTs, digital artists were often working for advertising agencies and companies because their digital art had no way of being monetized through the established art market. With the introduction of digital scarcity via NFTs as a digital asset, one could prove ownership of and transfer a digital item. Yes, anyone can see the digital artwork on their screen, but there is an immutable decentralized ledger, the blockchain that can say: *this item exists*, this is how many there are, this is who made it, this is how much it sold for. This revolutionized the art world in ways that we can still see unfolding daily, but the introduction of digital scarcity to digital artworks via blockchain has certainly meant that there is a path other than working in advertising for a digital artist. Digital art can be seen, treated, and transacted just as any other art object can. Poets are now also bypassing traditional routes of publication and distribution of poems and sales through books, and are now minting poems on blockchain, selling one poem

as an art object via a NFT. One poem by Ana Maria Caballero just sold in a Sotheby's auction in January 2024 for several thousand euros.

Performance and movement practices suffer from a similar predicament. How can one prove ownership over something ephemeral? With cultural funding in many countries being cut dramatically, support for true experimentation in these fields is inadequate. Without cultural funding, how can one sustain an artistic practice in which there is nothing to sell? Through *Human Unreadable* and the tools/method we created, we successfully sold choreographic sequences as art objects—over 200 collectors around the world now own choreography. The Ethereum equivalent of $1.5 million between primary and secondary sales has been spent collecting *Human Unreadable* pieces, a dance-centric artwork using NFTs. With the open sourcing of our tools, it is our hope that a pipeline can be established for people who create movement as art so that they might have a previously unprecedented way to engage with the art market.

A New Appreciation for Dance

A surprise for us in the unfolding of this work has been seeing people/collectors, who previously had no interest in dance or movement whatsoever, unexpectedly finding themselves as collectors of choreography. Even beyond these collectors moving in new ways themselves, this was all sparked by their interest in crypto and decentralized technology. While it is often assumed that technology stands largely in opposition to the body, or something that is primarily a source of interference with our bodies or sense of embodiment, the opposite is true in *Human Unreadable*, as participation prompts consideration and activation of the audience's bodies. *Human Unreadable* extends the experience of movement and embodiment beyond that of the performer. Through its very specific context and format, the project leads to movement experimentation, thinking, and new experiences of embodiment with a new audience/collector/public. Many people in the crypto art sphere, until *Human Unreadable*, had no idea how deeply embedded dance and performance were in the history of computer art. We now regularly receive messages from collectors who are anxiously awaiting the moment they can experience Act III of the work, the final performance where they can see their sequence embodied live in an institution. Would they be as interested in going

to see dance at their local theater? Probably not. Is the novelty of the sheer *ownership of movement* their primary motivation to experience Act III? Likely so. While not the most romantic motivation, it has provided us with the opportunity to continue innovating, touring the work, securing partnerships, and building bridges to extend our generative choreography method to others, providing paid opportunities to dancers around the world to rehearse, interpret scores, and perform in museums and installations. One dancer we hired to perform the *Human Unreadable* movement library during a major art fair, after the week of engagements, shared with us that these performances were the first time she had the chance to dance in front of an audience in the four years since her graduation from Julliard and that the job gave her hope to continue pursuing dance. If the ownership of movement on a small scale offered by this one project has such ripple effects, it is promising to imagine what could happen if this process becomes infrastructural and can lead to new ways for artists to secure resources that allow them to continue creating. We see an opportunity for the introduction of monetary value to foster cultural value and appreciation.

Concluding Thoughts

In April 2023, we participated in an event hosted by JPG and Gallery of Crypto Art held in Manhattan. We were almost at the point of completing the generative model, but wanted to see how the dances it produced looked performed live, through the body, before putting our pens down. This happened live during the event, so an audience watched the tuning process for a choreographic generative model. We would run the model, have the dancers perform live what it produced, and make notes on how it could be adjusted to produce more balanced sequences (fig. 18). In conversation with the dancers who would perform the generative sequences in rehearsals, many of them stated that after several hours their bodies weren't tired but their brains were. There is a strange tension when performing these sequences, thinking of movements as numbers, mentally arranging them in different orders, tempos, emotional climates, and then telling your body to do that and not make it look like you're thinking. This issue seemed to be much more universal than we realized at the time, because what is the story of contemporary life if not to figure out how to live and be present in our bodies, to move, while being

Figure 18. Choreographic tuning session, *Human Unreadable* (2023). Photographer: Art Davison © Operator, LLC

dictated by algorithms but trying not to look like it. No wonder so many of us have chronic headaches.

The body is technology and technology is a performance. Through both *On View* and *Human Unreadable*, the line between technology and performance is not clear. It is not that there is a *performance part* and a *technology part*, or a situation where dance is causing this reaction through technology, or technological capability is demonstrated through dance. Technology certainly can be a barrier to embodiment, numbing us, mediating our interactions—I type this now crouched over a laptop with a horrible posture—however, it can also be an invitation. As a performance maker, I can say that technology has

helped me break patterns, reflect on the profundity of our bodies as machines, give people an excuse to dance, find nuances of movement making and distribution that I would never have thought about otherwise, reach new audiences that would have been completely unreachable, and *sell my work*. Conversely, looking at technology through a performance lens is also very fruitful. What can we learn about technology companies by viewing UX design as performance? What types of performances do social media algorithms incentivize? How much of what we do in our daily life is actually done for the sake of sharing on the internet later? In our opinion, many efforts merging performance and technology end with one in service of the other, or as a technical demonstration, which always produces a result that from an art perspective, falls flat. As long as we keep thinking about performance and technology as separate worlds that come together and meet for a moment, we are selling ourselves and the public short. These are not separate spheres; there are themes, conceptual containers, human questions that if asked can only be answered by dwelling in the crevices between the human and machine, the real and imagined, the performed and the lived, and the embodied and the mechanical.

Acknowledgements
Dejha Ti (collaborator in life and Operator), Nils Arend, Isaac Patka, Desiree Masalehdan, Judy Mam, Eleonora Brizi, every dancer or performer we've worked with throughout this process, Claude.

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Do you want to get hit by a car? Then move like a GTA character!

–– Nina Davies

This contribution presents a fictional script in the form of a conversation between two former law students on their podcast, *Learned Friends*. The dialogue revolves around an incident involving a self-driving car designed to predict pedestrian movements, exploring the legal complexities arising from the integration of predictive technologies in the justice system. The script was used as narration for a film that was featured in *Precursing,* a solo exhibition by the author at Matt's Gallery in October 2023. As part of this issue of *Documenta,* the artist has included annotations that connect the fictional narrative to the research underpinning it. These annotations touch upon topics such as the Hammersmith Ghost case and issues of mistaken belief, the prohibition of photography and radio broadcasts following the Lindbergh baby kidnapping trial, the infiltration of artistic technologies into formal and bureaucratic sectors, the training and testing of self-driving cars in *Grand Theft Auto,* and the introduction of predictive technologies in judicial processes. Through this work, the author seeks to explore how the use of emerging technologies in storytelling impacts their application in fields where information accuracy is paramount.

Keywords: NPC, Predictive Algorithms, Simulation, Fiction

This paper provides an annotated script from a fictional podcast interview as an accompaniment to a real-life video installation presented at Matt's Gallery in London in October 2023. The intent of this script is to re-think an emerging viral dance as if it were a traditional dance of the future. Using fiction as a tool, I have based this script on the Non-Player-Character (NPC) trend seen on the social media platform TikTok, in which real-world human actors replicate the gestural vocabularies of video game characters, and construct a narrative within this style of moving acts as a response to a socio-technical environment similar to our own. Taking the form of a conversation between two ex-law students on a podcast called *Learned Friends*, this fictional conversation provides a peephole into a world where not the past, but the future increasingly informs the present. This annotated version of the script will explore some of the real-world references that have influenced this work such as the case of the Hammersmith Ghost, predictive sentencing, and the effects of using technology as a tool for storytelling. The annotations will interrupt the script at relevant moments so that the reader is able to see where these real-world references hide within the work.

Riley: Welcome back everyone, to *Learned Friends*. This is Riley here.

Devon: And Devon.

Riley: Today we're gonna be looking at a case that has been re-opened after 24 years.

Devon: Yeah… this is a super interesting one. Now, this is fairly normal isn't it – to have a case pending this long right?

Riley: Oh yeah, I actually looked into this, and the longest a case was pending for was 180 years.

Devon: What? [laughs]

Riley: No, I'm serious. It first happened in 1804 and was settled in… get this… 1984.

Figure 1: *Precursing* (Installation). 2023. Image courtesy of artist and Matt's Gallery, London

Devon: Wow!

Riley: Uh huh.

Devon: I'm speechless… So this is nothing.

Riley: What… the?

Devon: Piasecki v. Wade

Riley: Right yeah. I think it's actually uncommon for cases to be re-opened. Like for no reason.

Devon: Sure, sure.

Riley: So I did my research, as always…

Devon: As always… [tuts in a sarcastic way]

Riley: Wait? What? You still think I don't do my research?

Devon: I didn't say that…

Riley: This is ridiculous, so I just wanna say for the record, I always do… the most…

Devon: [laughs]

Riley: …extensive… [laughs]… research… Apart from this one time…

Devon: Sorry I need you to tell this story.

Riley: So, there was this one time, where we were messaging the night before we were gonna record an episode. And I was telling Devon about the points I wanted to hit when we spoke, and…

Devon: Basically, Riley didn't understand the assignment [laughs]

Riley: Yeah…I mean it's pretty embarrassing, but we were doing an episode about stationary security, which I'm sure some of you will remember. It was a computer game where you would detect security anomalies. And it turned out the people playing the game were… or sorry… let me rephrase that… who thought they were playing the game… were actually doing free labor for security services.

Devon: [laughs] And Riley… thought that… [laughs]

Riley: [sighs] … I had found a case from ages ago about a stationery security incident, where the stationery from an insurance company…

Devon: Sorry we need to just clarify here that you're talking about stationery as in…

Riley: Pens, and pencils, yeah… they went missing on the day a new client had opened an account with this insurance company, so the policy was written in pencil. Which resulted in the insurance company not being liable for anything on this account.

Devon: [laughs] Such a niche case. And so old…we're talking before computers, before laser printing, and when things were recorded only by hand using wet ink.

Riley: You know what, I was so proud of the research I had made. And Devon did not allow.

Devon: [laughs] because it was boring dude. The law is already boring enough. [laughs]

Riley: Fair enough, I'm still waiting for the chance for this to re-emerge. But… I don't think it's gonna happen.

Devon: But let's get into it…

Riley: …Piasecki v. Wade

Devon: I think maybe before we do, we should probably explain why it's been re-opened right?

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Although this script is not about ghosts per se, I feel it is important to introduce this notion early in the script as I want you—the readerm—to be thinking of ghosts throughout this work. Belief is central to the event of seeing a ghost; whether or not it is there is irrelevant. This idea of belief puzzled lawyers in the UK for around 200 years following the case of the Hammersmith Ghost in 1804. In 1803, a series of ghost sightings and attacks spooked the locals of Hammersmith. Disregarding the mass hysteria, a bricklayer by the name of James Milwood continued his nightly walks wearing all-white bricklayers work attire. On one of his nightly excursions, he was—and not for the first time—mistaken for the Hammersmith Ghost and consequently shot by vigilante customs officer Francis

Figure 2: *Precursing* (Video Still). 2023. Image courtesy of artist.

Smith (Ezard). During Smith's trial, held at the Old Bailey in London, his defense was that he mistakenly believed he was encountering a ghost. Although Smith was found guilty of manslaughter, the notion of "mistaken belief" was debated in courts for more than two centuries until it was resolved in *R v. Gladstone Williams* in 1984 (Cherer). As a result of the 1984 case, the notion of mistaken belief was allowed as a permitted defense and was later written into the Criminal Justice Act 2008, Section 76. It is important to note that mistaken belief is not permitted if the belief is not honestly held and reasonable, or if the defendant was intoxicated during the incident (Criminal Justice and Immigration Act 2008).

The dates mentioned above in this fictional script correlate to the dates when this debate around mistaken belief was re-opened in the UK. I am purposely nodding to this two-century-long debate as it is an example of how the notion of a human error was eventually permitted to be used (for the most part) as a defense. With the advent of technologically-assisted cognitive devices that—in the case of this script—are capable of error, notions of mistaken belief may have to be re-opened and expanded upon.

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Riley: Sure.

Devon: Now this is actually how we initially came across the issue, and some of you might have heard about this more recent malpractice case against the app *e-chemist*, where people were diagnosed with depression based on the way they moved.

Riley: And am I right in saying that these people weren't actually depressed?

Devon: Well, it's hard to say. Depression is common, right? So I think in most cases it was probably correct. But as you know the original feature of *e-chemist* was to provide prescriptions for low-risk medications as a way to reduce appointments with oversubscribed medical practices.

Riley: That's right…

Devon: And they eventually started providing diagnoses using various AI technologies.

Riley: Right

Devon: And some of these technologies were bought by the app in their early stages of development… including *Nervous Movement*, which is a generative model that detects whether you might be at risk of depression based on your body movements.

Riley: So, it basically says, "You have bad posture, you might be depressed"?

Devon: I mean I think it's more complex than that.

Riley: Sure.

