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

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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

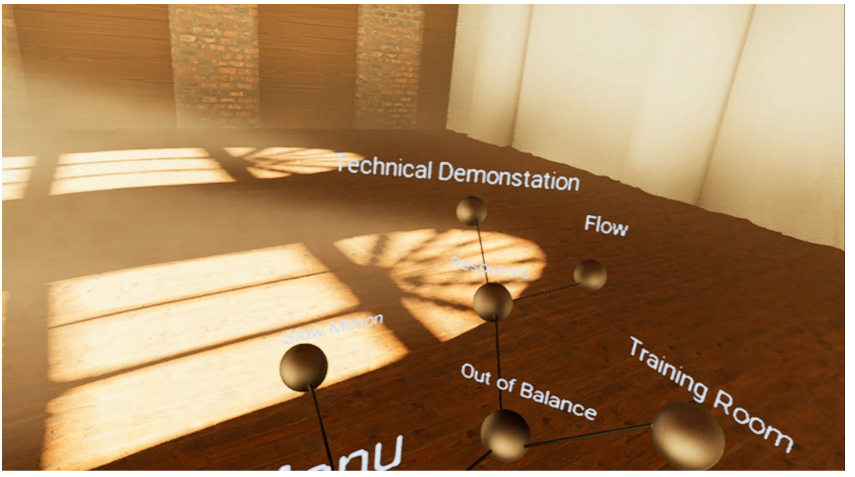



Figure 2. Screenshot from the VR Experience showing the Menu unfolding, 2023. © Ioulia Marouda and Adriana La Selva

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]

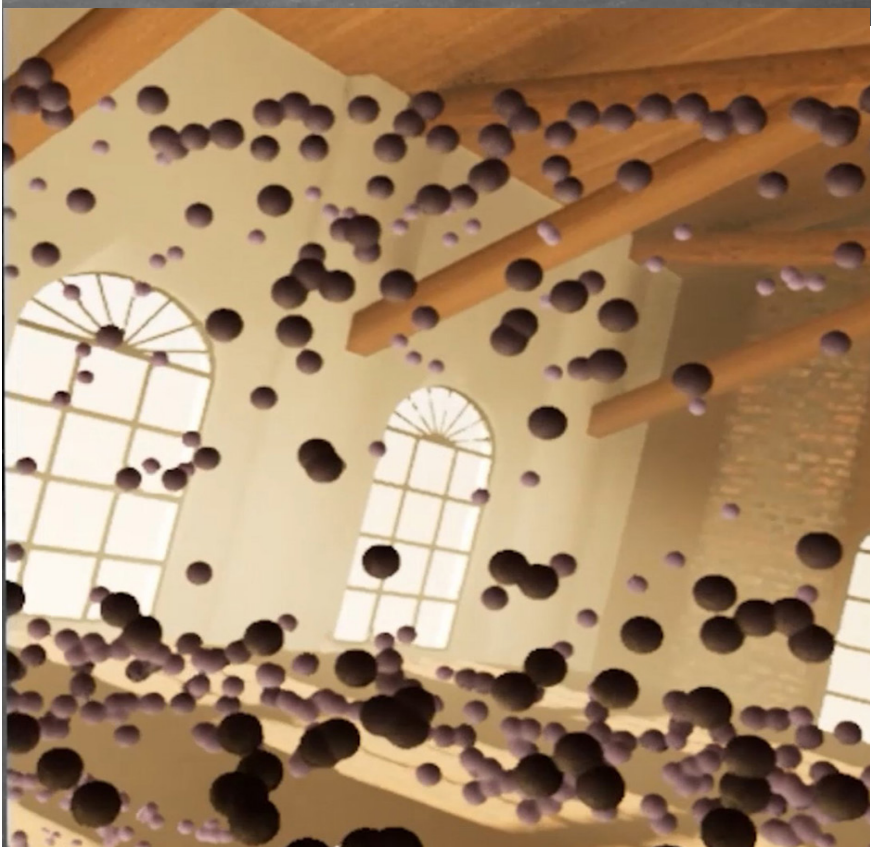
The experience begins with a brief introduction to the work by the researchers in the physical space, and a prompt to the audience to engage in the experience in any order they see fit.[6] After putting on the VR headset, the participant becomes immersed inside a spacious virtual room with wooden floors, 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



