

Computational media as tools for the creation of aesthetic and affective experiences in responsive spaces.

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ABSTRACT

This paper discusses the role of non-representational computational media and digital technologies in the creation of aesthetic and affectively marked experience in responsive architectural spaces.

Designing responsive spatial installations pays attention to the individual and collective experience of a space and the objects within it. The temporary and temporal nature of digital media, as well as the detachment between the mediated source and the disseminating channels, augment the physical affordances of the space, which opens the door to experimentally examining the interrelations of movement and presence, the subjective experience of dynamics and change: *temporality*, as well as spatiality -- the experience of the relation between bodies and space. This allows for a re-examination for concepts like enclosure and scale, which opens up the possibilities for designing more nuanced and powerful artistic experience.

A critical look at the differences between interactive and pre-composed media, and their influences on the aesthetic and affective experience of participants, allows for redefining the role of the participant from a spectator to a co-author, and for redefining the space from “where the event takes place” to becoming the event itself.

This paper examines some of these concepts through describing and discussing experiments and installations that were carried out by the authors within the Topological Media Lab at Concordia University, and discusses some future work and projects that build upon previous and current work.

KEYWORDS

Responsive Environments, Installation, Performance, Non-representational media, Agency, embodiment.

1. INTRODUCTION

The introduction of technology into the arts, and the results of the last two decades of trans-disciplinary studies that carried out critical re-examinations of concepts of space, performance, and the body, have created a rich theoretical and practical base from which we can contemplate the production of new artistic interactive systems that go beyond the traditional *action-reaction* software approach, and allow us to contemplate more complex non-deterministic performative systems that do not assume a telos and that could be described as auto-poetic.

By developing such systems we enable the performer, trained or otherwise, to go beyond the role of the active spectator, and experience the possibility of becoming a co-author and a co-creator of the experience, where the performer's behavior creates the environment, and the environment conditions their behavior.

In this paper we are addressing the design methodologies and considerations for exploring embodied interaction in relationship to the technologically active environment. We use our responsive media-rich environments as performative instruments where intentional, and otherwise computational, events co-create rich artistic and lived experiences. We investigate the perception of such environments from the point of view of the audience, as well as the performers that interact with them, and discuss the impact of technology on the performance, and the scenarios where technology can overcome the performance, or facilitate and invite the co-performance and co-creation in the same space. Finally, we anchor our research creation in the theoretical discourse that informed our designs, and discuss the outcome of such experimental performances to deepen our understandings of these newly lived experiences. The projects that will be discussed in this paper are the result of the theoretical, and technical, investigations at the Topological Media Lab at Concordia University¹.

2. THEORETICAL BACKGROUND

2.1 *Historical precedents – non-technological interactive performances*

Interactive performances are not always technological in nature. This concept allows us to look beyond the technical capabilities and technological limitations, and focus on the conceptual and theoretical process and methodology in designing and creating these environments.

The ancient eastern forms of public story telling, in which a narrator recounts tales and myths to a live audience, can be thought of as an early form of performances that allow audience interaction in a narrative and theatrical context. The Narrator would sometime resort to engaging his audience, when reaching a climax in his tale, by asking them for a verdict on the fate of character. When the audience votes whether the character should live or to die, the narrator would improvise an alternative storyline based on the audience's interaction, making this a very early form of a participatory performance where the spectator is endowed with agency and authorship.

These local storytelling traditions were later followed by other forms of non-technological interactive performances in the work of many artists and directors in the

20th century; These include Yoko Ono's *Cut Piece*, where the audience is invited to cut pieces of Ono's dress while she sits passively on stage², and Marina Abramović's *Rhythm 0* where the artist sat in a gallery space on a table that has several objects on it (knife, whip, chain, a bullet, a gun, etc.) and invited the audience to use the objects on her while she sat and observed passively.³ Such works do not only allow the audience to create unique performances, but also turns the spectators into temporary performers whose contribution to the event flow can be as critical as the artist's role himself.