Devon: But basically, yeah. But there's no definitive sad way of moving, right? What it does is it takes your movement data to produce a prediction on whether you will be more sad later.

Riley: Okay…

Devon: And it can never tell you're sad based on how you move, because… mood affects bodily movement differently across cultures… so it's entirely cultural-specific.

Riley: And is this what the current case is about? Misdiagnosing someone based on cultural differences?

Devon: Not exactly, no, but this is the reason why the app doesn't really work right? And I guess to sort of wrap up my bit here, in this on-going trial against *e-chemist*, the prosecution have stated that they do not want the predictions to be shown to the jury as evidence.

Riley: Which is where this gets super interesting…

Devon: Yeah, so the prosecution claim that if something is a prediction, then it isn't necessarily real at the moment it's made, and if a prediction is faulty, then could this mislead a jury? So I guess, the question is, how much do the jury believe the prediction? If the jury's not shown the prediction are they left with the facts that someone was prescribed medication that eventually gave them an anxiety disorder? Plain and simple.

Riley: So you're saying that the fact that the prediction was wrong, means it shouldn't be included as evidence? But isn't the faulty prediction actually incriminating? It's a clear example of it giving the wrong advice.

Devon: Yeah, you're not entirely wrong, and I think this is how Piasecki v. Wade gets brought into the mix.

Riley: Totally and I can see that. So they're – the prosecution – are trying to set some sort of symbolic precedent then…

Devon: Yeah, they're basically saying predictions aren't real, and that we shouldn't consider predictions within systems where finding truth is concerned, like a court. But yeah maybe we should move onto Piasecki v. Wade now.

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The use of technology in court proceedings has an immense impact on producing a verdict and, in turn, establishing truth. A commonly used example of how technology affects a trial is the Lindbergh baby kidnapping trial, a highly publicized 1935 court case in which Bruno Hauptmann was convicted of kidnapping and murdering the 20-month-old son of aviator Charles Lindbergh and his wife Anne. The media frenzy surrounding the Lindbergh baby kidnapping trial acted as a catalyst for the ongoing debate on the ethics of camera and media presence in court (Strickland). Following the Lindbergh trial in 1937, "Canon 35"—a ban on the use of photography and radio broadcasts—was introduced by the American Bar Association. It was

believed that the presence of this technology affected the process of a fair trial; for example, the flash of the light bulb blinding witnesses while making a statement could potentially affect the credibility of the witness's statement (Rogers 737). In 1956, "Canon 35" was expanded to include the use of television cameras in a courtroom, and in 1981 was revised due to the technology being less intrusive. This resulted in the allowance of newer, more discreet technologies. The media frenzy surrounding O. J. Simpson's trial in 1995 re-opened the debate on the use of television cameras in court, thus keeping this discussion in a constant state of flux.

Another example of scrutinizing allowed technology within the justice system is the use of slow-motion replay of video evidence. A case study on the trial of John Lewis (2009), a man who shot a police officer during a convenience store robbery, calls into question the use of slow-motion replay to detect the intention behind an action (Caruso et al.). In this case, the surveillance footage was only shown in slow-motion, which misled the jury into thinking there was more time for Lewis to notice the police officer and decide to shoot. Although it is obvious from the footage that Lewis authored the fatal shot, had the footage of the event been watched in real-time, the jury might have produced a verdict of second degree murder rather than first degree murder—the difference between a death sentence and a prison sentence.

Primarily focusing on this second example of using slow-motion replay on video evidence, it is clear that this technology—which offers a view usually undetectable to the human eye—shows us something that is not there, time. Time in this sense, is a ghost, rendering John Lewis' thoughts as a mere apparition. In this fictional script, the two characters debate the ethics of showing a jury predictive information relating to a case against an online medical prescription service. This conversation mirrors John Lewis' case study; but instead of concerning the speed of time, it is about the ordering of time. Here, the timeline is false. If a jury were to be shown a prediction produced by generative technology, a fundamental question of reality would be brought into question: what is this prediction's relationship to reality? The jury in John Lewis' case understood how slow-motion technology worked and were aware that it was in use, yet were unaware of the technology's limits. While there is no real-world example for the fictional "e-chemist" case, I wanted to propose a

Figure 3: *Precursing* (Video Still). 2023. Image courtesy of artist

future scenario where predictive technology is commonly used and included as evidence. I wondered whether a jury would question the technology that produced a prediction. Or would they be able to separate the prediction from reality? Or perhaps, after living with a predictive future self for so long, would anyone consider it to be a part of them, inseparable from their present self?

Riley: Cool, yeah. Well, this is the point where Piasecki gets re-opened. So Piasecki, the car company, who I'm sure you're all familiar with, was taken to court by the family of Robbie Wade. And Robbie Wade was fatally hit by a Piasecki Matica which was, I think one of their early self-driving cars… am I right?

Devon: My parents actually had one of those.

Riley: Really?

Devon: Yeah, there was some kind of government incentive to try and get more self-driving cars on the road, so the government was giving tax credits to people buying new cars, which made them the same price as other cars.

Riley: Right, and I guess that made the Matica relatively cheap then?

Devon: I mean, no one our age would have been able to afford it…

Riley: Unless you used your law degree to actually become a lawyer, instead of hosting a law-themed podcast.

Devon: [laughs] I mean… but carry on.

Riley: Yeah, so the case made against Piasecki by Robbie Wade's family turned into this really strange case where it seemed like the car malfunctioned… as many early models did. But in this specific case, there was some mysterious evidence.

Devon: Dun dun dun! [sung]

Riley: You know those rear-view mirror screens that are kind of a screen *and* a mirror?

Devon: yeah…

Riley: Well it showed Robbie running into the middle of an industrial estate, causing the car, which was backing out of the estate to swerve around him.

Devon: But that's not what happened, was it?

Riley: Nope… it hit him

Devon: Damn!

Riley: Basically, where the car swerved to was actually where Robbie was. He never actually ran into the middle of the lot.

Devon: But isn't the footage caught on the camera live?

Riley: You think that it would be, but no. It's all predictive because the whole system is based on where it will predict people to physically be, of course. There are live sensors, and then also a live network between the cars

Devon: Hence the government incentive.

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I want to briefly return to this belief that intent is something that could be seen using slow-motion technology in John Lewis' case. This idea that we can use slow-motion to access someone's thoughts originates from another industry. In cinema, slow-motion has been used as a tool for storytelling by filmmakers such as Akira Kurosawa, Stanley Kubrick, and Martin Scorsese. Scorsese in particular pioneered the use of slow-motion to access a character's feelings of rage, desire, or contempt (The Discarded Image). While there's no definitive way of reading slow-motion, its vast use across cinema and advertising over the past 100 years has created an expanded form of non-verbal communication, often predicated on assumptions. Thus it comes as no surprise that the members of the jury found Lewis guilty of first degree murder after watching the slow-motion footage of a moment that lasted two seconds. I like to think about the famous scene from *The Matrix* where Neo, the film's main character, dodges multiple bullets, gracefully back-bending and running up walls. If this were played in real-time, would the character seem to have as much control as when seen in slow-motion? Or would he appear to be merely flailing amongst the chaos? The reason I'm returning to this example is that when a technology is used as a storytelling tool, these alternative/artistic applications can spill over into other uses of these same technologies, in which greater precision and accuracy are required.

In 2022, AI filters were introduced to TikTok, one of which was the AI Anime Filter that uses one frame in a video and turns it into an anime image. AI filters on the TikTok app operate differently to regular filters in that they use machine learning to recreate an entire image rather than overlaying it with visual features. While this filter is mostly used to turn selfies into anime characters, it has also been used on empty spaces to try and detect ghosts. Not all images produced by this filter find ghosts, which is what makes it so creepy when a figure appears in the rendered image. In some cases when users take selfies, a secondary figure will appear behind the user. This technology, which is trained to find anthropomorphic figures, is in its own way being used for paranormal storytelling purposes on TikTok. Of course, methods of storytelling on TikTok differ from those of feature-length films, but nonetheless we suspend our notion of disbelief when we—the viewer—engage with these images. We know there's no ghost, yet we momentarily believe in this technology because it's fun to do so. The same goes for Neo dodging bullets with a super-human level of accuracy in *The Matrix*; we know that no one can register the movement of bullets that quickly, but, for the sake of the story, we believe it.

To return to the question of mistaken belief in regard to the case of the Hammersmith Ghost, bearing in mind that this notion of technology is being used for storytelling purposes, I wanted to consider the self-driving car as if it were Francis Smith, the man who mistakenly believed he saw a ghost and acted accordingly. The self-driving car predicts where Robbie will be while it backs out of the estate and tries to swerve around him. Here, the ghost would be the prediction, the version of Robbie that the car is moving around. In the case of the Hammersmith Ghost, the context for such an event was essential, namely that there had previously been multiple sightings of ghosts. In the case of the self-driving car, this would be the data the predictive model is trained on. In a sense we could draw comparisons between the car in this script to the jury for John Lewis's case–they are both applying technology's creative, fictional, and world-building functions to high-stakes decisions.

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Figure 4: *Precursing* (Video Still). 2023. Image courtesy of artist.

Riley: Yeah. But no, there's no live footage. But it gets even weirder.

Devon: Oh.

Riley: The predictive footage found in the car, shows Robbie moving in a weird way. Like he's in a video game.

Devon: What? Like GTA style?

Riley: Yeah exactly. He runs into the middle of the car park, and appears as if he kinda hits an invisible wall and kind of runs on the spot for a split second and stands – well kinda bobs, staring vacantly out into the distance.

Devon: But what do you mean by predictive footage? Sorry I've not heard this term before.

Riley: Well, this is the part I don't fully understand, but basically the car used a similar generative-predictive model as *e-chemist* uses, which can detect how people will move up to 10 seconds into the future.

Devon: Oh, I didn't realize that's how *Nervous Movement* worked…

Riley: Yeah… I think it's slightly different in that *Nervous Movement*, the company, make a prediction of how the body will move if the person was sad, and then if it's a close match, it alerts the person who was moving.

Devon: I see, so the prediction is the predicted movement, not the alert it sends out.

Riley: Precisely. And with the Piasecki Matica, the predictive data was always made visible to the passenger so that human intervention could happen when it was necessary, and, as I'm sure you remember, the movements it predicted weren't organic movements – like intricate, hands or individual movements. They were these sort of video game-like movements.

Devon: Yeah of course I remember this–I mean, I feel like we need to talk about Precursing.

Riley: Mmm yeah. I'm gonna come to that in just a moment… but just let me finish this.

Devon: Cool.

Riley: So, the pedestrian movement prediction never needed to be that intricate as it mainly needed to forecast the general direction and speed of pedestrians. And then also – the most important thing – is that these generative models are pre-trained right?

Devon: Right…

Riley: So, most of their training data comes from driving simulation games including games like *Grand Theft Auto*. So, the predictive footage it produced always showed the pedestrians moving in this programmed way.

Devon: See, I always thought this was just a fun feature of the model

Riley: No, it's mainly due to the manufacturers deciding it was a waste of processing power. But what I'm trying to get at here, is that what these models are trained on… isn't real life, yeah?

Devon: Mmmm.

Riley: – it's a video game…and I think there's something that this case opens up which is really important, which is if these generative networks are based on fictional representations of reality, then do they in some way turn reality back into fiction?

Devon: Uhhh, okay. I'm not entirely with you there. [laughs]

Riley: What? You don't agree or…?

Devon: No, I think I'm not following…

Riley: I guess I mean that in a sense these fictional, unreal worlds are in someway materializing through the autonomous machines that now control large parts of our daily lives because their cognitive functions are built and trained inside video games.

Devon: Okay…

Riley: And…as I promised…This is why I think Precursing is such an interesting practice and was so widely adopted. It's basically people recognizing that simulations have a direct relationship to reality and the need to exist in this sort of fictional way.

Devon: …I just wanna quickly explain what Precursing is because it was trending around 25 years ago where it wasn't uncommon to see a few people on the street every once in a while waving at a bus stop or running on the spot facing a fence.

Riley: It was fun. Did you ever do it?

Devon: Yeah of course, didn't you?

Riley: Yeah, I remember doing it all the way to the bus stop to meet my friend in the morning.

Devon: Wow… such commitment.

Riley: I know… I think that kid was probably my only friend. [laughs]

Devon: [laughs] Yeah… I mean you didn't need to tell me that. I'd figured that out years ago. We were just kids when Precursing came out, but it first started out as a prank, do you remember?

Riley: Uhhhh…

Devon: Where they would clump together and start precursing, and then self-driving cars wouldn't be able to tell which way people were gonna move individually and the car would eventually stop. So people would do this as a sorta joke.

Riley: Nice!

Devon: And eventually people realized that self-driving cars–or I think cars with autopilot as well – responded better to pedestrians who were Precursing.

Riley: When you say better do you mean responding faster?

Devon: Yeah, it made it easier for the cars to detect pedestrians, and by becoming these sort of characters they would match the training data which these machines ran off of.

Riley: But we don't really see this around much anymore, do we?

Devon: No… but… I don't know if you've seen this, but it's become really popular in rural, agricultural, and mining areas. Where, basically, there's no urban pedestrian sidewalks.

Riley: No way!

