



Connected: Birth-Death-Rebirth Through Tangible/Intangible/Virtual Explorations of Hands

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ABSTRACT

This paper presents *Connected: Birth-Death-Rebirth*, an art installation that explores imaginative lives from human hands in the extended physical environment with physical, virtual, and networked environments. The project is an extract of our body and generates virtual lives (birds, trees, and snakes). The new creatures build new societies based on computer algorithms and mimic human society and behaviors. The audience creates new organisms by putting their hands or objects into the white box in front of the projection screen. Their input becomes a flock of birds, a group of trees, or snakes in the projected virtual environment. Participants can get immersed in the virtual environment through a projection or a VR headset. In the virtual environment with a VR headset, they can navigate the world of *Connected: Birth-Death-Rebirth* by walking or teleporting using the VIVE controllers. The new world is the dynamism of the trees, birds, and snakes. They are born, grow, interact, dead, and are reborn in the environment.

CCS CONCEPTS

• **Applied computing** → Arts and humanities.

KEYWORDS

Immersive installation, interactive installation, virtual reality, embodied immersion, virtual creatures, hands

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1 INTRODUCTION

Hands play a vital role in shaping our human experience and defining our actions. They serve as the primary instruments through which we interact with the world, gathering essential information through tactile transducers and kinesthetic senses. Our hands enable us to perceive touch, pressure, heat, and cold, providing us with precise insights into our surroundings. Furthermore, hands

facilitate social cognition, allowing us to express greetings, consolation, affection, and even aggression [5]. Hands transcend their functional role in our lives when we contemplate their communicative gestures. While the voice serves as our primary tool for symbolic communication, hands often take a close second, surpassing all other body parts in their multifaceted capabilities. Not only do hands possess the sensory acuity akin to that of our eyes, but they also possess the remarkable ability to speak, sculpt, and shape our world. In this capacity, they enable both individual existence and foster social connections, embodying a profound social role that intertwines with our very essence [9]. They have the ability to provide comfort, build trust, and express emotions.

This paper introduces *Connected: Birth-Death-Rebirth*, an interactive installation that delves into the realm of imaginative lives stemming from the human hands. The project emerged from a question: "What do our hands think, see, or aspire to become?" This query led to a broader exploration: "Can we liberate hands from the confines of the body and envision their individual or collaborative potential as sensorial, perceptual, gestural, and social organs?" The installation embarks on a journey through the extended physical environment, encompassing physical, virtual, and networked realms, to uncover the possibilities that lie therein.

In this paper, we present the artistic exploration of imaginative organisms and immersive worlds, brought to life by the active participation of the installation's participants. Through the integration of physical and virtual experiences, *Connected: Birth-Death-Rebirth* breathes life into virtual organisms, giving rise to intricate societies that echo human behaviors and interactions.

The installation captivates participants, inviting them to engage and contribute to the creation of these virtual worlds (Figure 1). By harnessing the creative potential of their hands, individuals become co-creators, shaping the organisms and their environments. This interactive process provides a unique and immersive experience, blurring the boundaries between the physical and the virtual.

This paper presents the details of *Connected: Birth-Death-Rebirth*, unraveling the intricacies of its conception, implementation, and the perceptual impact it has on both participants and observers. By investigating the immersive realms crafted by this installation, we aim to shed light on the transformative potential of the human hands and their capacity to shape imaginative landscapes where virtual organisms thrive and human experiences intertwine.



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2 INSPIRATION AND BACKGROUND

The indispensable role of hands in shaping our individual identities has been a recurrent theme in many artists' oeuvre, frequently



Figure 1: Creatures in the virtual world created by participants.

making them the centerpiece of various perceptual interactive artworks. Golan Levin’s installation, “The Augmented Hand Series,” is a salient example of real-time interactive art that imbues the audience with a playful experience of their hands. The user’s interaction with the exhibit alters their perception of their hands by digitally transforming them - be it with an additional thumb, fingers bereft of a knuckle, springs inserted within, or fingers of varying sizes [3]. In a similar vein, “Gesture-Gesture” by Pablo Gnecco and Dan Moore delves into the distinctive and personal characteristics of hand gestures. Attendees at the exhibition insert their arms into sleeves, leading into a box, simulating an X-ray-like experience. Once the hand is enclosed within the box, custom software captures a snippet of hand movement lasting three seconds, which is then projected as gif files onto a wall [8].