2.2 *Crossing the borders – Space and the performance*

These previously discussed works are but a small number of what can be regarded as the theoretical precedents to our current interactive environments; They changed the role of the audience from passive spectators to an active participants. These attempts, alongside other experiments in theater, blurred the boundaries between the performance space and the audience space, thus breaking *the fourth wall* of the performance environment, which is a concept that assumes an invisible wall between the audience and the stage through which the audience follows the spectacle, yet keeps its distance from it.

The works of Arianne Mnouchkine and other artists of the same era challenged that concept and brought the performers to the same space as the audience, thus bridging the space-time of the audience with the space-time of the spectacle, allowing for a flow between the two spaces that became united by the narrative of the performance.⁴

These attempts cannot be studied in isolation of the influence of the Bauhaus and the work of Mohly-Nagy and Schlemmer on the concepts of stage design in that era. The work and research of the Bauhaus in creating *total theaters* focused on stage designs that remove the boundaries between the stage and the viewer, integrate media and mechanical apparatus that create total sensory experiences, expose the technology as part of the performance, and transform static performance spaces into dynamic spaces through technical means.⁵ These ideas and concepts found their way in the later part of the century where they didn't only influence the work of some performance and installation artists in the 60's and 70's, but also some more recent works by contemporary artists and art collectives like Dumb Type, Big Art Group, LAB[au], F0am, and many others.

The recent experimentations in responsive and media-rich environments draw their importance from attempting to liberate the performance from the structured narrative that traditionally governed the progress of events and the relations between the performers, the audience, and the environment. The non-linear nature of responsive media-rich environments has the potentials to involve participants in the event without necessarily requiring prior training in body or performance arts, but also not requiring any knowledge of the narrative of the space. This creates a new organic model for these performances where the role of the participant influences the environment, and is influenced by the environment at the same time, which keeps the narrative in flux and keeps the space at a constant potential for change.

The interactivity we refer to in this paper is the embodied interaction between participants in the same space, and also between the participants and their

environment. The corporeal nature of these interactions emphasizes the role of *the body* as an active element and an agent of change in creating the experience.

The correlation between body and space, and the duality of the physical space and the mediated and interactive space, is a major research interest and a main consideration during the process of designing the experiments that we will talk about later in this paper. Corporeal interaction mediates changes in the responsive environments, but can also become elements of the space that receive, and perceive, the change that is influenced by the actions of other bodies. According to Lefebvre, the active body creates its own spaces with the energies at its disposal, yet is still governed and influenced by the laws of space⁶, which is true in any context, not only in interactive environments. However, the term “laws of space” that Lefebvre talks about in here can be examined beyond the traditional physical delineation of walls and ceilings and material properties. We expand the term to include the environmental flux that we create through digital and computational media, and the impact of other bodies in space and their motion in space.

3. WORKSHOPS, PERFORMANCES AND INSTALLATIONS

3.1 *Einstein's Dream (2013)*

Sha Xin Wei, Michael Montanaro, Jerome Delapierre, Navid Navab, Julian Stein, Omar Al Faleh, Nicolas Chandolias

Designing computational media to enhance and activate spaces gives the spectators the capacity to re-conceptualize, re-contextualize and question the existence and perception of space and time.

Einstein's Dreams is an environment in which visitors encounter performers in responsive fields of video, light, and spatialized sound, presented and conceptualized as a set of tableaux. Each tableau is inspired by a vignette from Alan Lightman's novel, *Einstein's Dreams*⁷, which is set in Berne Switzerland in 1904, the year that Albert Einstein received the Nobel Prize. Or rather, a set of parallel 1904's, each of which is a different kind of time: in one, time slows to a halt as you approach a particular place; in another there is no future; in third, time sticks and slips; in a fourth age reverses and what is rotten becomes fresh as time passes.