Devon: No kidding, it's even become a health and safety requirement for working around industry vehicles like tractors and turbine harvesters, which use old generative models similar to Piasecki Matica.

Riley: Right, that's insane.

Devon: Yeah.

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As mentioned in the introduction, the NPC trend is one of the primary influences of this script. The trend has been evolving since the COVID-19 pandemic and has mimicked movement styles from video games such as *Grand Theft Auto, The Elder Scrolls,* and *Red Dead Redemption*. NPC—short for "non-player-characters"—are characters in video games that have limited interaction abilities or agency. The TikTok trend involves real people performing movements that are recognizably from NPCs in public spaces or while live-streaming in their homes.

Using the NPC trend as well as the case of the Hammersmith Ghost as a starting point for writing this script, I decided to set this story around a fictional trial in which a person was mistaken for a ghost. With an interest in predictive technology, I decided to look into its application in self-driving cars and came across YouTube videos of people training Convolutional Neural Networks in the *Grand Theft* Auto V video game. Looking further into this, I discovered that self-driving cars are commonly trained in virtual environments—particularly that of GTA V—as the robust design of these worlds provide safe and affordable training in a model's early stages of development (Martinez et al.). While I am not critiquing this approach of using fictional/simulated environments to train neural networks, I thought about the effect of slow-motion used as a tool for storytelling and how it makes us believe we can see things that aren't there. But what if, instead of us, it was the technology that was mistakenly seeing things? The AI anime effect on TikTok so easily proves that ghostly sightings can occur when neural networks are trained to find anthropomorphic figures. Although here the ghost is both the digital apparition seen by the car as well as the person moving is the shadow of their own future self.

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Riley: Well, I think we need to start wrapping up, but I obviously wanna bring this all back to the re-opening of Piasecki vs Wade, which has yet to be resolved.

Devon: Yeah, and I don't think it will be for a while to be honest.

Riley: You know what, I was thinking the same thing actually,

Figure 5: *Precursing* (Performance). 2023. Image courtesy of artist and Matt's Gallery, London.

or at least it looks like it's heading that way because it's opened up so many new questions concerning… even how the… how the legal system functions.

Devon: In what way?

Riley: Well, I guess the law has always been concerned with creating, or finding truth in past events, and now it seems that what we're dealing with here is a… well… something completely different. It's deciding truth within past situations that arise from prediction.

Devon: And a prediction is never wholly truthful…

Riley: Yeah exactly, and also a predictive technology can't ever be liable for something, which brings me to my last point.

Devon: Okay.

Riley: I was speaking with a Ph.D. student who regularly listens to our show – shoutout to Evan if you're listening to this! And they told me about this crazy proposal within the justice system to change the courtroom proceedings and protocols entirely.

Devon: What?

Riley: Yeah, I was actually gonna say this to you later, but was thinking this might need to be its own episode. Because what these people are suggesting is to get rid of the system of prosecution vs. defense.

Devon: Okay… [laughs] and…

Riley: And their reasoning for this is that the whole court system is a kind of make-believe setup anyways. Two people in wigs and robes tell a story to twelve random people who then decide the truest story between the two, and then another person in a robe and a wig decides a punishment based on stories told through anec-data.

Devon: Sorry, what do you mean by anec-data?

Riley: Sorry, anecdotal data, like how data can kinda tell a story. So, in this case a predictive technology usually tells a judge how likely it is that a defendant will do this crime again based on data about their background.

Devon: So, what are these people suggesting?

Riley: Well, I don't quite know yet, I need to do more research, but they're basically suggesting that the storytelling process of court proceedings need to change.

Devon: Okay.

Riley: I mean, the law is basically a storytelling machine, right?

Devon: Yeah, I'd agree with that, but it's enforced at a specific level.

Riley: Exactly. And I think that perhaps how it's enforced is what needs changing. But yeah, I think what's going on is that the storytelling process is now a kind of medley of past events as well as predictions.

Devon: Right, so there's two versions of every story.

Riley: Sometimes three; there's the plaintiff, the defendant, and sometimes the prediction. And I guess, the main questions here are, what will these new rituals look like? Will they break away from this binary system of one side versus the other? Will truth be accessed by looking into the future instead of the past? Will technology be the only harbinger of the future or will we appoint ceremonial positions to people who have been professionally trained to think about the future? Actually the questions are endless at this stage.

Devon: It's definitely an interesting time to be working in the legal field, that's for sure. Well, I think that's probably a good place to stop, as we've sadly run outta time, but I think maybe we should do a part two to this. Maybe for the next episode, what do you think?

Riley: Yeah, maybe we can do a poll on our socials and see what all you guys have to say.

Devon: Well, thanks for joining us again.

Riley: Just in case you forgot, you're listening to Devon and me, Riley, from *Learned Friends*. Please don't discuss any of the evidence that you've heard here today, and bye for now.

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Seventh Generational Thinking is an Iroquois practice that takes the position of someone living seven generations in the future when making large decisions that affect a community. It's the idea that the decisions we make today should not only benefit people living presently but also those of our future ancestors (Joseph). As we witness the effects of climate breakdown, this practice of appointing an individual or a group to represent people from the future has been taken up by non-Iroquois people (Krznaric).

Predictive sentencing, often facilitated through advanced algorithms and machine learning, is increasingly employed in the Western criminal justice system. These systems analyze vast amounts of data to forecast an individual's likelihood of reoffending and to help judges make more informed decisions about sentencing and parole. While proponents argue that predictive sentencing enhances objectivity and efficiency, critics raise concerns about potential biases in the algorithms, ethical implications, and the risk of perpetuating existing inequalities within the criminal justice system. The debate around the reliability and fairness of predictive sentencing continues to evolve as technology and legal frameworks adapt to these approaches (Jan et al. 4-6). Predictive sentencing relies on a myriad of data points, including an individual's criminal history, socio-economic background, education, employment records, and demographic information to construct a profile aimed at forecasting the likelihood of future criminal behavior.

Within this data analysis process, what would be the difference between actual data versus anecdotal data? What constitutes anecdotal evidence will differ from case to case, especially in cases concerning individual needs and circumstances (Codex FutureLaw). While this script does not make attempts to answer these questions directly, I wanted to think through the dichotomy within the legal system, which up until now has forensically considered the past to a system that incorporates predictive analytics. The work makes a speculative leap and further considers prediction as an active agent in the legal system. Inspired by this notion of Seventh Generational Thinking, I wanted to imagine a role for a human agent that represents the future. Unlike in the UK, where the defense and prosecution wear wigs and robes, perhaps this person would wear clothes from the future. Or perhaps the role of the judge would adapt to a ceremony

representing future figures. As a part of the speculative leap I make in this work, I also consider what it would mean to show a jury a prediction. In court proceedings today, what the jury is allowed to hear and see is censored and curated to avoid any overpowering anecdotal information. Harking back to the days of witchcraft, curses, ghosts, and predictions, I wonder what place the courts will hold for these technological apparitions and prophecies.

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Clock, Fall: A Performative Lecture on Choreorobotics

–– Sydney Skybetter (BROWN UNIVERSITY)

ORCID: 0009-0003-8063-3448

"Clock, Fall" was written as a performative keynote and presented at the Mahindra Humanities Center at Harvard University. The talk is about *choreorobotics,* a portmanteau of choreography and robotics, and a field which Skybetter has pioneered at the interdisciplinary intersection of choreographic theory and robotic motion planning. Choreorobotics offers a rich, critical aperture to consider how bodies in motion—human or otherwise—move through space and time to generate meaning. In "Clock, Fall", Skybetter dives into the origin of choreorobotics, recent advancements in the field, and how emerging technologies can be informed or disrupted by collective action and coalition building, drawing from his work as the founder of the Conference for Research on Choreographic Interfaces and podcast, "Dances with Robots". Topics covered ranges from Boston Dynamics robots, Tesla's "Party Mode" and Optimus robots, parasitic aesthetic theory, the movie *M3GAN,* Artificial Intelligence, and a little bit of Beyoncé.

Keywords: Interdisciplinary, free associative, caffeinated, novel, constellating

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Orientation

Greetings nerds.

My name is Sydney Skybetter. I'm a choreographer and the Deputy Dean of the College at Brown University.

© Sydney Skybetter

For everyone's collective reference, if you'd like to follow along, read my remarks after the fact or view these videos again, check out skybetter.org/clockfall.

<Excerpt of *M3GAN* dancing menacingly from here>
"M3GAN (2022) – M3GAN Dances Scene | Movieclips" © Movieclips

In 2022 a film came out called *M three GAN*, about an artificially intelligent robot, who predictably loses her marbles and goes on a homicidal rampage. In one narratively inexplicable scene, she does this gymnastic, vaguely lascivious dance before murdering a dude with a paper cutter. This filmic moment—like the garbage compactor scene in Star Wars, like Jack's death in Titanic—is simultaneously

iconic and nonsensical. It just doesn't make any goddamned sense. But that didn't stop it from burning brightly across the zeitgeist.

<video montage of M3GAN dances based on this and this>
"Death doing the dance from M3gan (yes this is actually made by Dreamworks animators" © BigCballer
"8 M3GANs dance at the Halftime show of the Rams v Chargers Game" © Movies with Epicz

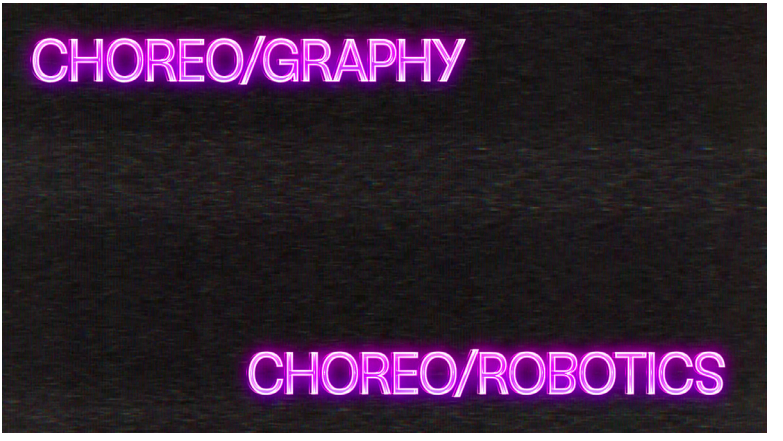
People riffed on *M three GAN* dances for months. They made appearances at NFL games. It took over TikTok. The self-serious goofitude of a murderous dancing robot was, for a gleaming moment, everywhere.

Upon viewing this, you can perhaps imagine hundreds of journalists across the country all simultaneously, each one desperately, trying to make sense of the cultural logic of this, and then, all, simultaneously googling "dancing robot murder expert", and being pleasantly surprised to learn that, in fact, there *is* an expert in dancing robot murder, and he's a professor at Brown, because of *course,* he's a professor at Brown.

True story. And around this time two years ago, I started getting emails. And phone calls. And sometimes, news crews just kinda showing up at my office.

© WJAR

This is the image that NBC used to represent me as a credible source on the subject of my life's work and research specialty. This slide shows me being interviewed wearing a lavender sweatshirt exquisitely paired with a matching face of incredulity, as I lacked media training and did not understand what was happening. The chyron names me as "Sydney Skybetter, Deputy Dean of Brown University's College for Curriculum", which is not a thing.



© Sydney Skybetter

Now, thankfully, you should know that the part of my brain that enables the capacity to feel embarrassment or shame burned off years ago as a result of a lifetime of being a professional artist.

As such, I'm here today to talk about choreorobotics, which, of course, is a portmanteau of choreography and robotics. To be an etymology ass clown for a minute, the word "choreography" is a contraction of a Greek root, khorea, as in chorus, meaning all together dancing, and an English suffix, graphy, meaning to write or *encode*. The word robot, meanwhile, is derived from the Czech, robota, meaning forced labor, or *slave*, and so the sub-field of choreorobotics is definitionally concerned with how bodies move and are encoded, and how performances *interface* with power.

So dancing murder robots, basically, is my field of research. Choreorobotics is, I recently promised my tenure committee, totally 100%

definitely a thing. <wink> It is also totally 100% definitely a word that a gaggle of us very recently made up. If nothing else, choreo-robotics as an interdisciplinary intervention at the intersection of choreographic theory and robotic motion planning, offers a rich, critical aperture to consider how bodies in motion—human or otherwise—move through space and time to generate meaning.

© Sydney Skybetter

I've been obsessed with bodies, choreography, robots and violence for a long time.

https://www.youtube.com/watch?v=Nr3RakYzidg © Sydney Skybetter

This is the earliest known video of my dancing. I'm approximately ten years old, and this is the living room of the house that my family rented on a clover farm some 30 rural minutes away from Fort Wayne, Indiana. I seem to be wearing jeggings rolled up in the style of capris, have what appears to be a black eye, and tote a hairstyle very much in the shape of the bowl used to cut it. I'm dancing to my favorite musical at the time, *A Chorus Line*, and seem to be improvising with the repetitive deployment of my favorite moves from the Tumblebus dance classes I would have been taking around then.

