Playtime for Punctum

Augmented Role-Play

by

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Abstract

Using a technology stack - stereoscopic camera, hand tracking, and VR - a combination of live video feed and virtual elements are integrated into a mixed reality experience featuring a player and a performer. The mix of live video with virtual augmentation allows access to expressive capabilities sharing affordances with games, performance, and role-playing. The production, called *Playtime for Punctum,* was realized by applying a research-creation methodology inspired by theatrical devising techniques, particularly improvisation, alongside conventional creative practices. The process was documented with an eye to the shifting roles required by the researcher, and the affordance of this augmented role-play format was explored, documented and analyzed in order to highlight insights that may be useful for future creators in related fields.

Acknowledgements

This research was carried out on land that is the traditional territory of many nations including the Mississaugas of the Credit, the Anishinaabe, the Chippewa, the Haudenosaunee and the Wendat people and is now home to many diverse First Nations, Inuit and Métis peoples.

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Chapter 1: Introduction

In my work as a theatre director I trained in and used collective creation, a devised theatre methodology characterised by improvisation around a theme until a production is distilled. In my work as a designer of escape games, I discovered and was excited by the experiential phenomenon of allowing oneself to become part of a fiction, and forget, for a time, that the real world exists. The things that interested me defied easy definition: there is no singular accepted structure of collectively making a piece of theatre, and there is no accepted phenomenology for what happens to a participant in an immersive experience. When this research started, the plan was to create a clear structural framework for adapting collective creation to the field of creative technology. I now realise that the attempt to formalise the ineffable process of creating through play was antithetical to how and why I create. This research helped me to articulate a rejection of structured, manageable, quantifiable, creation processes. There is wisdom in emotion; there are insights to be found in joy.

Augmented Role-Play

I desire to create a performance environment that includes the audience as an active participant in the creation of the fiction. I want to remove boundaries between the performance and the audience, and allow them to interface with the performance with a minimum of tech literacy. My goal is a state of liveness in the audience that engages them not only as a viewer but as a character in a way that affords nuanced, sophisticated responses by the system to the decisions of the audience.

I have done this by combining theatre traditions that rely on an active audience with some best practices from video and escape games to assert an experience that places the audience bodily at the centre. By assembling a technology stack that includes body tracking and passthrough augmented reality (AR) I am able to position the performance in tandem with player senses, and to use their motions and gestures to capture and react to their decisions. Furthermore, by allowing an improvisational flexibility in the performer's spoken lines and the structure of the technological components of the experience, I am able to afford an experience that is generous and generative, flexible and permeable, unique based on the participant's choices, both social and structural.