In one concept, a large theatrical space (24 x 20 x 8m) will contain multiple tableaux, each with room for 6-12 people in its own pool of light and sound. Visitors and perhaps performers can move from tableaux to tableaux. The performers' actions will evolve in concert with the dynamics of lighting, sound, and visitors' expectations in order to create different kinds of time, inspired by the novel's vignettes. Sometimes a performer will walk from a location, dragging the pool of conditioning light and sound. The pool mutates or merges into another pool with a different type of time.⁸

Figure 1. Einstein's Dream, Particles and Lights



Heraclitus theorized the concept of “flux”, which states that change is always happening. *You cannot step into the same river twice*, writes Heraclitus⁹, for the water is constantly flowing and changing.

This concept is at the core of this installation's design, for it allows us to envision a continuously changing space-time that responds to the constant movements of the performers/spectators in space, which in turn, triggers a continuous change of the media stream in the environment.

Figure 1 shows the participants as they engage with the active environment, influencing the constant flow of projected particles, while simultaneously affecting the sound of the environment according to their movements in the space.

Inevitably, in an immersive space such as Einstein's Dream, the media effectiveness and its impact on the performer's decisions and experience might be suggestive or dictative. This issue was addressed by moving away from representational imagery and sound, and by staying away from linear and sequential media. The explorations and discoveries of the potentials of the environment, as well as the potentials of the change that is at the possession of the participant, are key elements in the co-creation of an event-experience that naturally arose from such activated space. Playing with the sand, which was furnished in the play area, was not only a symbolic reference to the concept of time and the passage of time, but also a play on the physical manifestation that contrasts and complements the projected media -herein the projected graphical particles-, and a medium that enabled the media to have a physical manifestation beyond flat projections, which we can see in Figure 1 as one of the participants throws sand in the air to capture the media in space.

This integration of the performer and the environment happened by embodying and/or engendering broader intentions by way of personae and interpersonal (inter-subjective) engagement. The genre of performance work could just as well be considered conceptually abstract, as it could resemble naturalism, and everyday life gestures in environments as such become charged artful gestures. That way we have the opportunity to support participant/co-performer engagement (with the performers or with the space in general) and give them also the chance to alternate and sometimes coincide, and evoke action among themselves and the media around them. In that way, everything is becoming a generative part of the broader aesthetic. It is from within this vein of inquiry that a more appropriate or situational dramaturgical methodology might arise.

Figure 2. Einstein's Dream, Shadows



In a paper for the ACM conference on Designing Interactive Systems, the authors stated that: by developing systems that support the creation of non pre-determined experiences, and that adapt to each individual's input nuances in an idiomatic and fulfilling manner, and by capturing and analyzing continuous data streams, we allow the performers to embody and manifest their broader intentions by way of personae and interpersonal (inter-subjective) engagement with the systems and each other¹⁰.

As seen in Figure 2, the performers' computational inverse shadows are endowed with agency. While performers move and explore the space, improvise, and play with the space and each other, their inverse shadows intuitively decide to detach from them and remain still in a specific space for a while and continue following them after arbitrary period of detachment, or even disappear.

This is a kind of non-linear agency that eventually leads to a media-rich environment that moves away from technologies of representation and simultaneously culminates the co-creation between the performer and the space. System and performers become a generative part of the broader aesthetics, and they evolve, manifest, and co-create at tandem as they progress in creating a common language.

3.2 *Orbital Resonance* (2014)

Nikolaos Chandolias, Margret Westby, Anne Goldenberg, Doug Van Nort,

In a recent workshop at the topological media lab on whole-body movement and real-time media, a computationally and physically enhanced space was created as an instrument to be used by the performers and the spectators.

Orbital Resonance follows current threads in open source projects (in software and movement creation) and the DIY (do-it-yourself) ethos, hacking and creating sensors to explore the performer's internal physiological data¹, and to develop new methods in the choreographic creation for sonic performative environments and technological designs that are informed by the body.

The environment was activated for all bodies present in the space, which was a mixed crowd of trained performers and active spectators. The mixture of light and architectural structures created a space that does not imply parity between spectators and performers, yet can distinguish discrete data streams and physiological signals and computes them separately before combining them into a universal output.