I largely grew up in the Midwest at a moment when being a boy who danced was a positionally risky thing. My nascent engagement with ballet was read as queer, and neither my smallness nor meekness allayed the resulting violence. I was bullied a lot, called expletives from passing cars, shoved into lockers and punched in the back of the head at football games. My intention in airing this bit of trauma is to observe how dance and violence have always been linked in my embodied experience. This makes sense too from a dance historical perspective. The Western dance tradition arguably started in colonial French courts, and ballet, as historian Jennifer Homans puts it, was, for most of the 18th century, an "adjunct martial art", used tactically to augment courtiers' training in fencing and equestrianism.

Ballet and violence have mutually constituted one another for centuries.

<image of Louis XIV as Apollo ala this>
© Web Gallery of Art

Louis XIV, the arguable originator of the balletic form, used both dance and emerging technologies of dance notation as an explicitly colonial form of cultural propaganda, which

<image of Napoleon Bonaparte>
© Wallpapers Wide

Napoleon perfected by taking ballet dancers on conquests to North Africa, which

<slide of *The Nutcracker* ala this (first image)>
© Paul Kolnik

in turn shaped the plot of the original Nutcracker, *which* is an allegory of Napoleonic alliances, violence, and dance styles *which* became the most popular ballet of all time *and*, not coincidentally, tells the story of a machine that comes alive to dance and do murder.

Nailed it. <self high five>

In this fashion, my work today on dancing murder robots is simply a logical extension of the deep dance historical weirdness that came before; weirdness which provides useful vantage to understand contemporary media like <next slide> this.

Tesla

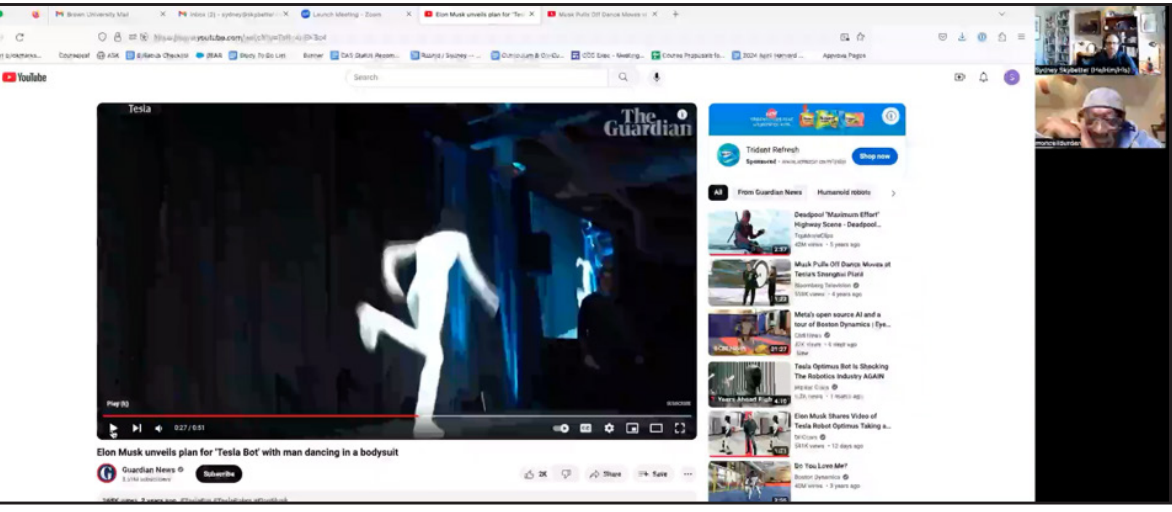
<Selected media of Tesla cakewalk dance footage>
"Elon Musk unveils plan for 'Tesla Bot' with man dancing in a bodysuit" © Guardian News

About two years ago, Elon Musk took the stage at the Tesla AI conference to announce recent progress from their "Optimus" bipedal robotics program. After introductory remarks, Musk brought on stage a dancer, dressed like a robo-minion from the then-recent film, *The Mitchells Versus the Machines*. Bear in mind, *The Mitchells Versus the Machines* is literally a satire of Elon Musk.

This human-acting-like-a-robot enters the space as a robot stereotypically might, with stiff limbs reminiscent of Daft Punk music videos. But then, out of nowhere, the dancer-slash-robot performs a series of movements originating specifically from the Black performance tradition.

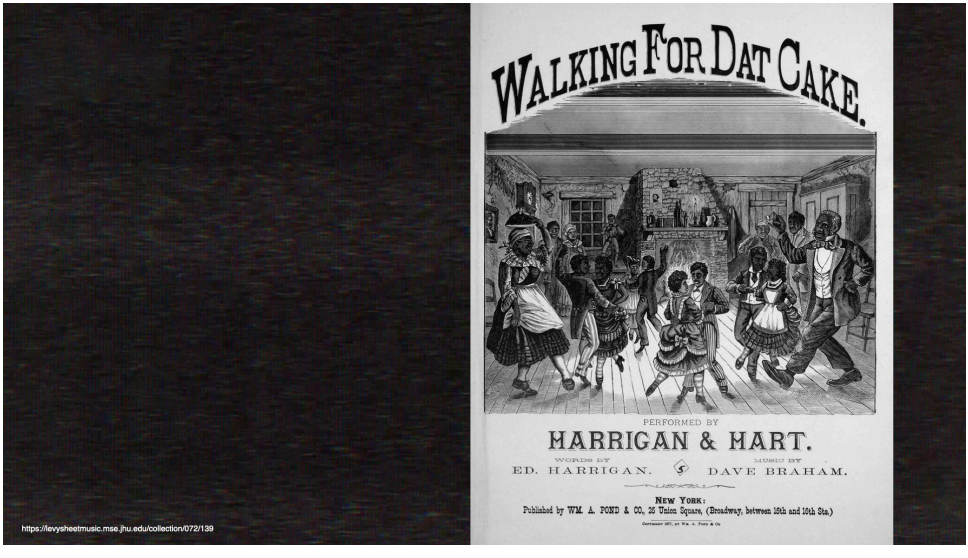
I wanted to make sure I wasn't misreading what was happening here, so I called up Professor Moncell Durden at USC—he's an ethnochoreologist and expert in African American dance history. We watched the video together a few times.

<Selected media of Moncell and I on zoom, low sound, starting as he and I watch the cakewalk dance>
© Sydney Skybetter



© Sydney Skybetter

He confirmed that there's some Charleston, some shaggy jazz with Broadway inflections, some two-stepping, and most saliently, a cakewalk.



© The Lester S. Levy Sheet Music Collection

The cakewalk, as black feminist dance theorist Brenda Dixon Gottschild might remind us, is a minstrel dance that originates in the 19th century within Black and enslaved communities that literally satirizes white antebellum ball culture. There are stories from the pre-civil war south of enslaved folx competing to perform the most exaggerated, effete prances, often with plantation owners serving as judges. These stylized, silly walks were so popular that white folx incorporated them into minstrel acts and antebellum socials, performing movements they thought were the epitome of blackness, but that Black folx had created as a carnivalesque mockery of white power.

<Selected media of Tesla cakewalk dance footage>
"Elon Musk unveils plan for 'Tesla Bot' with man dancing in a bodysuit" © Guardian News

After a minute, Musk seems to get bored, or irritated and shoos the dancer off stage.

<Media from Tesla AI day showing Musk talking, with the heart hands shirt, muted>
"Tesla AI Day 2022" © Tesla

He then goes on to talk about how we—his presumed audience of technocratic elites—don't need to worry about robot uprisings because his robots are gonna be friendly. Musk promises that by dint of our superior strength, speed and *intelligence*, we will always be able to overpower any robot rebellion. Recall here, again, that the root of the word, robot, is "slave".

This is an example of what the kids call a "self-own", and an object lesson in what theorist and co-curator of this series, Christopher Grobe, calls "bot face"; roughly, the use of robotic performance to reify and extend the violent appropriation of blackness into emergent technological domains using the racist logic of blackface.

<media of Musk dancing, ala here>
"Elon Musk shows off bizarre dance moves at Tesla event in China" © Global News

All of this should be placed within a more general performance context, namely, that Elon Musk is a troll. I mean that *personally*, in

that he is an amply documented sexual predator with a fondness for anti-semitism and conspiracy theories about white genocide. But also, I mean that *characterologically*, as a means to understand his personal, fiduciary, and performative priorities. As a troll, he proudly and deliberately orchestrates his sizable online presence towards controversy.

<image of CTO twitter bio>
© Sydney Skybetter

Earlier this year, Musk on-the-nose-ed-ly changed his official Twitter bio to "CTO", or Chief Troll Officer, a role suitable for the owner of a platform that monetizes hate speech.

<Selected Media of Tesla cakewalk dance footage, slightly more slowed>
"Elon Musk unveils plan for 'Tesla Bot' with man dancing in a bodysuit" © Guardian News

Trolling and minstrelsy are mutually reinforcing performative stanchions. This dysregulated, flukish dancing makes for weird Internet news and modulated meanings across differentiated audiences. To tech journalists, it's a goofy joke aimed at a Tesla competitor, Boston Dynamics. To Musk's red piller fan base, it's a comment about "us" being smarter and more capable than robots, and the robots, to be clear, are coded as Black. To those who'd criticize overt racism in Silicon Valley, well, where are you going to post your little comments if not on Twitter? Any controversy, agreement, *or* disagreement draws attention to Tesla and enriches Musk personally. It's a tidy ouroboros of swampy surveillance capitalism; a performance where critics enrich and sustain the very thing they resist.

And yet. Because trolling is such a haphazard, hasty pudding of a critical stance, this shaggy performance maintains unlikely traces of resistance. The dance is so derivative that its ideological and aesthetic dark matter remains present; material that *might* have been cloaked in a more thoughtful presentation; racial anxieties writing citational checks that Musk can't cash. Within this overtly racist performance are, nonetheless, stories of resisting anti-blackness that came before. It suggests that some bodies in dissent have a longer half-life than might be pessimistically presupposed. That

somebody performed a cakewalk at a party thrown by Elon Musk could be read as trolling the *Wehrmacht Erlkönig*. So while Musk remains the richest man in the world, or whatever, dancing just a few feet from him is a black-coded robot throwing ancestral shade.

<edited footage of Optimus walking by Cybertrucks, edited with footage of Musk talking with heart t-shirt from here>
"Tesla AI Day 2022" © Tesla

At the following year's Tesla AI conference, Musk showed off heavily edited footage of "Optimus" walking constipatedly around, while narrating how its operating system is a transferable AI; an intelligence that can be relocated from robotic body to body, agnostic as to whether that embodiment is a bipedal robot or car or truck or otherwise. This suggests AIs will access different expressive registers depending on what form of embodiment they occupy. If robots are an expressive articulation of artificial intelligences, which, themselves, are algorithmic manifestations of the biases of their designers and training data, then, the racist hierarchies of AI-powered robots can be observed through their movement, dance, and *gesture*.

<zoom in on Musk heart image from video, here>
"Tesla AI Day 2022" © Tesla

Consider then, what it means for Elon Musk,

<zoom in on Musk heart image from video, here>
"Tesla AI Day 2022" © Tesla

a man with the moral character and aesthetic complexity of a Gordita crunch wrap,

<zoom in on Musk heart image from video, here>
"Tesla AI Day 2022" © Tesla

to talk about the future of labor while wearing an illustration of two robot hands forming a heart.

Musk's obsession with robots, dance and misogyny has been noted by all manner of internet cretins and resulted in some deeply weird, dancerly rat holes.

<image of Musk dancing with a robot>

Here's an AI-generated image of Musk with a femmebot apparently named Catnilla as posted by internet person Daniel Marven, who kicked off a true world-class archipelago of incel expressivity and fervid fantasizing that Musk was secretly designing the perfect dancing robot wife.

<other images of Musk dancing with a robot>
© RedanceMe

This was, in fact, very much not a thing, and had to be debunked again and again on Reddit, Business Insider, and a bunch of other platforms by pointing to the original illustrator-slash-prompt engineer-slash—this is true—dance teacher, Diana Stark.

I read this Pygmalionic internet faff to understand how embodied AIs relate to audience reception, performance and power.

<image of cybertruck>
© Tesla

Hold on to your butts. Tesla, of course, recently released the Cybertruck, a militarized refrigerator on wheels that looks like it was designed by someone who did just a ton of cocaine and then tried—and failed—to draw a rectangle from memory. The Cybertruck, like other late Tesla models, ships with functionality called "dance mode", or "party mode", a bit of software that enables users to choreograph to music their vehicle's lights and the movement of windows, fuel cap, mirrors, trunks and frunks (as in, front trunk, it's a thing).

A bit of a re-frame is useful here. Musk says that Tesla is one of the largest manufacturers of robots on the planet because, he argues, Tesla cars are robots. This is like, the one thing that Elon Musk and I agree on; that robots are computational systems with sensory apparatuses no matter the form factor. It's an important semantic frame that suggests choreorobotic performances need be situated neither in human nor humanoid embodiment.

<media of cyber truck holiday light show>
"Cybertruck Light Show" © Tesla

I'm trying to understand why Tesla encourages owners to daisy chain their vehicles together to perform car de ballets such as this one. There have been hundreds of these performances, and Tesla has actually commissioned some of them. The most famous are choreographed by a guy whose internet handle is HVPad, who was engaged by Tesla last Christmas to create this quasi holiday-themed sensory blitzkrieg.