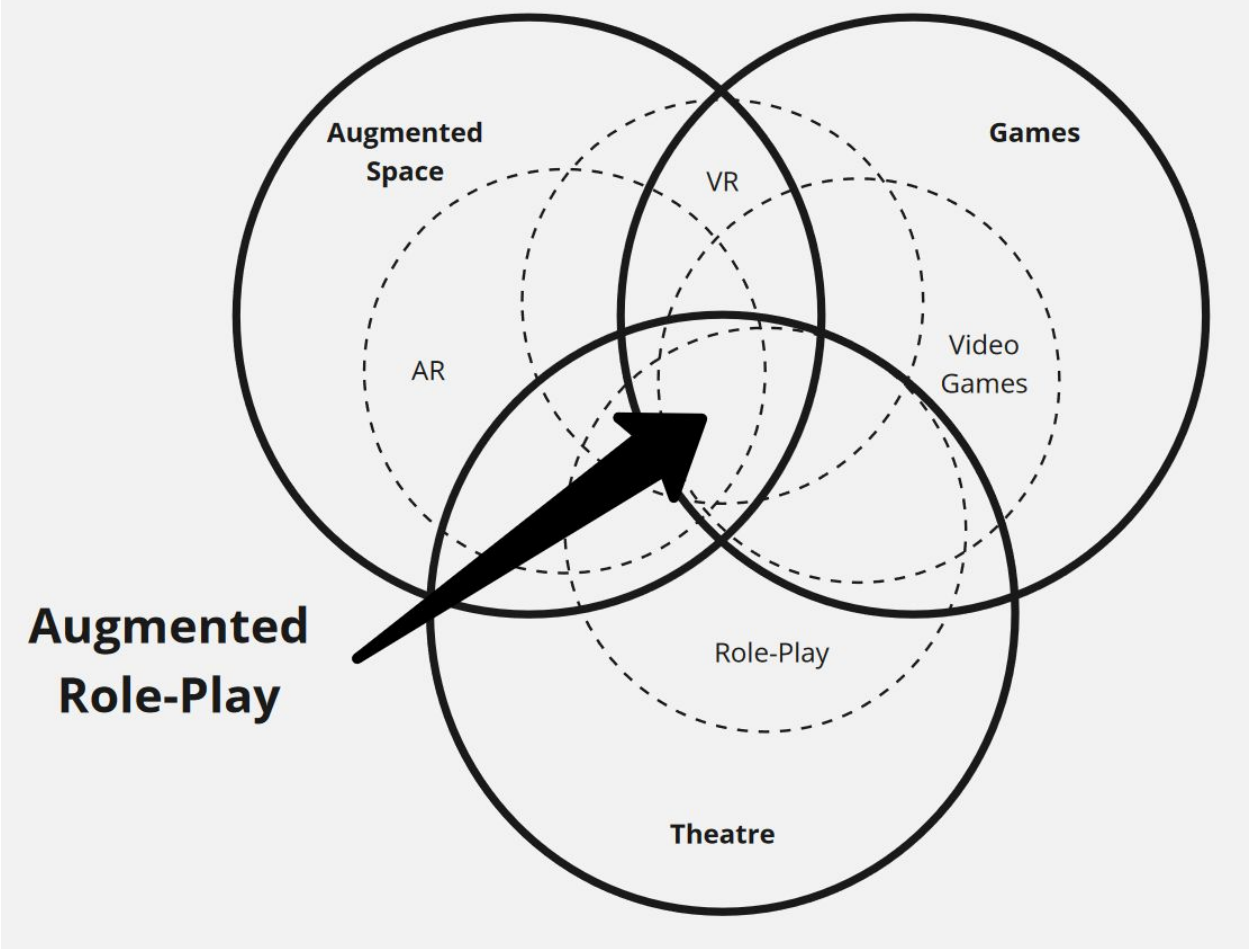

Figure 1: The overlap of disciplines where augmented role-play is situated

The term augmented role-play, one I have created for the purposes of this research, describes the format that emerged from this project. It is situated at the overlap of game, theatre, and mixed reality (MR) (Figure 1), and describes an experience that places the audience at the centre of a digitally-augmented narrative experience that exists in both real and virtual space. It is a participatory performance, involving (in this particular intervention) one player and one performer. The player is able, through a technology stack including stereoscopic passthrough video and body tracking, to interact with the virtual elements of the performance with their body, unimpeded by hardware or wearable interfaces. This creates a context for a player to inhabit the experience and effect a large measure of agency on the performance in subtle ways, with a minimum of onboarding and tutorializing. The term "augmented role-play" was chosen to differentiate the role of the player from that in a conventional game or roleplay scenario: the term "play" is highlighted in order to underscore the unstructured, joyful,

improvisational play asked of the player, and paired with "role" to accentuate the social performance aspects of the experience, as well as indicate that some role-playing is expected (see Performance).

In notes and documentation the term "player" became the word used most often to refer to the audience-participant since thinking of them as a player rather than an audience member, user, participant etc helped to clarify what kind of behavior was expected and how to design for them. That practice has continued into this research paper, and the term "player" is present throughout. The term "player" is used in this paper synonymously with "audience-participant", and also because thinking of the participant as a player clarifies their role in the experience. I have included a glossary (Appendix A) to clarify key terms and their meanings in the context of this research.

Playtime for Punctum

The augmented role-play production produced as part of this thesis, entitled *Playtime for Punctum*, is an installation that features the story of a reunion between a young adult and their childhood imaginary friend. The young adult, portrayed by a non-player performer, is packing up their childhood room as they prepare for a move. While packing, they discover some objects that remind them of their imaginary friend, named Punctum (a word borrowed from Roland Barthes' *Camera Lucida*, referring to a photograph's detail that wounds the viewer by establishing a relationship between them and the subject), embodied by the player. They are reminded of the games that they and Punctum used to play, and asks that the player play these games with them again in order to reconnect with their childhood self.

Methodology

Taking inspiration from prior theatre and escape game design practice combined with collective creation and research-by-design techniques, and melding best practices from game design and theatre development, a research-creation methodology characterised by game sketching and play-based user research interventions was applied. Taken as a whole, the intervention is broadly framed as creation-as-research (Chapman & Sawchuk, 19), but the nature of the research shifted along with the nature of my role. Early experiments with candidate technologies can be framed as research-for-creation (15), which informed mixed

reality game sketches, which were then used as the foundation for theatre-inspired workshops. At this point the research can be framed as research-from-creation (16), as play-based experimentation with the sketches by the participants, many of whom were experienced theatre improvisers, led to insights that guided the creation of the final product.

Goal

This research intervention is two-pronged. The first key outcome is the product: the definition and deployment of an interactive installation using AR and a performer, articulated as augmented role-play. The second is a reflection on the research-creation methodology, and an analysis of how the insights that arise might be applied to further design interventions and other disciplines.