The process of creating technological apparatuses, and the choreographic choices in the performance, were not limited to reading and computing the performers' physiological data, but also to capturing and computing the movement and gestures of the participants' and translating this input to visual and sonic representations. The generated sonic environments were channelled through surface transducers under the floor and in surrounding speakers, and created an engaging sensorial experience for the audience.

Figure 3. *Orbital Resonance*, Light Followers

¹ The sensor data where recorded offline due to technical complications



Orbital Resonance is a 3-person choreographed performance that invites the audience to sit and move in the performance space rather than outside it. The performers, who are equipped with wireless microphones and offline sensors, start the performance with a breathing session and slowly move to sound improvisation and then to an improvised choreography of movement and sound. The voice qualities feed into the lights and change them accordingly, and a sonic spatialization system circulates the sounds in such a way that can be felt them through the ground (via transducers) and through platform fixtures that are placed in the space. Transforming from breath to heartbeats and as the movement evolves, spectator and performer seize to exist and become just co-creators. As seen in Figure 4, everybody is moving in coordination, informing the media and the movement at the same time.

Performers, programmers and spectators are actively co-creating the space experience by improvising with their bodies and voices. When a new body enters the space, it immediately becomes integrated in the general aesthetic and immediately starts adding to the collective creation of the environment.

Figure 4. Orbital Resonance, Improvising with Sound, Media and Spectators



3.3 Striped Bodies (2012)

Omar AL FALEH, Elizaveta Solomonova

Striped Bodies is a playful experimental media-rich interactive game that examines the correlation of movement, body, and space through setting simple performance rules for the participants to generate an aesthetic and interesting experience in space, and to allow for a conceptual study of bodies in space.

In this installation, the role of the body as an active agent in changing the environment, and a co-author of the experience, is amplified and studied to better inform the practices of designing responsive spaces for improvised and performative studies. The system uses non-representational abstract media that is mapped to the bodies of the participants. Steering away from representational media was a conscious decision to avoid any possible conflict with identity and bodily representation, and focus on visualization of abstract forces like movement and position.

While we will refer to this installation as an experiment, but we emphasize that it does not follow any scientific discourse as scientific experiments usually do, nor does it produce any concrete results. Instead, participants, who are mostly not trained in performance arts nor in summoning expressive body language, will engage in a responsive media narrative that follows a predefined set of rules which will be handed to them upon commencing the game, and they will be asked to verbalize their experience of space once they finish playing for further studying the experiences.

The game scene is a dark empty space surrounded by black curtains to ensure isolation from outside environmental conditions. The elimination of visible boundaries makes space look and feel infinite, and enhances the sense of intimacy to eliminate the social inhibitions of being watched. Invisible infrared lights flood the

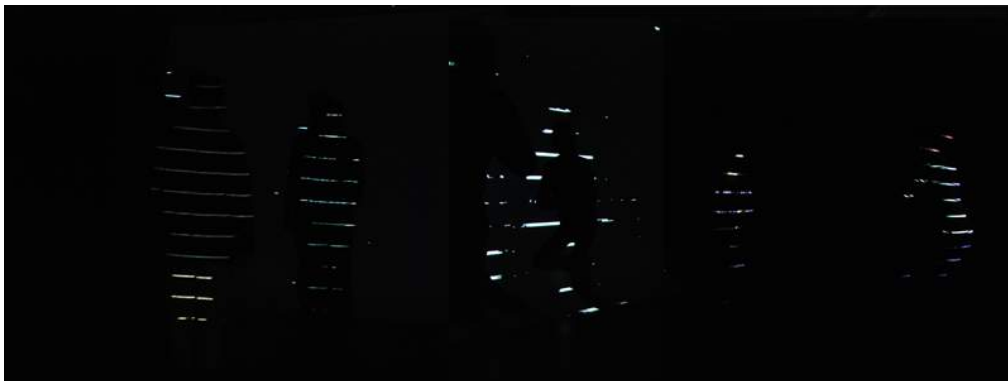
scene to facilitate gesture and movement tracking; an infrared camera and a high-definition projector are installed in the corner of the room to capture the movement and map the participants' bodies with the projected visual feedback.