Observe, these five crimson Cybertrucks facing the camera, dramatically framed by a series of Tron red trusses bisected by perpendicular fluorescents. The front of each truck is bound by two horizontal strips of light, the top extending a beam from truck left to truck right. These LEDs are capable of smooth variance and the appearance of flowing illumination. This pentagony of Cybertrucks creates a rippling visual field staged to fill the entirety of the parking lot that contains them and demonstrates a capacity to synchronize piercing lights to tacky, self-serious music. The vibe serves policing realness, the trucks composing a phalanx of armor and penetratingly asymmetric visuality that brings to mind copaganda such as

<image of KITT>
© Ivonkingsley

Knight Rider and

<image of robocop>
© Flixster

Robocop, but without those franchises' irony and campy self-awareness; an aesthetic perhaps best described as "Stand Your Ground laws meets musical theater summer camp". In this aesthetic vein, it's perhaps not surprising that Tesla maintains active contracts with police forces around the world, ranging from

<image of Mexican cybertruck>
© infodefensa.com

Ciudad Valles to

<image of Dubai cybertruck (first image)>
© Dubai Police

Dubai, and that before the Cybertruck was even released to the public,

<image of Oracle police cybertruck>
© Motortrend

Oracle, which does police stuff apparently, was already planning on manufacturing a version with extra-aggressive Tron styling for cops.

Teslas aren't just for policing though, of course. Their dance functionality indicates that they're also, you know, for kids.

When Disney's *Encanto* was released in 2021, it inspired a series of home-brew, garage-staged performances.

<video of Tesla dancing to Surface Pressure>
"Encanto - Surface Pressure // Tesla Custom Light Show For Kids!" © HVpad

This is my personal, illustrative favorite, "Surface Pressure", also choreographed by HVPad. Observe the deployment of theatrical lighting and a cornerstone of the contemporary dance trade, the smoke machine.

This particular performance is conventional of the Tesla medium: there are musically coordinated movements of the fuel cap, mirrors, and side windows. Sometimes the trunk and frunk get into it. The light show *is* the primary attentional draw, but the presence, movement and/ or stillness of car components form the robotic embodiment through which a musical visualization is staged.

Reading car parts through dance theory has limits. One of the dominant theorizations of how choreographies create meaning is through mirror neuronal meta kinaesthetic empathy. It goes something like this. I, someone with ballet training, go to a ballet show. I see a dancer perform a movement I recognize, let's say, a *fouette*.

<cropped gif demonstrating fouette>
© Center Stage

Now I've done lots of *fouettes*. They looked exactly like this. I have a visceral sensory memory of what my body feels while spinning. When I see someone else *fouette*, the mirror neurons in my brain fire

as though I'm the one doing it. I sense, in someone else's movements, my own embodied history. The dancerly architecture of my aesthetic sensibilities—what I find meaningful—is preconditioned on embodied experience *and* the ability to empathically project onto others.

<media of Tesla light show for kids>
"Encanto - Surface Pressure // Tesla Custom Light Show For Kids!" © HVpad

Kinaesthetic empathy usefully demonstrates the sheer disjuncture of meaning-making potential between a human body in performance and the robotic enclosure of an AI, such as this Tesla. I cannot empathize with a window closing or frunk opening. The Tesla body is too unlike mine to be interesting for long, which perhaps explains why choreorobotic artists like

<media of Catie Cuan>
"In Her Prime - Full Performance - Smithsonian Arts & Industries Building - Catie Cuan FUTURES" © Catie Cuan

Catie Cuan,

<media of Huang Yi>
"HUANG YI & KUKA - A DUET OF HUMAN AND ROBOT" © Huang Yi Studio + 黃翊工作室

and Huang Yi, and

<media of Merritt Moore>
"Merritt + Robot Dance" © Merritt Moore | Robots & Dance

Merritt Moore, and

<media of Beyoncé>
"Beyoncé - Cozy Renaiisance World Tour Kansas City, Missouri October 1, 2023" © Maverick

Beyoncé, perform their dances *with* robots to accommodate an audience's nominal interest in a robot by itself.

<media of Cybertruck dancing, about 1 minute into this to include windows and frunks>
"Electro Moves: Cybetruck Dance Spectacular" © Cybertruck To Rent

The limited applicability of kinaesthetic empathy also explains why so many of these performances drift towards scale and spectacle. Indeed, there are regional syndicates of Tesla owners with performance proclivities, resulting in an impressively diverse gamut of kitsch and a burgeoning global proto-fascist choreorobotic aesthetic.

<video of bring me home>
"israel the big tesla light show ועמל לארשיב לודגה תולסט תוראה עפומ סיפוטח 137 לש סרורחש" © Tesla-IL

Consider this performance produced a few months ago by an Israeli Tesla accessory store that brought together a world record-breaking 700 Teslas to, in their words, "shout the cry of the kidnapped men and women in the captivity of Hamas".

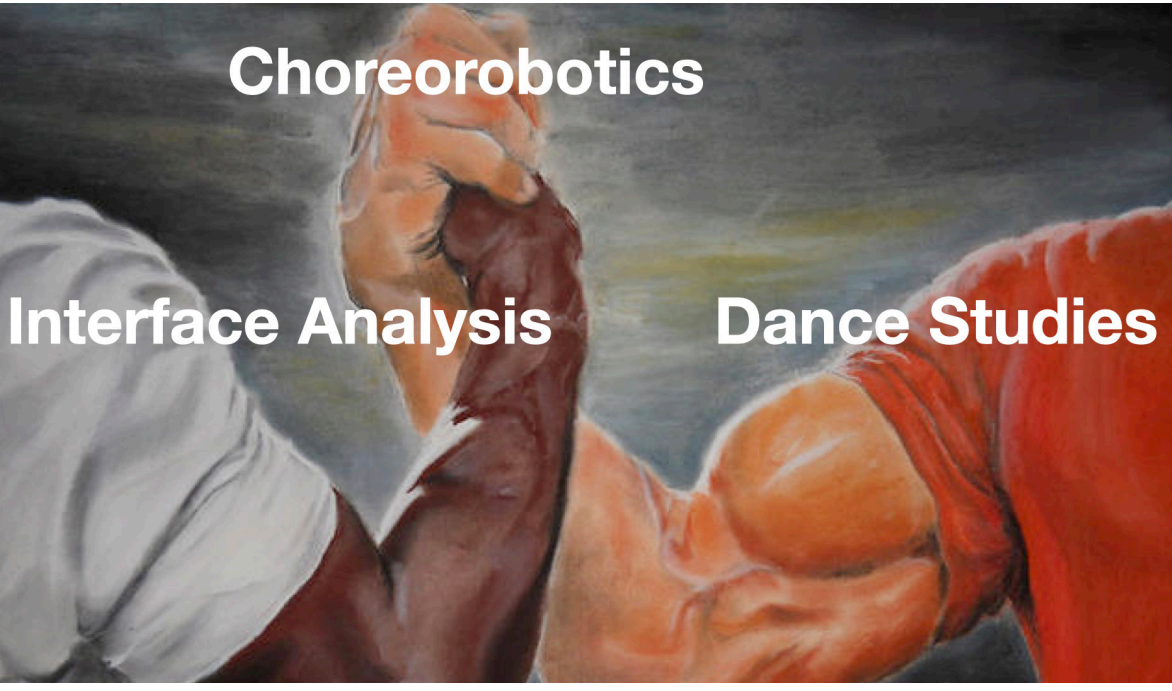
This is one of many such performances. The mass spectacle-ization of choreorobotics brings to mind the movement choirs of Leni Riefenstahl and Albert Speer's *Lichtdom*. The use of a luxury car as a robotic performance apparatus also illustrates some of the ideological limitations of the form. It's hard to imagine Tesla dances for progressive causes. Assuming each of these 700 Teslas is worth an average of $25,000 per—and I think that a low estimate—the baseline production cost for this bit of colonial propaganda starts at approximately $17,500,000. I have been unable to locate any Tesla performances that, for example, support more, progressive, causes.

So, sure, cars have always been marketed and sold to extend their owners' sense of identity. We have been trained under capitalism to understand our vehicles as an extension of ourselves; a cyborgian, performative proboscis that Musk's Teslas take to an extreme by shipping cars with end-user choreorobotic performance software.

<Media / documentation scroll from GitHub, here>
© GitHub

This is documentation of Tesla's dance functionality from GitHub. With a little Python you can create a script that will sync your lights and the opening and closing of your falcon doors to any piece of music you upload to your car on a thumb drive.

There's also a rudimentary interface that shows the waveform of the dance track, with sliders and checkboxes indicating what parts of



© Sydney Skybetter

the car you want to move, in what sequence and for what duration. It's a little like Garageband, but for car dancing.

One of the facets of my research at Brown is Choreographic Interfaces; the computational means for emergent choreographic production. I think about how software enables dances to be made, whether those dances are embodied by people or machines, because in this context, the design of the software determines what gets to be called a dance, and what the component repertories, grammars and declensions of that dance can even be. This is where interface analysis and dance studies get cozy;

when we consider, echoing performance theorist Joseph Roach, that aesthetics and interfaces are ideological formations that contend simultaneously with what an observer already understands about culture, and what a designer aims to communicate about power.

<Image of police cybertruck>
© Daivatd

Tesla's vehicular razzle dazzle points to a predominant choreorobotic norm; that the platforms deployable for performance exist coterminously with misogynistic tech bro goblin culture, as well as numerous flavors of anti-black and anti-brown violence. Indeed, much choreorobotic creative production can be keenly framed in the context of military dual use. Consider: the inevitable deployment of the cybertruck's lights to alert or disorient onlookers by police forces.

And then those same lights are being used to musically visualize your favorite song by Coldplay.

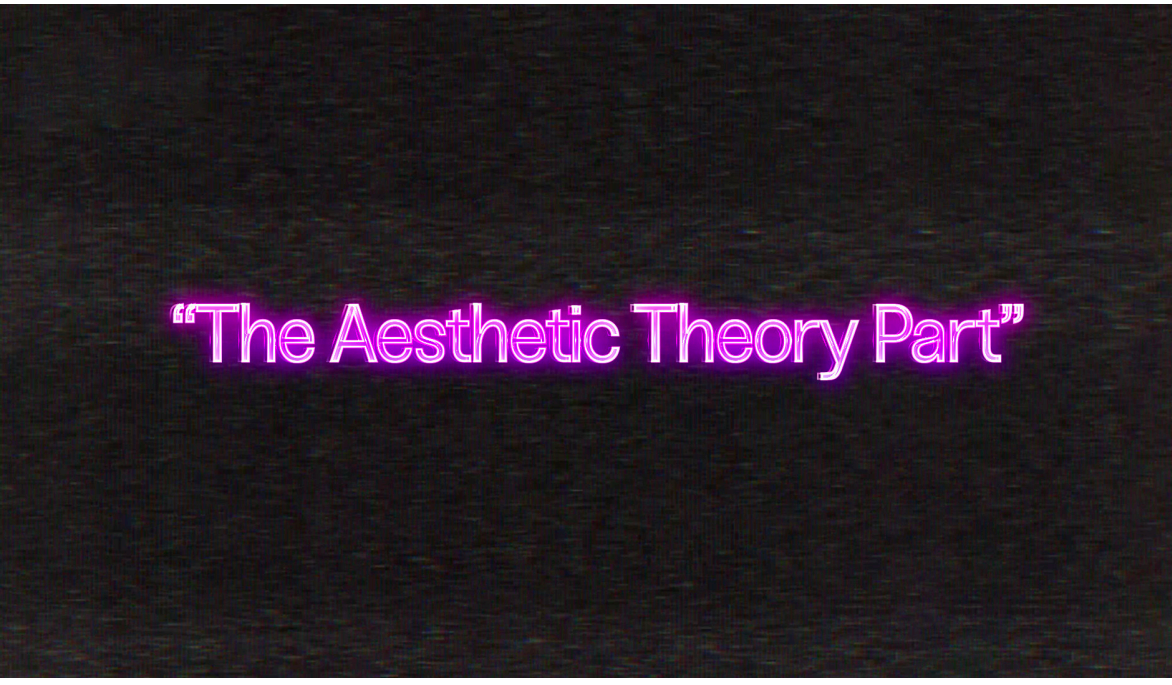
<Video of cybertruck Coldplay song>
"1st Custom Cybertruck Light Show - Coldplay - A Sky Full of Stars (Revised)"
© Vegas Tesla LightShows

Theoretical Framing

I am drawn to the gnarliest braids of emergent choreographic phenomena because I want to understand how dance history's violent entanglements perpetuate themselves. And thus, how that perpetuation can be resisted and reversed. The means of dancerly production at play, in choreorobotics especially, are bonkerballsly expensive, and concentrated within corporate, academic, and military facilities requiring specialized networks and institutional privileges as a precondition for access.

<image of the book *The Play in the System*>
© Amazon

The text that helped me understand this matrix of relations is <cough cough Brown graduate> Anna Watkins Fisher's *The Play in the System: The Art of Parasitical Resistance.* Fisher argues that surveillance capitalism is so advanced, proliferated and ubiquitous, that we are *all* implicated. There is no *outside* of it. There is no turning it off. To greater or lesser extents, we're all already jacked into the machine, and resistance is inevitably co-opted, to its benefit, by the borg.