Research Questions

- How might the discoveries made through this research-creation process be applied to other design interventions?
- What are the affordances of augmented role-play and how might they be explored?

Chapter Overview

Chapter 1 has been an introduction to the augmented role-play format and a brief discussion of the research creation methodology that has guided this process. Chapter 2 is a review of the context of mixed reality and play-based performance practice and a discussion of related work. Chapter 3 is a process journal detailing the design and deployment of the research, including the development of the installation. Chapter 4 is a summary and analysis of *Playtime for Punctum.* Chapter 5 is a discussion of the reflections and conclusions drawn from the study of this process.

Chapter 2: Context Review

Play

The nature of play has been analyzed by thinkers like Johannes Huizinga, who articulated it as unproductive, unserious activity, without profit or material value, proceeding according to its own rules (Huizinga). Roger Callois went on to locate play on a continuum ranging from *paidia* to *ludus*. Ludus refers to the structure that governs the environment of play - the rules - while paidia refers to spontaneous play, analogous to the unstructured rampaging of a child on a playground (Hendricks, 177). "Games without paidia seem ultimately sterile, formulaic settings in which players quickly lose interest; but games without sufficient ludic elements also lack appeal in that they do not lead the player toward increasingly sophisticated challenges or permit complex social interaction" (Ibid). Callois articulated paidia as "joy in free improvisation, which derived from a desire for freedom" (Kwastek, 81).

A goal of the augmented role-play is to afford a unique set of events and outcomes based on what a player can bring to the experience, both physically through interactions and emotionally through their engagement and embodiment in their own performance. In other words, to use the technology stack to afford a form of structured narrative play. "Play does not have a predictable course or outcome and is based on inner infititude. It is based on rules, and it resides in an artificial realm" (Kwastek, 75). Augmented role-play is an attempt to engage with play, especially paidic play, as it explores a form of interactive digital narrative that is based largely on free improvisation within a minimal structure, minimally governed by rules, or ludus. It occupies a precarious position on the continuum between ludus and paidia; it is necessarily structured, governed by the rules of the computer system, but possessed of the potential for paidic play due to the inclusion of a human performer and the nuanced potential of the social interaction elements.

Interactivity

Conventionally, when interactivity is considered in a theatrical context, an audience is invited to interact with performance through participation. An example highlighted by Janet Murray in her seminal work *Hamlet on the Holodeck* is the scene in *Peter Pan* (1904) in which the audience is invited to clap along in order to save Tinkerbell. This interaction, however, is devoid of agency for the audience. Should they make the collective choice to not clap the play would grind to a halt, as there is no provision in the production for any other outcome. "When audience members are included in the story, they serve only as the butt of a joke" says Murray. "The slender story is designed to unfold in the same way no matter what individual audience members may do to join the fun" (Murray 160). This is an example of a story that will unfold in the same way regardless of external input (in a "non-ergodic" manner). Of course, a lot of time has passed since the turn of the twentieth century, and the relationship of the audience to theatre has changed, especially outside conventional contexts.

Case Study: Sleep No More

Sleep No More (Punchdrunk, 2011) sits as the gold standard in participatory theatrical immersive experience, name-checked in every conversation with experts made as part of this research (see Expert Interviews). Every aspect of the performance and space is carefully curated and controlled. Participants are encouraged to explore every detail and never know what to expect, as individual participants might be taken into secret passages or given secret tasks at a moment's notice.

With its open-ended structure that allows a participant to experience what the show has to offer in any order or arrangement, *Sleep No More* is an example of a production that asks its participants to be constantly embodied within the fiction while navigating it. The narrative of the production is intentionally unclear and meaning is made by the participants, in relation to what they choose to experience and how they experience it. The space itself serves as an interface: choices presented to a player include where to go, who to follow, and even what furniture and set objects to peruse.

Active audience theatre, possessed of active co-presence of audience and performer, of the sort that occurs in *Sleep No More*, is possible because of the phenomenon of *liveness*. Josephine Machon, a scholar of immersive theatre, articulates liveness as being a necessary part of active theatre.

> *Whatever forms the imaginative journey through the event takes - via fusions of scenographic design, sound, digital technologies, physical performances and interactive audience participants - what is clear is that the sensual worlds created exploit the power of live performance. Immersive practice harnesses the lasting ephemerality of performance… by 'lasting ephemerality' I am highlighting a paradoxical experience that the work can offer in that the live performance of the work is fleeting and only of the moment, never to be repeated in any form, yet it also lasts in the receiver's embodied memory of the event, a pleasurable and/or disquieting impression that remains.* (Machon 44)

A theatre performance possessed of liveness is unique to the moment, never quite the same no matter how often it is staged, but is captured through the participant's experience and memory of it. Liveness, then, is a form of interactivity, allowing that every performance is affected by the presence of the audience.