Connected is a project that probes the concept of immersion, a term generally defined as the viewer’s loss of awareness of the real world outside the virtual environment. This sense of immersion in a fictitious world is crafted by complex computational hardware and software. Various disciplines such as Literature, Gaming, Architecture, and Aesthetics have dissected this concept, but it is most keenly examined by Virtual Reality scientists and artists who endeavor to fabricate novel immersive environments that push the technological envelope. This investigation strives to oppose the disembodying inclinations of virtual reality, challenging the viewer’s sense of physical continuity by transporting them into a visually conjured realm.

This project serves as an extension to “Amputation Box” by Johnston, Seo, & Gromala [2]. It features a box with an opening on the top and a display on one side. Participants insert their hands into the opening, visually amputating any object introduced, and presenting it as a virtual entity: animated, disembodied flesh. The displayed dismemberments are projected onto a monitor affixed to the box. This project emphasizes the interconnectedness of immersion, construed here as a flow – a stream of energy, curiosity,

and the temporal and spatial continuum. It endeavors to bridge the gap between the human and artificial worlds, culminating in a virtual yet embodied immersion experience [2].

The project *Connected: Birth-Death-Rebirth* delves deeply into embodied immersion, a concept that is intimately woven with the Asian philosophical construct of ‘Ki.’ As a cornerstone of traditional culture, ‘Ki’ is often translated as air or breath and, in a broader sense, refers to life force or spiritual energy, permeating every facet of existence [1], [12]. ‘Ki’ is believed to flow through channels within the body, forming a vital link between the individual and the universe. Such a notion gives rise to practices in traditional Eastern medicine where practitioners, well-versed in the manipulation of ‘Ki,’ aim to heal patients by infusing them with positive ‘Ki’ and purging the negative. We perceive it as a ubiquitous energy that facilitates balance - within oneself and in relation to others and the broader world. ‘Ki’ represents a time-honored worldview, elucidating the intricate interconnectedness of the cosmos [10], [11].

The immersive experience intrinsically implies and requires an energy flow, which originates from the external phenomena of the installation. This flow permeates the perceptual surface of the artwork and the skin, seeping into the internal body and cognition. This energy flow bears similarity to natural currents, like those found in rivers, veins, and oceans. An invisible force, akin to the omnipresent energy enveloping us, imbues us with life. The necessity of energy is evident in every facet of existence – it fuels our movements, sustains our breath, illuminates our vision, fosters growth, and facilitates metabolism [7].

There exists an intriguing parallel between ‘Ki’ and Maurice Merleau-Ponty’s phenomenological approach, as both focus on the human experience and our relationship with the world. These aren’t isolated processes but are rather ongoing, reciprocal interactions. Merleau-Ponty, in his work “The Visible and the Invisible,” argues that all entities based on dualistic premises (mind and body,

subject and object, etc.) are interconnected by reciprocal definition. He illustrates this principle with instances from our tangible experiences such as touching and being touched, observing and being observed, and the interplay between the sentient and the sensible [4]. According to Merleau-Ponty, we cannot touch ourselves, or even somebody else, without this recognition of our own tangibility and capacity to be touched by others. Further, our existence cannot be singularly defined as either the toucher or the touched. Our embodied subjectivity, as per Merleau-Ponty, is grounded in the interweaving of these dual aspects - at the juncture where the two trajectories of a chiasm intersect with one another [4].