Fisher points out that the word, "parasite" comes from the Greek, *para* (meaning alongside) and *sitos* (meaning food, or a meal). She examines the commedia dell'arte character of the parasite; how it cozies up to power with *flattery*, wielding the resultant proximity for its own ends: usually, like, food, but more broadly the parasite's own continuation. In classical context, the parasite has specialized knowledge—usually of a religious, moral, or *artistic* sort—that makes it somehow useful or interesting to a host. The parasite is, however, definitionally precarious, forever a guest in someone else's house; always on the brink of being asked to leave; forced to maintain a delicate balance of extraction and siphoning while playing the part of esteemed, compliant guest.

The host, despite their performance of hospitality, has limits. The parasite gets away with as much as possible, but never more, because if the host begins to question the arrangement, the parasite's access will be cut off, and parasites can't *live* without a host system. The stakes for being found out are total. Parasitism then, as a mode of resistance to corporate capitalism specifically or hegemonic power broadly, is always politically ambivalent, delicately situated, necessarily subtle, and always already incomplete, in that, in the *long* term, resistance inevitably benefits the host.

But in the *short* term, there's a bit of slack. Reaction time is a factor. Until the host responds by reflexively shutting down and expelling the parasite, there's a tiny window for play.

Simultaneously siphoning while sustaining the host system necessitates the parasite's artful management of *implications* across performative, spatial, and chronological dimensions; a dance of willful misappropriation across space and time. Who is most successful at this play of surfaces? In Fisher's view: *artists*, who arguably have the most latitude to wield their implications to creative effect. After all, the history of the Western performance tradition—dance especially—is a history of doing whatever it takes to keep the lights on.

Boston Dynamics

<Dance media from Uptown Spot>
"UpTown Spot" © Boston Dynamics

I began studying choreorobotic performance in earnest in 2018, when Boston Dynamics released "Uptown Spot"; a music video of their quadrupedal dog robot, "Spot", grooving to a cover of Bruno Mars' and Mark Ronson's *Uptown Funk*. Today, Boston Dynamics is one of the most advanced robotics companies on the planet; think Cyberdyne Systems but based in Waltham, Massachusetts and owned by a Korean conglomerate, Hyundai. The company was founded in 1992 when Marc Raibert—then a professor at MIT's Media Lab and founder of the Leg Lab, true story—spun off his grants from the Department of Defense to hang out his own shingle: Boston Dynamics. By the time he released "Uptown Spot", some 25 years later, I understood the company to be a military robotics contractor in the tradition of *Terminators* one through six and *Ghosts in the Shells* one through eight. As such, I had no reason to *expect* that the company would produce *music videos* featuring AI-powered robots bibbidi bobbidi booping through a potpourri of dance techniques sourced from the Black dance vernacular.

In "Uptown Spot" we observe a quadruped twerking, doing the running man and two-step, all performed with rhythmic precision to a track sung by a man of color written by a white British dude about selling cocaine in *Harlem*.

<Media of gifs with surrounding technical context from API>

I want to note that these aren't just appropriative choreographic choices manifested exclusively at the level of YouTube performance. These dance techniques have been lifted out of cultural context and encoded at the level of software and *interface*. The twerk, for example, is an Africanist and African American movement technique that contemporarily gained prominence in New Orleans in the 90s and has since been a staple of hip hop and femme Black dance performance. The choreographic interface governing Spot's motion planning defines a "twerk" as a motion which "Lowers the robutt down [pause for laughter] and back up once". An end user can select how much to lower the robutt, but according to the interface, the movement can only last one beat of a 4/4 meter, and even then, only within certain tempos. The robot thus aims to perform a Black-coded movement, but without the possibility of rhythmic complexity and exclusively on a basic 4; the Miley Cyrus of time signatures.

<Slowed dance media from Uptown Spot>
"UpTown Spot" © Boston Dynamics

When this was first released, it wasn't clear if it was a joke; an elaborate ruse, orchestrated to trigger snowflakes such as myself into applying critical race theory onto a war machine apparently capable of bringing the funk. I was fascinated by this vexing performance and wanted to know more about how such a William Gibson fever dream could somehow also be real, so I sent a cold email to info at Boston Dynamics dot com, not really expecting a response, to the effect of, hi, I'm a choreographer, and you're a military robotics company, literally what are you doing? Minutes later, I got an email back from Marc Raibert, saying, quote, "we want to do more: more dancing steps, more types of robots, multiple robots dancing together, robots + people, and perhaps some big production videos.... Do you know choreographers in the Boston area who might want [to] work with us?"

"Uptown Spot" was a seemingly sudden, mega-viral success predicated on *years* of aesthetic experimentation that placed military tech in dancerly performance contexts vis-à-vis quasi-music videos. Absent that knowledge, one could watch this without discerning it was the outdraft of millions of defense dollars and conservative ideological posturing. The prior art, however, is significantly less subtle.

<video from big dog reflexes>
"BigDog Reflexes" © Boston Dynamics

In 2009 Boston Dynamics released a YouTube video called "BigDog reflexes", featuring their DARPA funded, couples Halloween costume-looking, Spot-antecedent getting kicked around a parking lot. The sound is intermittently and theatrically slowed and distorted, with ironic, floral top notes of 80s horror VHS tapes,

<video from big dog reflexes featuring slowed down noise section>
"BigDog Reflexes" © Boston Dynamics

the whine of the robot's gas-powered go-kart engine distended into a Hellraiser mewl.

<remix of boston dynamics robots getting kicked and stabbed, ie

from here>
"Every time Boston Dynamics has abused a robot" © Daniel Estrada

"BigDog reflexes" kicked off, as it were, a now-established representational trope wherein the resilience of a Boston Dynamics robot is demonstrated by just really kicking the shit out of it.

<Media of "BigDog Evolution">
"BigDog Evolution" © Boston Dynamics

Two years later, the company released a compilation video of Big Dog's progress, accompanied by a strange bauble of a blues song called, "Let the Big Dog Eat". The lyrics to this particular rendition begin with,

Way over yonder in the middle east
They've sure got a big dog he's quite the beast
Nowhere to hide and nowhere to run
When he blows you to kingdom come

Lots of people have recorded this song. Most of them tastefully abstain, you know, from the fervid, Orientalist fantasy of Middle Eastern violence part. This version was sung by the almost famous brother of

<image of James Taylor, i.e. this>
© Concord Records

James Taylor,

<image of Alex Taylor, i.e. this (first image)>
© Music Museum of New England

Alex Taylor, and was produced by King Snake Records, which, in the 90s was a small, independent label in Sanford, Florida. You might have heard of Sanford; it's where Trayvon Martin was murdered by George Zimmerman. In fact, King Snake Records was located just five minutes away from the scene, by car.

<image of Jeb Bush>
© Education Next

Meanwhile, the phrase "let the big dog eat" entered the popular discourse briefly when Florida Man Jeb Bush, 2010 Visiting Fellow of the Harvard Kennedy School and self dick stapler of a 2016 Republican presidential candidate, in a moment of Dukakisian flair, summed up his tax policy as "let the big dog eat". Nobody outside Florida knew what he was talking about. He has since retired from public life.

<Media of "BigDog Evolution">
"BigDog Evolution" © Boston Dynamics

"Let the Big Dog Eat", sung alongside abundant representations of military accouterment ranging from camo to V-22 Ospreys, squarely situates this media within a matrix of colonial, orientalizing ideologies, while evidencing audience-oriented—if still nascent—choices pertaining to musicality, sound design

<media of Big Dog with horns, here>
"BigDog Olé" © Boston Dynamics

and even costuming. I read "BigDog Evolution" as a proto-music video of sorts, and while the eponymous big dog performs less overt dancerly material here than in "Uptown Spot", the robot's movements through space and time teem with political signposting; representational flexes that grew subtler as Boston Dynamics' messaging matured, and they moved towards a mass market.

Between "Big Dog reflexes" and "Uptown Spot", Boston Dynamics' quadrupeds miniaturized, went electric, and were made semi-autonomous via AI.

<Technical image of Spot>
© Boston Dynamics

Meet, Spot. In 2019, Boston Dynamics started selling them to just about anyone with a spare $75,000 dollars, give or take another one or two hundred Gs for sensor packages and robotic arms. The company has maintained its military contracts while leaning into the big "three Ds" of robot jobs—anything dull, dirty or dangerous. For example, Spots have been deployed at Chernobyl and Fukushima, cementing one of Boston Dynamics' preferred narratives: Spot is tiny, agile, and artificially intelligent; it excels at sensing and surveillance, and is the perfect substitute for *people* in work contexts where you

wouldn't want to send a human.

This logic informs Spot's deployments in policing contexts, such as when cops sent them in to defuse such tense situations as,

<slide of media of Spot near bus in Hollywood>
"LAPD deploys robot dog to help with standoff in Hollywood" © KCAL News

in Hollywood, California, when an armed man refused to get off of a bus,

<slide of Houston motel spot media>
© Eyewitness News

or in Houston, Texas, where a naked, armed man dragged a Spot into a motel room. Better the robot than a police officer, or, you know, counselor, or mental health practitioner, or gun control, I guess. Cops trebucheting robots into the danger zone results in predictably racist and classist outcomes.

<media from NYPD deployment here>
© *New York Post*

In the fall of 2020, a Spot was deployed in the historically black neighborhood of Cypress Hill in Brooklyn to resolve a parking dispute.

<media from NYPD deployment, here>
© *New York Post*

In February of 2021, a Spot was deployed in the historically black neighborhood of Wakefield, in the Bronx, to investigate a home invasion, and in

<media from NYPD deployment, here>
"NYPD robot dog hits streets of Manhattan" © FOX 5 New York

April of that same year, a Spot was deployed into a public housing complex in Manhattan to investigate a domestic dispute.

The resulting citizen anger can be understood in the immediate historical context of, among other things, horrific racial disparities in COVID healthcare outcomes and the trial of Derek Chauvin for his

← **Post**

Alexandria Ocasio-Cortez
@AOC

Shout out to everyone who fought against community advocates who demanded these resources go to investments like school counseling instead.

Now robotic surveillance ground drones are being deployed for testing on low-income communities of color with under-resourced schools 👍🏽

> **New York Post** @nypost · Feb 23, 2021
> Video shows NYPD's new robotic dog in action in the Bronx trib.al/nJF1yEh

2:31 PM · Feb 25, 2021

2.4K 20K 112K 708

Post your reply Reply

murder of George Floyd amidst violent suppression and surveillance by police of Black Lives Matter protests all around the country.

The NYPD's Spot deployments became an object lesson in cops and Boston Dynamics' collaborative striving for innovation at the intersection of anti-black surveillance and class struggle.

<media from "Do You Love Me">
"Do You Love Me?" © Boston Dynamics

No matter how virtuosic their renditions of the Black social dance vernacular, no matter how well they funked it up, discoed, did the twist, or the mashed potato, none of it allayed the irresolution of Boston Dynamics' robots being representationally enveloped in Blackness all while being martially deployed against Black communities.

This music video is set to the Contours' Motown classic "Do You Love Me", and begins with a Boston Dynamics "Atlas" robot pointing to the camera as though to gesture towards and implicate the viewer in response to the question posed by the lyrics, "Do you love me now that I can dance?" Titled, "Do You Love Me?", this media was released in late December of 2020, just as the NYPD deployments of Spot were hitting the mainstream press. The question, do you love me now that I can dance, reads as an admission of sorts; an ironic insecurity on the part of a military-adjacent robotics manufacturer; self-effacing tactical bot-face for the sake of PR spin.

The sheer racist face punchability of the situation was perhaps best summarized by

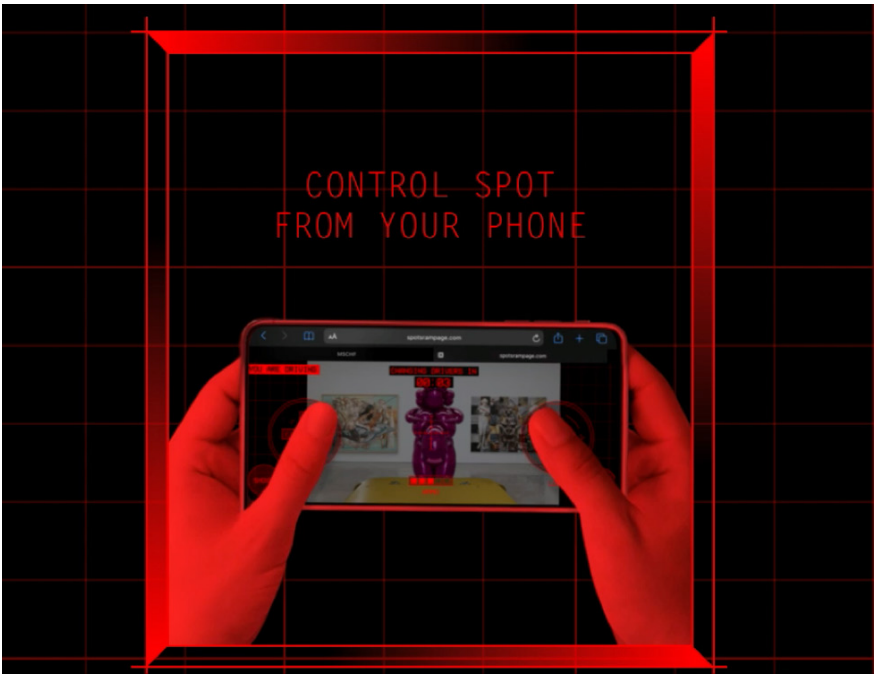
Representative Alexandria Ocasio Cortez: "Now robotic surveillance ground drones are being deployed for testing on low-income communities of color with under-resourced schools".