Interactivity is distinct from *agency*. Murray summarizes the difference thusly: "In a tabletop game of chance, players may be kept very busy spinning dials, moving game pieces, and exchanging money, but they may not have any true agency. The players' actions have effect, but the actions are not chosen and the effects are not related to the players' intentions" (Murray 161). "Agency, then, goes beyond participation and activity" (162). Within the context of interactive narrative, agency is the difference between having a story told to you and making your own story through meaningful choices and immersion. Murray describes *immersion* as the "pleasurable surrender of the mind to an imaginative world" and the suspension of critical faculty along with the simultaneous exercising of creative faculty. "We do not so much as suspend disbelief so much as we actively create belief" (136). "A participatory environment can engender the kind of phenomenon of play as when we were children playing with toys, wherein we, the players, endow objects and environments with life" (138). To Murray, interactivity is a creative act.

Murray identifies that there is a discomfort inherent in participating in a narrative without being aware of the boundaries (148) and suggests that limitations be built in the form of mechanics and interface, forming a "smart costume" (144) that serves as a guide rather than an explicit limitation to interaction. Marie-Laure Ryan imagines digital narrative interactions without such limitations or discomfort. She describes Murray's titular Holodeck (a system that can generate synthetic matter and react seamlessly to any user input, usually used for entertainment in *Star Trek: The Next Generation*) as the holy grail of storytelling (Ryan 44), as it exemplifies an experience in which the participant is wholly integrated in the narrative. In the Holodeck, choices made by the player are unconstrained and the system is powerful enough to react to them in natural ways.

Until computational limits can be overcome, interactive narrative design must exist at a point of tension between narrativity and interactivity. Consider, as an example, a piece of hypertext fiction. A designer must create every line of dialogue and every potential narrative arc — a considerable investment of time and effort — but the narrative experienced by a player can be controlled to the letter. The player is offered the choice between several options, which in turn leads to new pages of narrative and new options. Player interactivity is limited to the strict paths created by the designer. A game like *The Sims* (Maxis), very different from a hypertext fiction game, contains no structured narrative. Any story gleaned by a player of *The Sims* is derived via their own interpretation - which means there is no distinct story or narrative arc to be experienced. The potential for interactivity in *The Sims* is nearly endless. It offers the player a multiplicity of choices - which furniture to buy, where to place it, which characters to visit, what their Sims can do as a hobby - and thus offers innumerable outcomes and play states. Until we achieve the computational power necessary to deploy the mythical Holodeck, experiences must tend to lean toward either interactive or narrative, being interactive with narrative or narrative with interactivity.

In *Interactive Digital Narrative*, Hartmut Koenitz addresses the difficulty in analyzing nonlinear interactive narratives via the metrics used in examining traditional arc-driven narratives. Conventional narrative analysis is focused on narrative output which, in a narrative devised by an author and codified through the act of writing, is fixed. Output in a digital narrative, presented with the assistance of computer software and discovered through interactions, may

tend to generate outputs that are not necessarily conducive to a robust analysis of the experience using conventional means: "…traditional narratology has little to say about digital procedurality" (Koenitz 96). Koenitz proposes a model for Interactive Digital Narrative (IDN) involving recognizing the role of system and process in instantiating a narrative as a participatory process. IDN conceptualizes narrative design as a web that must be traversed by a player in order to instantiate a narrative. The elements of that narrative design are influenced by the Environment (the physics of the virtual space), the Assets (the graphics and story elements) and the Settings (user-derived decisions about the program, including user interface (UI) elements and save/restore options).

Koenitz is particular about his definition of a system - in his case, he is referring to the "digital artefact… the sum of what the IDN system contains" (98) - but the conception of the instantiation of digital narrative might be applied to a system of research-creation.

> *Once a user starts to engage with the system, a process is created that is defined by the opportunities the system provides and shaped by the user's actions. The resulting product of interactive digital narrative - a single walkthrough - represents an instantiated narrative. Given the participatory process and the procedural nature of IDN, very different narrative products can originate from the same system. (Ibid)*

IDN might be applied when opportunities for paidic play are kept low by the medium; it serves to analyze experiences that are highly structured and necessarily limited. IDN was the inspiration for the structure of the workshop that kicked off the exploratory play-based workshop process, adapted in order to design and analyse paidic play within the highly structured and limited space of digital narrative.