In this project, we explore immersion as a phenomenologically interwoven state between spaces and human existence, where the mental and physical confluence mirrors the seamless blending of land and sea at the shoreline. The phenomenological perspective and Ki-oriented philosophical stance underpin our focus on a subjective creative experience that remains in a constant state of flux, shaped by the evolving experiences of the participants. Furthermore, these elements - 'Ki', phenomenology, and immersion - serve as a comprehensive framework to enhance our understanding of subjectivity. By highlighting the interconnectedness and the inseparable nature of mind and body, they offer a holistic perspective on human experiences.

3 DESIGN AND IMPLEMENTATION

3.1 Design Concept

Connected: Birth-Death-Rebirth is an art installation that expands the traditional confines of physical spaces by integrating physical, virtual, and networked environments. It creates networked aesthetics through a virtual world consisting of various new creatures, captured hands of the audience. Connected serves as an extension of our physical self, giving birth to virtual lives that take the form of birds, trees, and snakes. In the project, the audience's created organisms construct their society and interact with each other in the digital world. Their behaviors and interactions mirror the intricate dynamics of natural ecosystems. Some creatures are vivacious, dynamic, and swift, while others maintain a serene, passive, and languid demeanor. A smaller group exhibits neutrality and indifference. These entities are seamlessly integrated with the virtual world, their existence a blend of conscious, preconscious, and bodily elements.

The installation consists of a white box, a projection screen, and a VR headset (Figure 2). The audience has the freedom to participate in an active or passive manner. They can introduce new organisms into the ecosystem by inserting their hands or objects into the white box located in front of the projection screen. These introductions metamorphose into a flock of birds, a cluster of trees, or a slither of snakes within the projected virtual environment. Participants can immerse themselves in the virtual realm through the projection or via a VR headset. With the latter, they are able to traverse the world of *Connected: Birth-Death-Rebirth*, using VIVE controllers to walk or teleport around. Participants witness the vitality of the trees, birds, and snakes inhabiting this digital environment. These entities are born, grow, interact, die, and are reborn in a continuous cycle. The immersive VR environment offers a dynamic experience where the mind, body, and environment coalesce, communicating



Figure 2: Participants try Connected through physical and virtual spaces.

within a technically mediated, spatially encapsulated, and sensuously interactive computational environment.

3.2 Technical Details and Implementation

Connected is a sophisticated construct comprising multiple components (Figure 3), including a physical setup (Figure 4) and a range of computational processes. The physical setup encompasses a white box containing a live web camera aimed at a green screen. The TouchDesigner [13] program detects motion by assessing differences between recent frames from the live feed. If motion is detected, an image or animated GIF, generated from the live video, is saved to a designated directory in the file system after a brief delay. This motion detection process then undergoes a cooldown period before resuming. When a capture is taken, the TouchDesigner script embarks on a series of manipulations (Figure 5, Figure 6). First, chroma keying is applied, a technique that identifies and removes a specific color from the image, most commonly a bright, primary shade like green. This is the same technique used in film and television to superimpose actors onto different backgrounds. Post chroma keying, the TouchDesigner script proceeds to digital masking. Digital masking involves selecting specific areas in an image for further processing while leaving the rest of the image untouched. This could mean selecting the background for removal or isolating an object of interest to be highlighted or altered in some way.

Once these two stages are completed, the script then mirrors the image. Mirroring is a form of symmetry where one half of the image is a reflection of the other. This process can yield visually compelling results, particularly when applied to abstract shapes or organic forms. In the case of "Connected," the mirroring process is leveraged to create more complex and visually intriguing shapes from relatively simple hand gestures or objects.