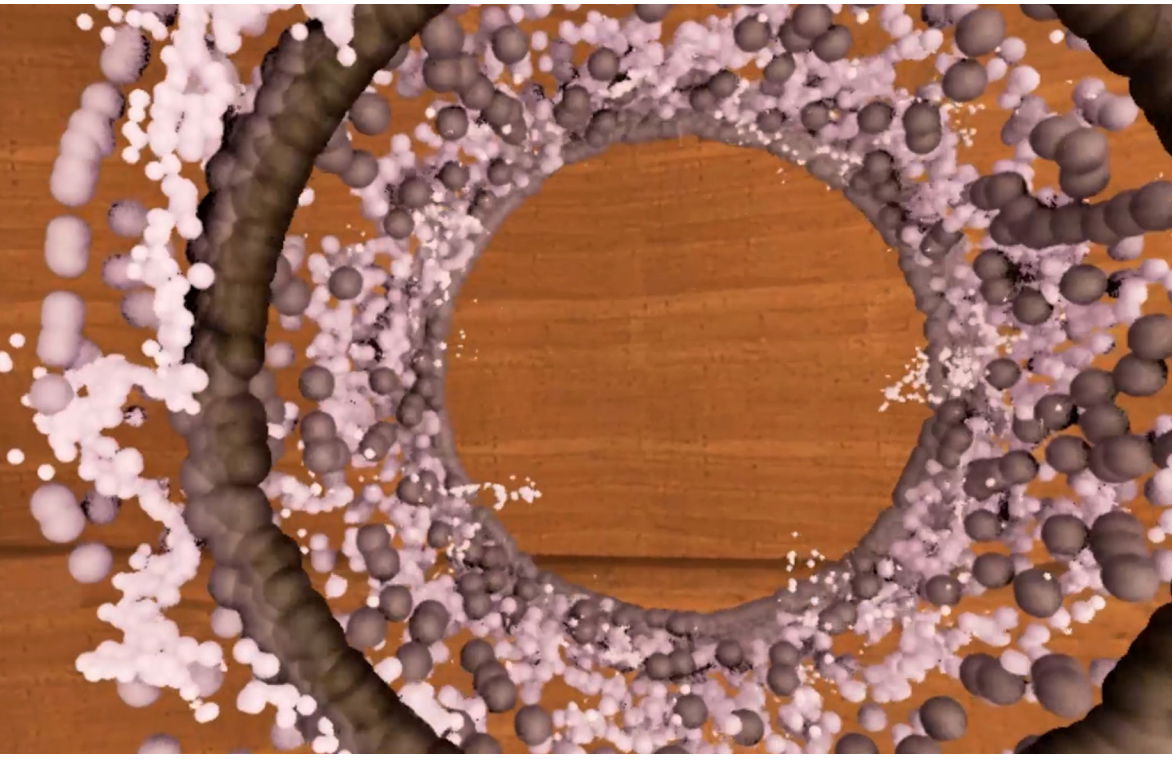


Figure 4. Screenshot of the rings of particles from below in VR, 2023.
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ternal application, real-time extraction of the participant's voice pitch and volume is conducted. These particular characteristics of the voice were chosen as they are connected 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, gener-

Figure 5. Screenshot of the Slow Motion Virtual Environment, 2023.
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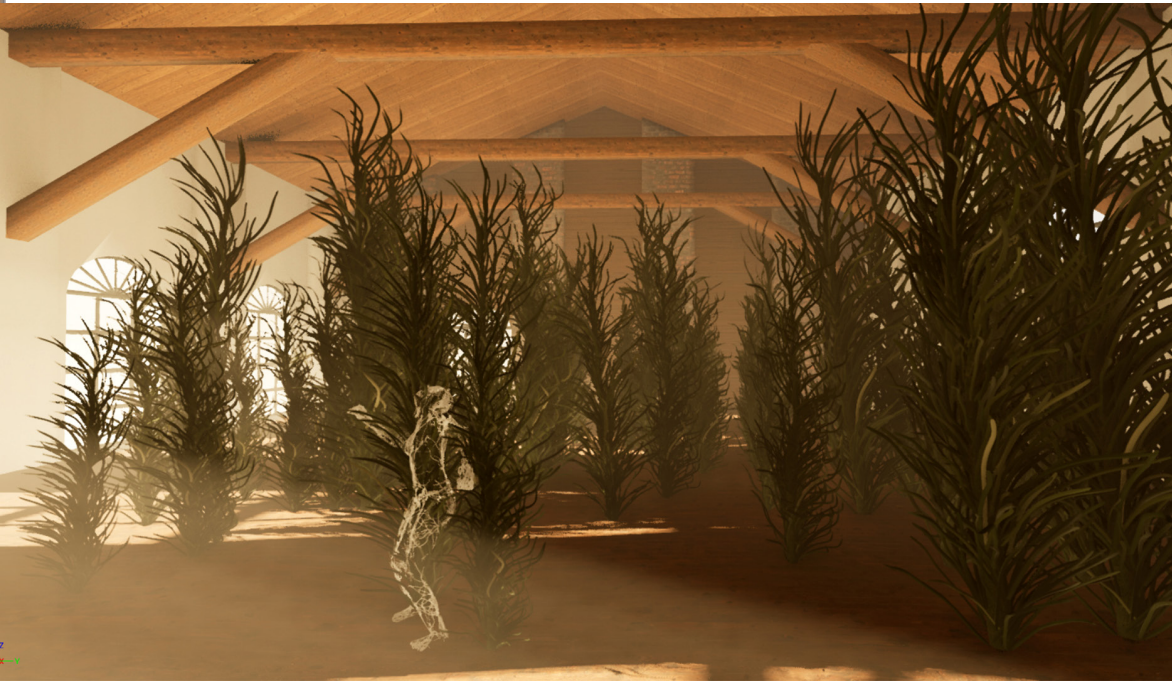