Performance

Collective creation practices served as the inspiration for and foundation of the research-creation process. Collective creation is a form of communal playmaking originating in the late 1960s, originally attributed to artistic director Paul Thompson of Theatre Passe Muraille, that arose as a response to disenchantment with the highly commercial theatre scene of the time combined with a desire to carve out a creative identity for Canadian theatre distinct

from the entrenched British and American tradition and the over-general regional theatre (Bessai, 71). It is a community-oriented process of creating theatre characterised by theatrical play, exploring theme and action until insights highlighted and of interest to the team lead to the foundation of a production. My artistic practice as a director and playwright, prior to embarking on this research, has been situated in the theatrical tradition of collective creation. The natural starting point for the process of developing augmented role-play, then, was to use collective creation as an inspiration. Collective creation is a means for a team of performers to devise a performance that is resonant among all of them, without relying on prohibitive conventional creation processes. The needs of a team of performers that want to devise work from scratch to use collective creation are analogous to the needs that led to the development of augmented role-play: not only does no clear tradition of creating participatory performance augmented by VR and body tracking technology exist, but there are few analogous artworks to adapt or contrast the production with. The resources to source the specialized talent to fill out the roles a conventional production pipeline might require are absent.

The nature of performance itself is interrogated by Katja Kwastek, who describes it as a term that denotes public-facing presentations of the exceptional, separate from normal life, and possessed of a high quality (Kwastek, 82). Performance, to Kwastek, has a lot in common with play: it occurs in comparison with an idealized, remembered model of itself (see Augmented Space) and is often a type of play addressed to an audience (Ibid). Interactive art asks the audience-participant to take on the role of an actor when engaging with it. "[the audience-participant] can be guided into a fictitious role and can either seek to fill it or distance himself from it" (84). The augmented role-play interrogates this relationship of the player to the artwork, asking them to acknowledge their role as actor and engage in play, which is itself the act that makes the performance.

Case Study: Osmose

> Char Davies' *Osmose* (1995) was an installation consisting of a head-mounted VR display and real-time motion tracking of the player's breathing and balance. Players used their breath to navigate through and between large world spaces, exploring the relationship between their body and the space. Players reported a transition in their motivation from a desire for action and reward to a sense of

contemplation: "Being supercedes doing" (Davies). Furthermore, the motions of the player became a sort of performance, as their gestures were projected as silhouette to an audience. Osmose is an early example of an augmented role-play, as it highlights the liveness of the experience while challenging what we know of interface - in this case, the natural act of breathing becomes the vector by which the experience is navigated.

Case Study: Draw Me Close

Draw Me Close (Jordan Tannahill, 2017) is a VR performance in which the single audience member is given a role, and asked to share the virtual space with a performer whose movements are tracked by motion capture technology. It shares many structural and philosophical similarities to *Playtime for Punctum*: a technology stack (in this case, Optitrack for motion capture, Unity for VR, and Vive for interface) tracks a performer's body and situates that performance and the participant in a virtual reality. Interestingly, like *Playtime for Punctum*, the production is thematically concerned with questions arising from reflecting on childhood and on relationships with absent family. Unlike *Playtime for Punctum* the participant is comparatively passive; while they have a role, they have little agency. The experience has moments that offer opportunities for performance-play by the participant, but is content to exist as a conventional theatre intervention characterised by moments of theatrical magic facilitated by the technology stack.

Sociologist Erving Goffman suggests that everyone is an actor at all times, taking on roles and putting up fronts based on the role's perceived value to society (Goffman, 23). He suggests that the presentation of role is key to social mobility, and that one's ability to play a role informs how one will be treated. While a sociological analysis of role theory is not in the scope of this research, the importance of roles and role-playing is central to it. Goffman articulates this experience as undertaking a performance, and conceives of the role-player as a performer, going so far as to suggest that there are interactions that occur on-and-off a "stage" (77). The relationship between role and performance has been identified and explored through games, most clearly articulated in the revelation of role-playing games as a format. These games, such

as the classic *Dungeons & Dragons* (1977), offer a way of safely engaging with and exploring the performance aspects of social conventions, practicing roles in low-consequence environments (Bowman, 137).

Role-playing as a gaming tradition shares a cultural heritage with improvisational theatre, and is a type of performance undertaken for the sake of an audience consisting of other role-playing performers. It is a highly personal performance between all players who are equal agents in the creation of shared fiction (Konzack). Augmented role-play is an opportunity to engage in an improvisational role-play in yet another context: rather than being equal agents in the generation of the experience, a single player is afforded the opportunity to undertake a roleplaying performance wherein there is no expectation of sharing with other players.