AOC's read rhymes with Simone Browne's "Dark Matters: On the Surveillance of Blackness", in its historicizing of surveillance technologies perfected in anti-black contexts from the triangle trade to the TSA. AOC also echoes Ruha Benjamin's "Race After Technology", and her pronouncement that "Black folks live in the future". As in, the future is dangerous for black folks, but the danger eventually knocks for us all.

The NYPD's Spot deployments resulted in fierce backlash from local policymakers and activist artists. At about the same time as AOC's comments, a collective founded by <cough cough> Brown / RISD graduates, MSCHF, released a virtual experience titled *Spot's Rampage*. The work featured a Spot with a 68-caliber strap-on paint gun, and gamified controls enabling random website visitors to puppet the robot at two-minute intervals. The Spot's puppeteers then proceeded to destroy a whitebox gallery space filled with representations of Warhol's Brillo Boxes and Duchamp's *Bicycle Wheel* amidst remixed brand markings of arms manufacturers, Raytheon and Lockheed Martin. Spot's installation amidst loud signifiers of ironic art history, then juxtaposed against the iconography of the American military industrial complex, accessibly situated Spot as found art of war for a popular audience.

I'm particularly interested in the choreographic interface undergirding all of this.

https://spotsrampage.com/ © MSCHF

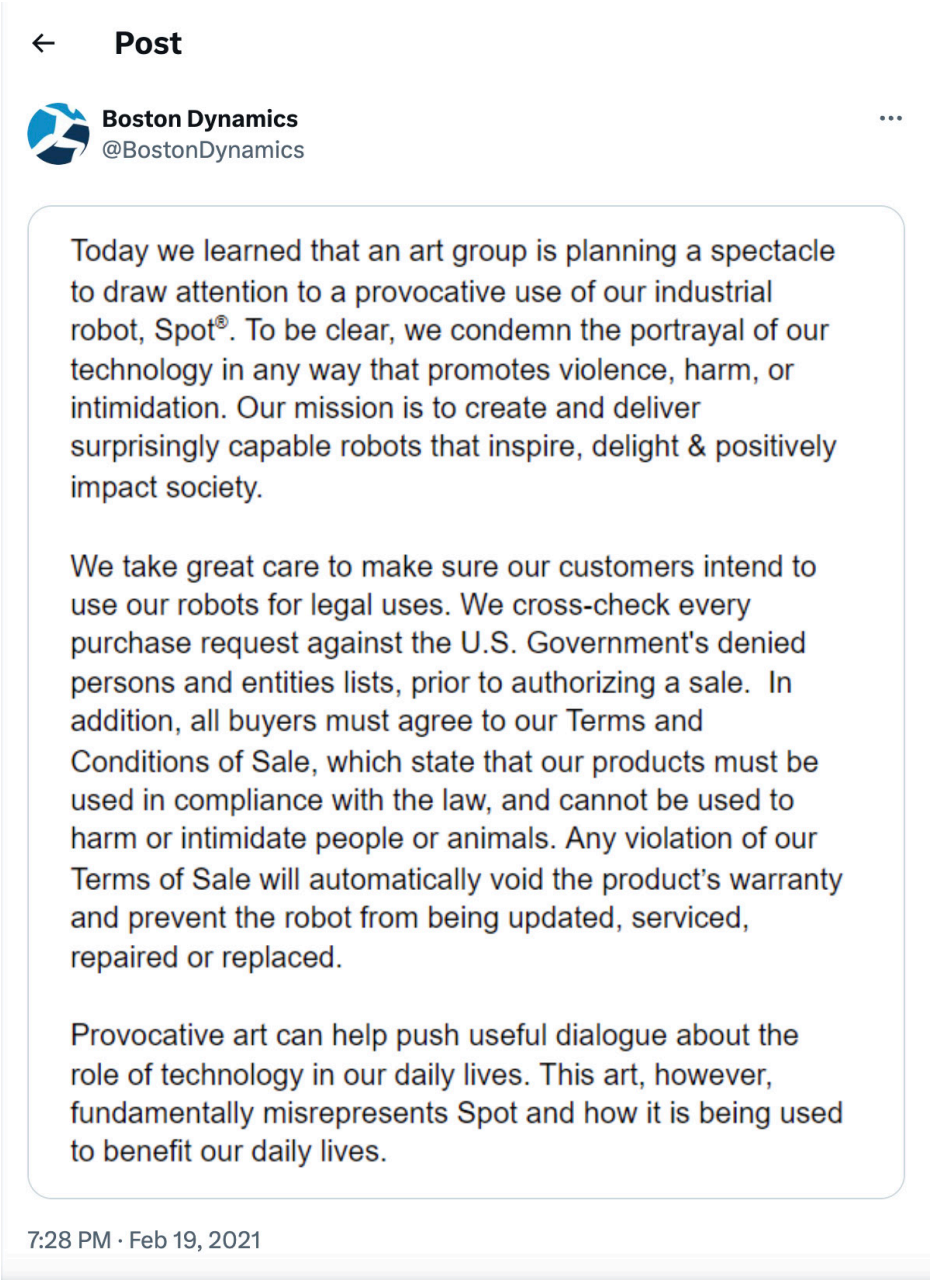


© MSCHF

This software enabled a global gaggle of internet users to pilot Spot's movements and weaponry, underlining AOC's point that the robot is a ground drone—a cute tank, really—best understood as an instrument of class warfare that ultimately destroys whatever context it's placed within. *Spot's Rampage*, crucially, distributed users' *implication* in the ensuing maelstrom. Piloting Spot was *fun*; a Fortnite-ization of art history as mediated by a robot going ape shit in Brooklyn. Our collective entanglement in choreorobotic violence made, briefly, hilarious.

Until it got shut down by Boston Dynamics,

Who had—and I'm thinking of Roach here—aesthetic—as in, ideological—concerns for what gets to be art, or not, what art is allowed to do, or not, and therefore, what art should be permitted to exist, or not.



© Sydney Skybetter

> "We condemn the portrayal of our technology in any way that promotes violence, harm, or intimidation… Provocative art can help push useful dialogue about the role of technology in our daily lives. This art, however, fundamentally misrepresents Spot and how it is being used to benefit our daily lives".

It's hard to know exactly what happened next. MSCHF claims Boston Dynamics used a backdoor to remotely brick their Spot, which is certainly possible from a technical perspective, if ultimately unprovable. Either way, with Spot apparently deactivated, Spot's Rampage was over.

© MSCHF

Until it wasn't.

MSCHF then loaded up Spot's carapace with just giant guns, and displayed the sequel to *Spot's Rampage*, titled *Spot's Revenge*, at the Perrotin Gallery in the Gangnam district of South Korea, about a 20-minute bus ride and middle finger's distance from Hyundai's global corporate headquarters in Seoul.

The backdoor deactivation of *Spot's Rampage* demonstrates the asymmetric, blackboxed matrix of power that choreorobotic performances navigate.

Parasitism, turns out, goes both ways. *Spot's Rampage* got shut down because it pissed off Boston Dynamics, but specifically because the company maintains means of controlling its products even when they're notionally piloted by others; parasitic manipulation of a host via a previously unknown and undisclosed virtual umbilicus lurking in the hardware.

Any art deploying robotic components is subject to terms of service and use as interpreted by the manufacturer, thus requiring artists' continuing implication within and negotiation of a corporate legal framework. The withdrawal of host and manufacturer support usually means the end of the art, except *that* was surely MSCHF's tactical intention all along. *Spot's Rampage* triggered an allergenic response from Boston Dynamics that—continuing the logic of Fisher's *Play in the System*—demonstrated the conditional edges of the company's supposedly innovative culture and corporate hospitality. The friendly neighborhood transnational AI and robotics company couldn't metabolize the performance, and thus, had to expel it, inadvertently sustaining the very choreorobotic project they tried to quash. Tweeting jeremiads about the *proper* role of creativity in society while trying to kill some art made the company's hypocrisy plain.

Between lousy press coverage of the Spots in New York and pressure from the Brown University weird art community, the NYPD pulled the plug on the partnership with Boston Dynamics in April of 2021, almost exactly three years ago to the day.

<imagery from NYTimes piece here>

The Spots were deactivated and returned to Boston Dynamics, and Spot's tenure in New York City was over.

Until it wasn't. Last year, Mayor Adams hosted a press conference in Times Square to announce that he was letting Spot "out of the pound", and that the robots would rejoin the New York Police Department's menagerie.

<Excerpt media of spot dancing at press conference ie here, others>
"Crime-fighting robot dog joins NYPD" © NBC News

Throughout the demonstration, for a fawning audience of police and press, Spot danced.

The Final Frontier

<images of Apollo>
© Apptronik

One of the platforms I've begun researching from the choreorobotic perspective is "Apollo", a robot intended for eventual deployment in space missions by frequent NASA collaborator Apptronik.

<video of Apollo dancing>
© TheHumanoidHub

A few weeks ago at South by Southwest, Apollo premiered a dance derived from movement training data extracted from YouTube videos by Czech / Nigerian choreographer Yemi A.D. This choreographic method—feeding a generative system dancerly motion capture data—is, perhaps predictably, yet another means by which choreorobotic systems are compelled to appropriate and perform Blackness. That's Yemi right there, grooving, superiorly, alongside his own choreorobotic doppelganger. Apollo, by the way, is the bipedal robot most likely to be sent, by NASA, to the moon.

I've been thinking about outer space a lot lately. Choreographers, of course, are trained to think about how human movements through space and time create meaning. But not just any space and all time; terrestrial space and sublunary time. On earth, space and time

maintain a proportional relationality grounded in our kinaesthetic experience of Earth's gravity. Most of our bodies know what it feels like to roll down a hill, to sit in a theater, or to drive in a car. We hold proprioceptive sensing of these things in common. Human culture perpetuates difference, but what we share with almost absolute uniformity is the experience of being pulled downward at a rate of 9.8 meters per second per second. Our bodies, our theater, all of dance history, all creative production, the entirety of our understandings of the social and the civil are predicated on living on *this* planet as orbited by our moon, as we circle our sun. What we call culture is made possible by having physics in common.

Our conceptualization of relativity and the interstellar, meanwhile, braids space and time into spacetime. Out there, the absence of uniform gravity suggests new dimensions to the experience of embodiment and an unevenly distributed phenomenological understanding of our most basic societal premises. Out there, our bodies will exist across a brain-melting matrix of time-dilated relativities, wheres and whens, thens and theres, nows, histories *and* futurities. All of which profoundly flummox terrestrial means of creative production.

Perhaps we can imagine, cerebrally, sort of, the distances, scales and embodied phenomena required for the maintenance of life off Earth. We can do math, we have models, science is real and we have the technology. But our bodies have no lived comprehension of a void made up more of time than space, and there's a lot of space, and it's all trying to murder you. Navigating these intense spans of spacetime *requires* our bodies to be homed exclusively within suits, space stations, and shuttles. Somewhat like their simpler antecedents, cars, these media are inordinately complex computational, surveillant and *robotic* apparatuses with deep investments in human signification, embodiment, artificial intelligence, and interfaciality. Next-generation space stations are basically just giant Voltron robots pumped full of oxygen that we populate with our bodies and a mikrokosmos of the social. As such, I posit that physiological and, especially, *cultural* survival in space will be predicated on choreorobotic theory and practice.

In a Marshall McLuhan-y sense, I'm sure we'll go through a period of skeuomorphic cultural production that leverages terrestrial creative modes as we venture into space. The dance of the future will, for

a while, probably look like the dance of the before times, just with less gravity. We will absolutely do space ballets, and space painting, and space Shakespeare, and generally plug and play creative modes from Earth into the vacuum. But, out there, normative, earth-bound performance architectures like theaters are completely implausible. The maintenance of social ties requires a common culture and shared means to make meaning. To navigate the interstellar, live in space and inhabit other planets, we have to conduct technological research encompassing cultural, aesthetic and performance inquiry. To understand what life is out there, yeah we'll need scientists, but we will also need artists, dancers, and choreographers who can ascertain the creative opportunities uniquely afforded us by space-time. Science will tell us what it is. Artists can tell you what it means.

At Brown, we're planning a microgravity choreorobotics initiative to think through the relationship of robots, performance, architecture and the void; to imagine the aesthetic, as in, ideological, frames required to consider the cultural dimensions of interstellar travel; performance phenomena governed asymmetrically as much by the physics of space as the geometry of time.

<slide of the Aurelia Institute>

I've also begun working with the folx at the Aurelia Institute, whose mission is to prepare humanity to become a spacefaring species. The Conference for Research on Choreographic Interfaces and our podcast "Dances with Robots" is planning an entire season dedicated to figuring out what it takes to send dancers into parabolic flights to conduct zero gravity performance research.