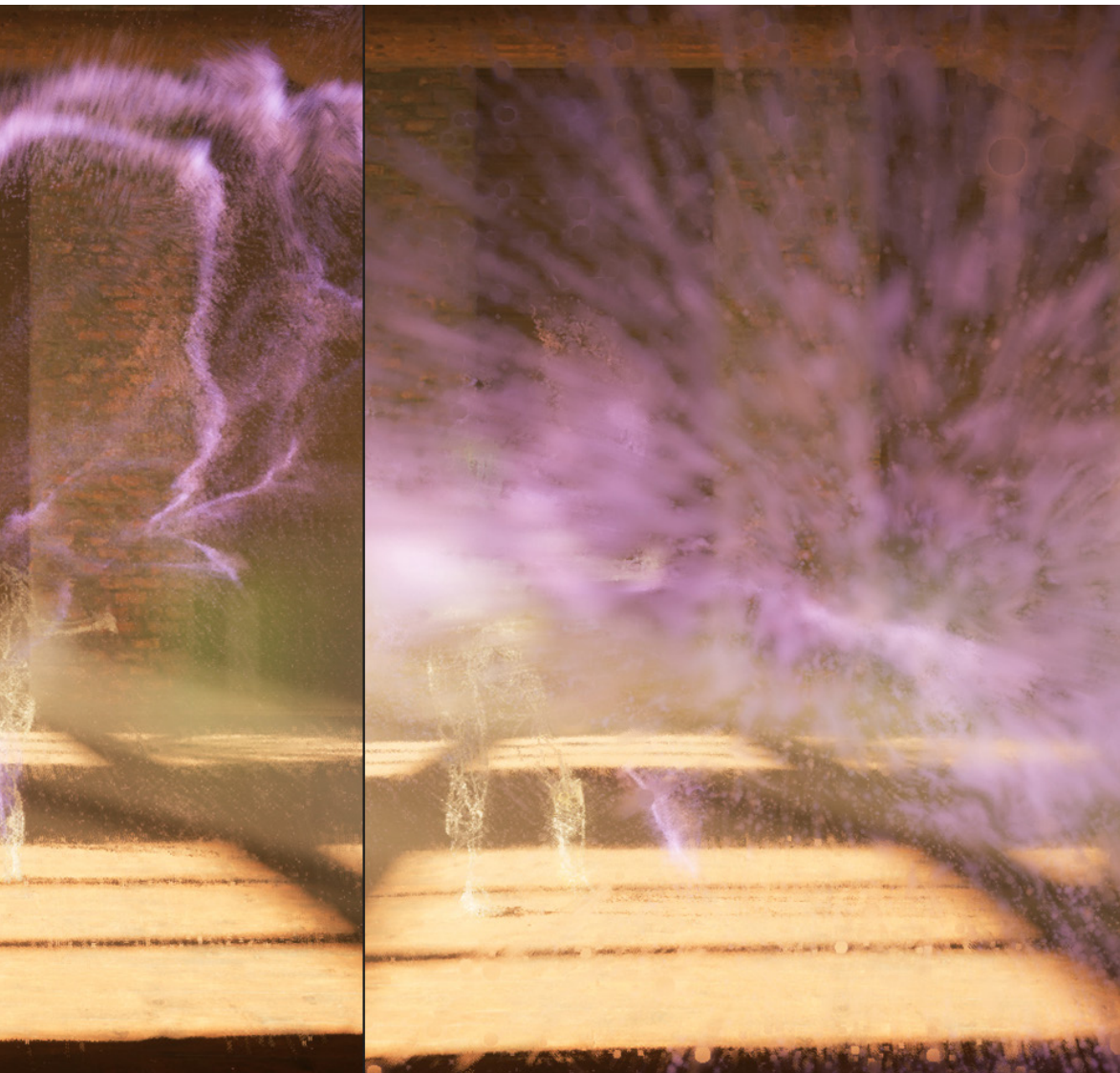
Figure 6. A participant interacting with the virtual seaweed, during the Slow Motion exercise, 2023. © Ioulia Marouda and Adriana La Selva

ating a reactive and unpredictable movement in the virtual plant (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

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.


effects that originate from the participant's physical presence and ripple outward to influence the entirety of the virtual environment.

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 graph-

ics, 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.

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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).