Role-playing also has an identified value in the design process, for example, as part of user research interventions. Designer Thomas Erickson is concerned with the informal, practical methods designers use to engage with issues. He lists teambuilding, involving users, collaborative design, design transfer, and design evangelism. To him the design process is one of communication among audiences. He discusses stories and their use as design tools and describes them as concrete accounts of particular people and events in particular situations, not scenarios. He gives the example of the "stress pile" story, in which a pile of papers on his desk echoes his own experience of stress at that moment. Stories are atypical, unlike scenarios, but are exceptional. Stories reveal what people think about their work: what they like and dislike, and what are the real problems. In each listed instance of communication stories are traded, shared language developed, and common referents discovered. The research process of this thesis, undertaken through a series of workshops, involved improvising simple stories generated by prompts drawn from the affordances of hardware. These stories were used, as Erickson suggests, as catalysts for design, as they captured recurring scenarios, anxieties, and themes inherent in the technology, at a high level of detail, grounded in experience rather than conjecture.

Finally, the nature of the artist's shifting role is a consideration that arises when analysing the creation of interactive performance.

> *In the analysis of classical stage plays, theater studies differentiate between drama or theater text, mise-en-scene, and performance*

> *in the narrower sense of a one-off event lasting from the moment the audience arrives until the discussion of the performance afterwards. This corresponds to a differentiation of four different actors: the author, who elaborates the concept of a work and records it in a text; the director, who stages the work; the actor, who realizes it; and the spectator, who receives it. The same differentiation applies to musical performances, which are brought into existence by a composer, a conductor, a musician, and a listener, although in this type of performance the conductor and the musician are active at the same time. However, what applies to theater plays and musical symphonies doesn't apply to all types of performances. In performance art, the author, the director, and the actor are often the same person, as are the composer, the conductor, and the musician in musical improvisation.* (Kwastek, 83-84)

This research-creation process was heavily influenced by role-shifting made necessary by the nature of developing the performance elements in parallel with the technological ones (see Research Process Journal)

Augmented Space

In *The Actual and the Virtual*, Deleuze articulates the difference between virtuality and actuality being one of optics: actual objects pass into virtuality when they are processed by our eyes and become ephemeral preservations of the past. The meaning of the virtual exists by virtue of its relationship to the actual it is associated with: "virtuals communicate directly over the top of the actuals which separate them" (Deleuze, 151). In *The Poetics of Augmented Space* Lev Manovich raises the issue of meaning-making made through the context of virtual information overlaid on architecture. He points out that this "layering of dynamic and contextual data over physical space" is nothing new: artists and architects have been engaging with augmented space since before the term existed (Manovich, 12). He follows this thread by describing the trajectory of art as expanding dimensionally, from 2D art hung on a wall, to the use of the gallery as a 3D installation, and "if we follow this logic, augmented space can be thought of as the next step in the trajectory" (15).

Augmented space holds the potential for making unique new meanings in the juxtaposition of information with architecture, and the exploration of the relationships between the augmentation and the real. Manovich suggests that architecture and the immaterial architecture of information are situated together in physical structures, and that the design of augmented space be "approached as an architectural problem… consider the 'invisible' space of electronic data flows as substance rather than just as void" (28). Boris Groys points out that, when presented with artworks that involve generative code, "the viewer's imagination is stimulated to imagine the generative code, to imagine all the variations that can be generated by the code. Such an attempt, however, immediately points the viewer in the direction of the invisible set of rules on which the different variations are based" (Groys, 142-143). An augmented architecture may tend to address Groys' critique by situating these rules in a familiar spatial context, and open up possibilities of generative meaning-making by considering the code in relation to actual space.

Jacob Wamberg argues that augmented reality represents an opportunity to revitalize the index as a means of communication, and "reactualizes certain layers of communication in nature" (Wamberg, 465). Indexes in augmented reality are empowered with physical influence, says Wamberg, which is distinct from the passive index of signs "pointing toward things". Pre-1900s icons were produced by people and disconnected from objects and were abstracted from the physical environment. "The index was always an imprint of the bodily limb or instrument that made the sign rather than of any extracorporeal or extrainstrumental object" (466). When photography and audio recording became available, suddenly these new media were physically imprinted by things they represented. As technology advanced, the ability to capture physicality increased, and so did the sophistication of the indexicality involved. When we reach the sophistication of a gesture-based augmented reality interface where this research is situated, Wamberg points out, "mere gestures turn into actions, such as when, for instance, a lowered hand can dim the lights" (469). The indexicality present when space is augmented and gesture activated as a means of interface is at once a return to pre-modern indexing - a human-produced, disconnected signifier - and also mediated by computer.

Chapter 3: Research Process

Research-Creation

As a director and practitioner of theatrical collective creation, a technique characterized by improvisation, I found myself resistant to assigning structured methodologies to the research. My natural inclination as a creative artist has always been to explore through play and trust that emotion and intuition will guide development. Attempts to apply frameworks such as research-by-design (Roggema) were unsuccessful, as I found it unnatural to work with such structured methodological constraints. It was only as the research had coalesced and reflection was possible that it became clear that I had, without completely understanding that I had done so, applied a research-creation methodology.