Figure 5. Striped Bodies, striped projection on participants' bodies



High contrast black and white stripes are generated and projected on the participants' bodies, where the size and speed of the white portion of the stripes is proportional to the averaged movement in the scene, which is collected and computed by the infrared camera. Idle state of the participants generated zero-height white stripes, thus covering the bodies, and the space, in darkness. This allowed participants to play with the ability to see each other and to allow themselves to be seen, which is done by changing the intensity of their movement. The movement average is also mapped to a sound engine that changed its gain to reveal and hide ambient and active sounds, thus coupling visual perception with aural sensing. A background sound track played throughout the entire experiment, unchanged by any environmental factors.

Figure 6. Striped Bodies, participants in near idle state



Participants are split into teams of two, a leader and a follower, and are instructed upon entering the scene to follow the following set of rules:

- I. The leader assumes a pose and waits for the follower to imitate her.
- II. The leader is to change position only when the follower has successfully imitated her.

- III. A change of the background sound for the first time reverses the roles of the leader and follower
- IV. A change of the background sound for the second time is the cue for both participants to improvise movements independently

This leader-follower pattern created synchronized movement choreography with a small time delay between the performers, and generated focus on bodies rather than the representational projection of movement on the bodies.

The choice of black and white stripes as a visual mapping gives the scene a sense of regularity through repeated motion, and hides body details to make participants blend in the background, only to reveal themselves through the progression of continuous movement.

These conditions draw from the concepts of mobility and sight as main elements in constructing space, where idle bodies disappear in darkness, and movement enables sight, thus building the common space between the participants.

At the end of the experience, participants were asked to fill out a short questionnaire consisting of open-ended response items. They were asked to first close their eyes and focus on the question at hand (their perception of space, of the other participant, of the movements that they performed, etc.), and then attempt at verbalizing the best they could how the experience felt, as opposed to simply describing what it was.

This method was inspired by work of Claire Petitmengin on the phenomenology of lived experience¹¹, as well as by Eugene Gendlin's¹² work on experiencing and focusing techniques. Both approaches advocate for dropping the more explicit descriptions of the obvious, in favor of studying the source of experiential subjectivity by isolating and focusing on how an event felt. Getting in touch with the felt dimension of an experience undoubtedly requires a certain degree of training, willingness and concentration.

Synthesizing the answers from different participants showed a very interesting link between movement and sound. Most participants wouldn't go in details about describing the space in its physical manifestation, rather focused on the other body in front of them, and the effect of the mirrored movement in their perception of the body of the other as a reflection, or an extension, of their own.

The participants in our experiment game were random selection from undergraduate students in the Computation Arts department at Concordia University, which implied a level of understanding of responsive media and the behavior of responsive systems, and a certain level of curiosity. Participants knew each other to varying degrees through their classes, which also provided a corresponding level of comfort in improvising and performing in front of each other. It was observed that those who were more familiar with each other performed in a more relaxed way and felt more freedom in exploring the space in the third improvisational stage of the experiment.

4. CONCLUSION

The above installations are a selected few from a repertoire of experiments that were conducted in the Topological Media Lab, and that that examine concepts of performance, agency, space, and the changing roles of spectatorship in responsive media environments. Some of these installations take the form of complete and finished performances, and some are experiments that remain in an unfinished state

on an aesthetic and choreographed level, but functions as a milestone in the process of investigating the evolution of the different roles that can be assumed by participants in responsive media-rich performance environments.

The essence of this research stems from the belief that the novelty and capabilities that are available to us when we design interactive performances should not imply the birth of a novel form of art. We introduced a few examples in the theoretical background of this paper that demonstrate our firm belief that using technology in the process of artistic production is to be regarded as a tool to enrich and develop on an already existing rich history of artistic practices and theories that date back to the early 20th century, and sometimes even before. The ability of technology to enhance the consciousness of one's self and one's body, and to mediate change in the environment that can alter the perception of presence and embodiment, without physically deforming spaces, provides us with great tools to use in our artistic and academic investigation into the possible futures of current art forms.

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