Once these manipulations are completed, the resulting images are outputted and passed to the Unity [14] process. Here, the images (Figure 7) are used as the basis to generate a diverse array of fascinating virtual creatures. When a new image or animated GIF is detected, the Unity application determines the type of organism to be spawned and creates it using the newly produced image or animation. This application also regulates the behavior and interactions of the spawned organisms within the environment and

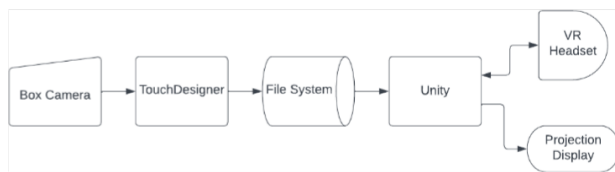


Figure 3: Overview of key components of the installation,

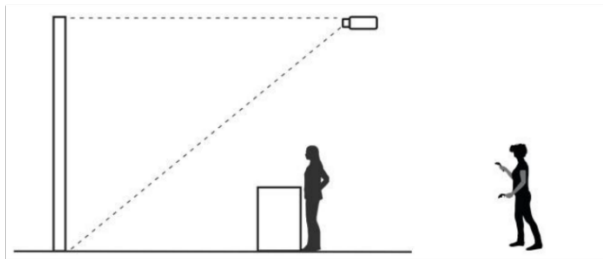


Figure 4: Physical installation setup.



Figure 5: Motion detection script.

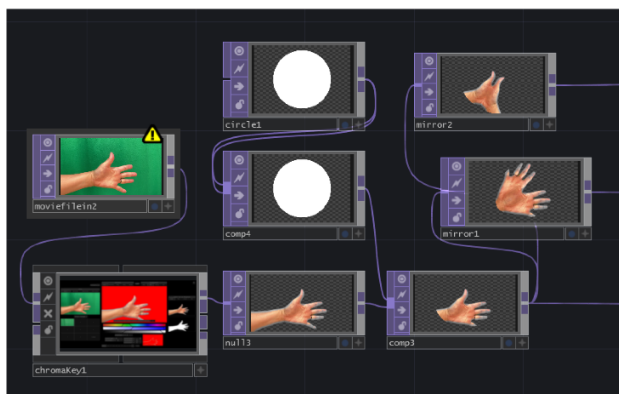


Figure 6: TouchDesigner image manipulation.

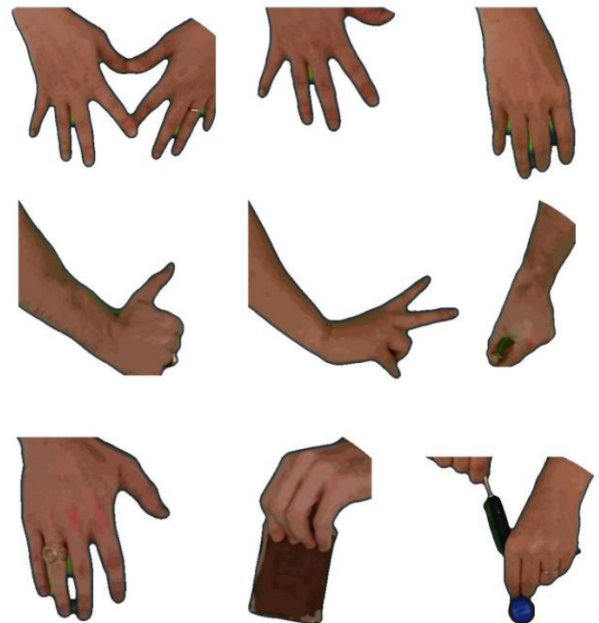


Figure 7: Captured hand images.

feeds input to both the projection and virtual reality displays. Each creature is unique, its form and behavior determined by the image from which it was spawned, further enriching the interactive and immersive experience for the user. The virtual reality system can be experienced using an HTC VIVE headset, providing an immersive and interactive experience for the user.