Chapman and Sawchuck highlight the value of research-creation as a "methodological and epistemological challenge to the argumentative form(s) that have typified much of academic scholarship" (Chapman & Sawchuk, 6). Performance studies scholar Dwight Conquergood suggests that there are "nonserious ways of knowing that dominant culture neglects, excludes, represses, or simply fails to recognize" (Conquergood, 146); insights that cannot be captured in text form tend to be ignored by academic communities that, accord to Conquergood, grant more weight to ways of knowing that can be captured in text form. Conquergood's example is the separation of thinkers in a hypothetical academic community: the creative artists of the Department of Fine Arts from the scholars in the Department of Art History. Conquergood's conception of what performance studies brings to epistemology can be summarized as analysis "braiding together disparate and stratified ways of knowing" (152). It is counterproductive, argues Conquergood, to segregate artists and performers from people who think about art and performance. It is "pedagogically powerful" (143) to utilize performance, including improvisation, as a means of knowing and exploring ways of knowing.

Both Conquergood and Chapman & Sawchuk allow that "the role of "intuition and 'feeling'" (Chapman & Sawchuk, 12) bears scrutiny that other academic methodologies overlook. It was this perspective that drove the research process: the intuition that identified the most

interesting, exciting, fun-to-play-with aspect of each stage of research (be it game sketch, workshop insight, script, or prototype) drove the emergence of the next iteration. It was only late in the process that enough distance from the emotion existed that critical reflection could be done. "It is only through working theoretically and artistically, or creatively, with their research topics", write Chapman & Sawchuk, "that [the artists] become invested and engaged in a process that is right for them" (Ibid).

This insight was deeply resonant. The research had begun with the dual-intention of devising a technologically-enhanced performance with collective creation techniques and implementing a framework for expanding accessibility of performance-capable technology, but the nature of the research was in such constant flux that these goals had to be abandoned. Collective creation had been inspiring the process, but collective creation had not been followed. The focus on developing a performance took focus away from research into technological accessibility, and that goal was pared away. The decisions to abandon these elements of the research were not made lightly, but they were made largely through intuition that they were the wrong direction to take, and the intuition that other, less well formed, directions were more emotionally exciting.

Chapman and Sawchuk, as they attempt to unpack research-creation, are hesitant to offer a clear definition: "research-creation is not a fixed methodological approach. It refers to an important variety of different possibilities" (14). They offer four subcategories to serve as definitions for ways of inquiry, three of which are closely relevant to this research. *Research-for-creation* is "creation that is pursued as a type of research in and of itself, involves an initial gather together of material, ideas, concepts, collaborators, technologies, et cetera, in order to begin" (15). *Research-from-creation* is characterized by using art in order to "generate information on user-responses to help build the project in question, as well as future initiatives" (16). *Creation-as-research* "involves the elaboration of projects where creation is required in order for research to emerge. It is about investigating the relationship between technology, gathering and revealing through creation, while also seeking to extract knowledge from the process" (19).

This research intervention as a whole is situated in creation-as-research, as it was only once the creative production culminated that research insights emerged. Looking at the research as a

whole allows the relationships between technology, creative techniques, and disciplinary practice to be analyzed in a way that was not possible in the moment. However, due to the fluctuating and experimental nature of the research-creation process, research-from-creation and research-for-creation are also applicable at different stages in the process (see Figure 2). As the needs of the production shifted, my role as researcher and artist also shifted (see Shifting Roles), and this shift also characterized a shift in the nature of research-creation that was being done.