Practically speaking, this will consist of vomitously vacillating between zero and 1.8 Gs, hurdling us towards outer space at six miles above sea level and at 400 miles per hour to dance in microgravity within 22-second intervals. Figuring out how to make dances in variable gravity, six miles above sea level at 400 miles per hour within 22-second intervals is the most immediate next step in our choreorobotic research.

Along with Aurelia, I've begun organizing teaching materials for a next generation of sky walkers to think critically about the hu-

man-robot interfaces of the future, as a precursor to considering the ideological—as in, aesthetic—prerogatives of interstellar culture. We have to understand space stations and robots like Apollo as culturally situated objects that carry the ideological priorities of their makers wherever they go—be it Texas or Mars. The risk as I see it, echoing Octavia Butler and bell hooks, is that if we aren't mindful of how hegemonic juices flow through these systems, we'll wind up with imperialist white supremacist heteropatriarchy in *space*. At a contemporary moment of great investiture by offensively rich white men in the colonization of the cosmos, this seems like something we should resist with some serious fucking fortitude.

The Silicon Valley move-fast-and-break-things ethos can make this all feel like a very *now* kind of thing, but there are useful torsades of history that hold choreography, robots and space travel together. Consider, Apollo.

<slide of Apollo>
© Apptronik

Naming this robot, Apollo, gestures simultaneously towards aeronautic and dancerly lineages. Most prominent, of course, is the nod to

<slide of Apollo program emblem>
© Wikipedia

NASA's Apollo program, named for the

<slide of Apollo the god>
© Wikipedia

Greek god of the Sun *and* of the dance. Apollo too plays prominently in Western performance, for being the *nom de guerre* of the arguable originator of the balletic tradition itself, wait for it,

<slide of Louis XIV as Apollo>
© Web Gallery of Art

Louis XIV, le Roi Soleil. He would deploy

<Later image of Louis XIV>
© ART-PRINTS-ON-DEMAND.COM

Apollonian symbology as his personal emblem and propagandistic icon of the French empire as long as he lived. And even beyond.

<image of Cannons>
© Wikipedia

The French military emblazoned the symbolic set on their canons for most of the 18th century, concretizing Apollo's importance for both pirouettes and parabolic projectile warfare.

<Image of globe balloon, here>
© Wikipedia

The origins of space travel navigate nearly *identical* striations of power. One of the first attempts at escaping gravity dates back to 1783, when the Comte Antoine de Rivarol proposed to the Louis XIV-founded Royal Academy of Sciences two conjoined scientific ventures. The first, a "globe airostatique" capable of being humans' first flight. The second: a humanoid, clockwork automata, a primitive robot, with a silk larynx and leather lungs capable of uttering in French what translates sycophantically into English as, "O adored king, father of your people, their happiness shows Europe the glory of your throne".

Robotic performance and colonial imperatives go way back and meet at regular intervals over the next three or so centuries. The articulation of that history is out of scope for this particular lecture, but I broach it here as a note of caution.

<image of Atlas in space>
© Marc Theerman

The Chief Strategy Officer at Boston Dynamics, Marc Theermann, posted on LinkedIn a few weeks ago this image of Atlas robots performing tasks on what appears to be the moon in the context of a note of appreciation for Elon Musk. He says, "At Boston Dynamics, we have explored the possibility of robots playing a role in space exploration… I believe that our humanoid robots could be a valuable asset in the coming *centuries*".

Elon Musk, meanwhile, founded SpaceX to literally colonize Mars. So, there's that.

All of these projects are, on differing scales, ideological projections that extend robotic embodiments and hunger for capital and territory across time and *into* space.

Consider then, Apollo, <video of Apollo dancing>

a robot laden with history, setting the stage for a next generation of human robot interaction, and a likely kernel of space culture to come. Consider the clumsy processual mimicry of an artificially-intelligent robot imitating the movements of its black progenitor. Consider this ineffectual denouement of a choreorobotic performance; a dance about the future of labor that devolves into glitched asymmetry as Apollo's two robot hands attempt, and fail, to form the shape, of a heart.

<ENDING>

Thank you.

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Author's biographies

Ania Catherine is an artist and choreographer from Los Angeles, currently based in Madrid. With a practice merging choreography, film, performance, technology, installation, poetry, photography, and combinations thereof, Catherine retains the thread through mediums of a conceptual approach to movement, drawing on principles of slow cinema, the aesthetics of boredom, and her studies (academic and physical) of the body as a tool for both learning and unlearning. She holds a master's degree in Gender and Public Policy from the London School of Economics and works internationally in performing, choreographing, speaking, directing, and teaching. In 2016, she co-founded Operator with Dejha Ti.

Nina Davies is a Canadian-British artist who considers the present moment through observing dance in popular culture and how it is disseminated, circulated, made, and consumed. Previous research projects have included the recent commodification of the dancing body on digital platforms and rethinking dances of today as traditional dances of the future. Oscillating between the use of fiction and non-fiction, her work helps build new critical frameworks for engaging with dance practices. Her work has recently been exhibited at The Photographers Gallery, London; Seventeen, London; Matt's Gallery, London; and Bloomberg New Contemporaries 2023.

Rory Fewer is a composer, DJ, and doctoral student in the ethnomusicology program at the University of California, Riverside. His research examines electronic dance music as a form of futurity praxis among queer rave collectives in Bangkok. He holds an M.A. in ethnomusicology from the University of California, Riverside.

María Regina Firmino-Castillo is a faculty member in the Department of Dance at the University of California-Riverside. She is a transdisciplinary scholar and artist whose research and practice focus on the body as a site of ontological production, destruction, and transformation, especially in the contexts of coloniality and anticolonial resistance. Her research engages anthropology, performance and dance studies, among other fields, to critically analyze bio/necropolitics, modernity/coloniality, militarization, ecocide, and genocide, especially through the perspectives of those most impacted by these interrelated forms of violence. As such, her work is deeply informed by dialogical engagements with research and artistic collaborators rooted in communities of struggle in Guatemala, México, and the United States. Firmino-Castillo's artistic practice includes documentary and experimental video, and she engages in performance as a method of onto-corporeal investigation.

Laura Karreman is an Assistant Professor at Utrecht University, specializing in Media and Performance Studies. She teaches in the MA program Contemporary Theatre, Dance, and Dramaturgy, and coordinates the Research MA Media, Art, and Performance Studies (MAPS). Her research focuses on embodied knowledge in dance transmission, digitization's impact on performance archives, and epistemological shifts due to AI and Human-Robot interaction. Currently, she participates in the research project Dramaturgy for Devices which investigates how expertise from performing arts can contribute to the development of social robotics. Karreman co-edited Performance and Posthumanism: Staging Prototypes of Composite Bodies (Palgrave Macmillan, 2021). Other publications include chapters in Futures of Dance Studies (The University of Wisconsin Press, 2020) and Contemporary Choreography: A Critical Reader (Routledge, 2017).

Tejaswinee Kelkar is an associate professor at the University of Oslo, after working as a data scientist in the music industry. Her research interests are in melodic cognition and motion capture.

Adriana La Selva is a theatre-maker, a performer, and a researcher. She is currently a fellow FWO researcher, working on a Ph.D. at S:PAM (Studies in Performance and Media- Ghent University) —in association with IPEM (Institute for Psychoacoustics and Electronic Music), Utrecht University, Manchester Metropolitan University and Aalborg University. Her research investigates what it means to practice an archive, by addressing the transmission of embodied practices through virtual media and dramaturgical approaches to archival practices. She is since 2015 member of the international theatre group The Bridge of Winds, led by Odin Teatret actress Iben Nagel Rasmussen. Adriana co-founded Cross Pollination together with Marije Nie, an international network of performers and researchers, which focuses on the dialogue in between practices and new ways of knowledge building.

Pieter-Jan Maes is professor in the field of systematic musicology, and coordinator of the research institute IPEM and the Art and Science Interaction Lab (ASIL) within the University of Ghent (www.asil.ugent.be). The IPEM team's research concerns embodied and social interaction with music. Digital innovative technologies play a central role in this, both in terms of fundamental knowledge acquisition, as well as the development of new artistic-creative possibilities in terms of human experience and interaction with music. We focus especially on the possibilities of extended reality (XR), artificial intelligence (AI) and data networks.

Diego Marín is a PhD candidate at the University of Oslo (RITMO Centre), and graduate of the International Master in Dance Knowledge, Practice and Heritage Choreomundus. He is a dancer, choreographer and stage director, as well as Professor in the MA in Performing Arts program at Universidad Internacional de la Rioja (UNIR Mexico). He has been a guest lecturer at the Rambert School of Ballet and Contemporary Dance in London and visiting student at the University of Cambridge (CFI). His artistic and academic work on dance has been awarded by the Sistema Creación (SACPC Mexico) and nominated for prizes such as the One Dance UK Award in Science and Research 2022. He is the author of the book *Encarnando lo artificial* (*Embodying the artificial*) and the podcast *Hacia una danza posthumana* (Towards a Posthuman Dance).

Ioulia Marouda is a multidisciplinary designer and artistic researcher. Her interests lie in the encounters across diverse fields, exploring unexpected connections between science, artistic practices, human tradition, and the hybrid knowledges that they produce. Currently, she is a doctoral fellow in Art Science at Ghent University, where her research focuses on the transmission of embodied knowledge through immersive and interactive technologies. Her unique background enables her to transcend traditional disciplines, and she frequently engages in collaborations with both artists and scientists. Using data, computer graphics and scientific concepts, her work aims to reveal the imperceptible forces that shape our lives, forging a connection with the more-than-human world.

Live Marianne Noven is a performer and theater maker based in Oslo, Norway. In 2014 she devised and produced the performance Running Live, originally part of her BA at Aberystwyth University, before it gained wider recognition. She performs with Grusomhetens Teater, Pause Performance Company and in solo-work.

L. Archer Porter is an interdisciplinary artist-scholar whose research centers on the intersections of performance, media, and technology. With a PhD in Culture and Performance from UCLA and a Masters in Dance Theories from UNC-Greensboro, Porter examines how digital platforms shape performance practices, focusing on the dancing body in digital culture. Her forthcoming book, *Homebodies: Performance and Intimacy in the Age of New Media* (University of Michigan Press), explores the complexities of home dance performances online and the aestheticization of intimacy in Web 2.0. Porter's recent work delves into the impact of blockchain technology on dance and choreography. Porter is currently on faculty at the Johnny Carson Center for Emerging Media Arts, University of Nebraska, Lincoln, where she continues to explore the evolving relationship between performance, media, and technology.

Jorge Poveda Yánez is an interdisciplinary researcher-artist with formal training in the performing arts, social sciences, anthropology and the law. As a Fulbright scholar, he became a teaching assistant and doctoral fellow at the University of California, Riverside where he currently works. Jorge uses a combination of performance and theoretical research to explore the artistic, material and philosophical aspects of digital dance, AI art and crypto-choreography. His recent mixed-media performances include *Unknown_Performance_1*, *We've Been Here Before* and *A Queer Reggaeton Dance for the End of Our Times* presented across the US, Belgium and France. Some of his written publications include "From Humans That Move Like Machines to Machines That Move Like Humans" (Dance and Movement Research Journal), "It is not Dance, is Data" (European Language Resources Association) and "Dancing Someone Else's Dance Through Someone Else's Body" (Dance Articulated Journal).

Sydney Skybetter is a choreographer. Hailed by the *Financial Times* as "One of the world's foremost thinkers on the intersection of dance and emerging technologies", his work has been supported by the Alfred P. Sloan Foundation, the Doris Duke Charitable Foundation, and a Creative Capital "Wild Futures" Award. He is a Senior Affiliate of metaLAB at Harvard, the Founder of the Conference for Research on Choreographic Interfaces and Host of the podcast, "Dances with Robots". Sydney is the Faculty Director of the Brown Arts Institute, and an Associate Professor of Theatre Arts and Performance Studies.

Dan Strutt is a Senior Lecturer in the department of Media, Communications and Cultural Studies at Goldsmiths, University of London, where he teaches film, screen, and virtual media analysis alongside creative economy theory. His monograph *The Digital Image and Reality: Affect, Metaphysics and Post-Cinema* was published with Amsterdam University Press in 2019, and the co-authored *Fashion as Creative Economy* by Polity in 2022. He currently collaborates with dance and digital artists on funded projects in the area of motion-capture dance and telematic performance, most recently in a 2023 British Academy Innovation Fellowship, and publishes on virtual embodiment, ethics, and digital creativity.

Nanna Verhoeff is Professor of Screen Cultures and Society in the Department of Media and Culture Studies of the Faculty of Humanities at Utrecht University. Trained as a scholar in media and performance studies, she specializes in the analysis of the emergence and transformations of screen and interface cultures. She has published on early cinema and contemporary screen cultures; mobile and urban media, art and performance; situated data and algorithmic practices; and concepts and methods for the creative humanities. Her latest book *Urban Screens: Situations, Practices, Concepts* will be published in print and open access by Amsterdam University Press.

Hugh Alexander von Arnim is a doctoral research fellow at the University of Oslo. His research interests include multimodal music data analysis, focusing on sound and motion, as well as interactive system design.

Forthcoming Issues:

Documenta XLII (2) - Theatre in Times of Hyperpolitics - Winter 2024

Documenta XLIII (1) - Milo Rau: Comparative Lensens - Summer 2025