3.2.1 *Types of Organisms.* The installation gives rise to three types of virtual organisms: birds, snakes, and trees (Figure 8). Bird organisms are structured around a single point entity, characterized by particular coordinates and velocity parameters, coupled with textured quadrilaterals. On the other hand, snake organisms mirror the nature of their real-world counterparts, leaving behind a chain of self-similar textured cards in their path, reminiscent of the classic Snake video game. Both bird and snake organisms abide by the same movement principles within the virtual environment. These organisms embody the notion of ‘boids,’ a term coined by Craig Reynolds [6], demonstrating an awareness of their relative locations to one another. They follow a set of ‘flocking’ rules that include centering, avoidance, and velocity matching, thereby displaying lifelike behavior both individually and collectively.

When a participant's hand is captured, it does not merely add a single boid to an existing group. Instead, it generates a new flock of boids unique to that particular hand. Each newly formed flock operates independently, with no interaction with previously created boids. As such, every new interaction gives birth to a distinct flock of organisms. In contrast, tree organisms take the form of fractal trees. The moment they are spawned, the positions of their branches are computed, and the program animates their growth, starting from the ground and extending upwards into these pre-established

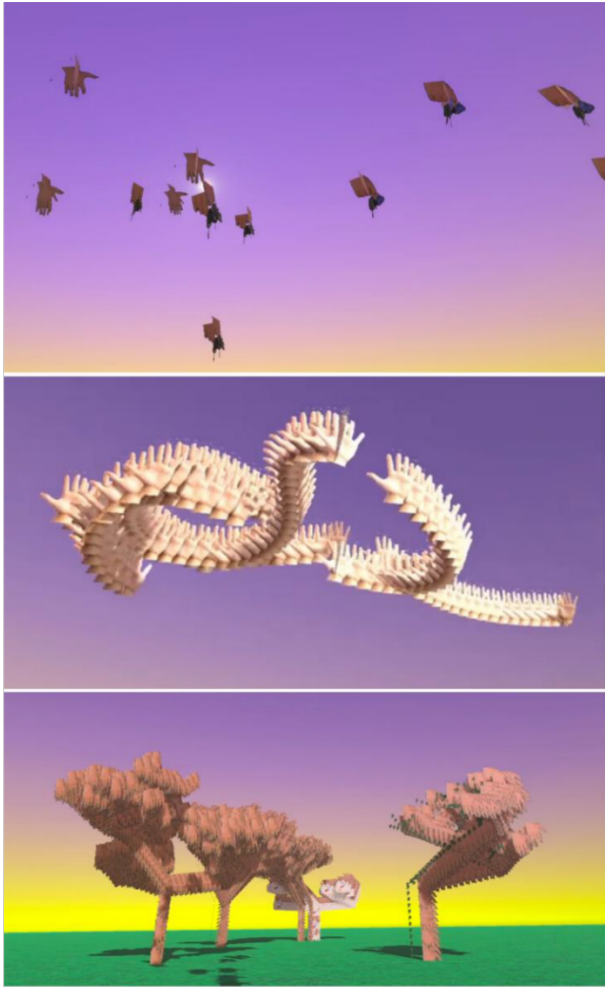


Figure 8: Virtual organisms: Birds (top), Snakes (middle), Trees (bottom).

positions. This intricate process lends a dynamic and organic feel to the evolution of these entities in the digital landscape.

4 CONCLUSION & FUTURE WORK

Connected: Birth-Death-Rebirth proposes an engaging journey of self-discovery, where our hands are given the autonomy to exist beyond their physical constraints. This dual existence within our tangible world and the crafted virtual realm simultaneously fosters a profound sense of separation and connection, thus offering a novel experience of networked immersion.

While the current project centers its explorations around hands, future iterations aim to delve into the autonomy and interactive potential of other body parts. The exploration might extend to individual fingers, facial features, arms, and legs, or even consider the body as an interconnected whole. Further, the dynamic interplay between virtual organisms and real-world interactions will be deepened not only with everyday participants but also with the

incorporation of professional actors and dancers. By including professionals trained in movement, we can harness the full spectrum of human expressiveness and thereby enrich the complexity and diversity of the virtual organisms that our project generates.

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