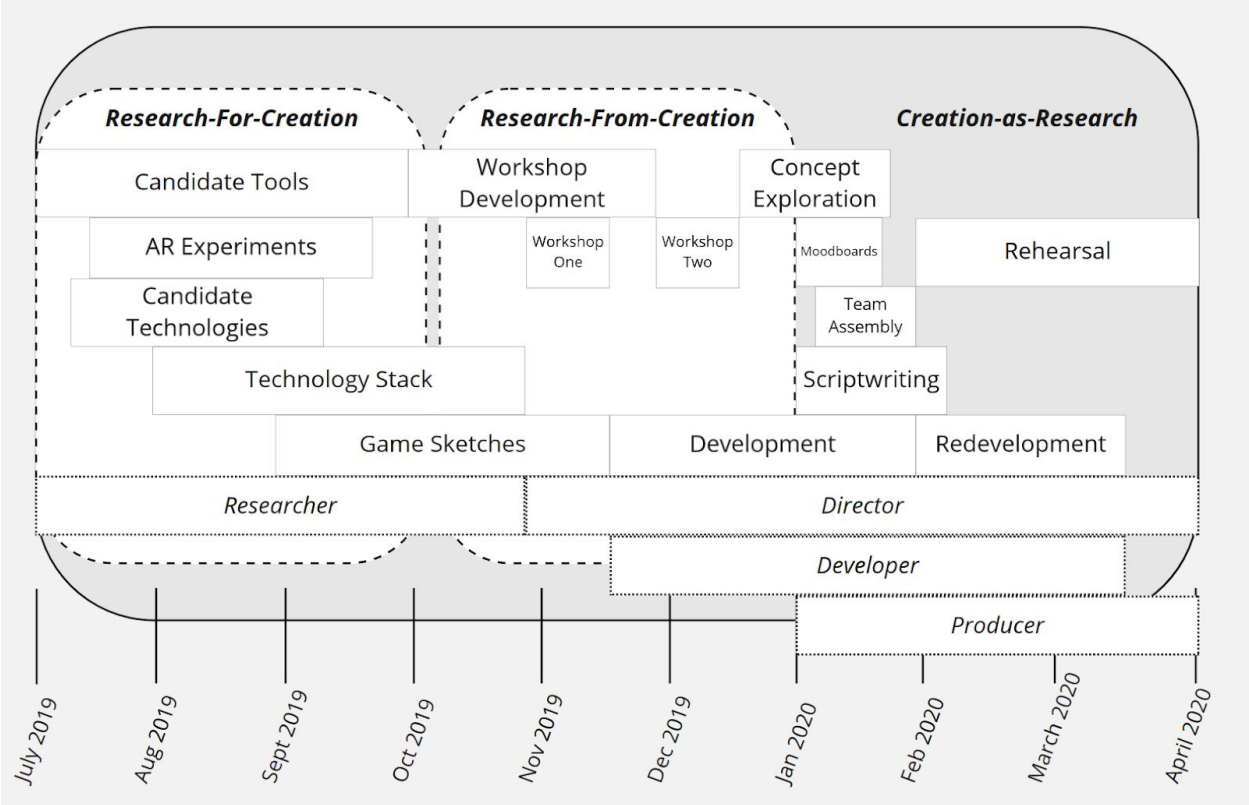

Figure 2: Research-creation process visualized

The earliest stages of the research were spent under the auspices of research-for-creation. From the core desire of the research - to create an interaction placing the participant bodily and psychologically inside a fiction, unmediated by screen or physical interface - the gathering of and experimentation with candidate technologies began. This period was characterized by research into documentation, experiments with different tools, and game sketches. My role at this time was that of researcher.

After this stage emerged a period in which the research was situated in a research-from-creation context. Armed with the technology stack and game sketches, I devised a theatre-inspired improvisation workshop (see Workshop Process Journal). This was a period of design relying on user-responses to guide future development: insights highlighted by this phase helped me, to paraphrase Chapman and Sawchuk, to push the limits of the technology and develop paths of exploration and experimentation that led to the development of new research questions (17). My role during this time was that of director and developer.

With the affordances of the technology and the insights gleaned from the workshops - which were largely based on the emotional response and intuitions of the participant performers, as well as my own creative impulses - the late stage of development emerged. This phase had the most in common with conventional design methods native to the disciplines of theatre and game design, as it was a period in which the production's script was written, the foundational code developed, the team assembled, and rehearsal embarked on. This phase is situated in a creation-as-research frame. It was here that the technology and code evolved from sketch to prototype, and it was here that deep engagement with questions of theory and the intersection of technology, medium, and practice could be effectively explored. It is also from here that the prior research could be effectively reflected upon. At this time my role was that of producer, as well as developer and director.

Research Process Journal

Candidate Tools

The origins of this research, and the early experiments that informed its final form, occurred in the summer of 2019 as an independent study exploring the phenomenon of immersion before thesis research had officially begun. A series of experiments with mobile-based augmented reality narrative design suggested to me that screen-based AR was insufficient to explore the issues and experiences I was interested in approaching.

My first explorations were concerned with interactive storytelling embedded in actual objects. My goal was to reduce the distance between narrative and player. I undertook an independent study over the summer of 2019, situated as a study of immersion. I looked at immersive

technologies starting with the panorama and the stereoscope, up to today's immersive technologies such as video games and virtual reality. While doing this research, I began experimenting with AR. I had intended only to dabble in mixed reality, intending to realize a puzzle in AR as part of the summative project. I first used EyeJack, an accessible tool for quickly making AR experiences using images and animation. EyeJack was all I thought I'd be using, and that I'd quickly move on to another tool.

Eyejack was not sophisticated enough to create a specific augmented interaction I had in mind, so I moved to Vuforia on Unity, a game engine I had some experience with. My experiments using Vuforia got me interested in AR: I found Vuforia more flexible than EyeJack, able to achieve more sophisticated effects since it was a development platform rather than a product. The exploration of augmented reality technology became the focus of the independent study, and afforded me the chance to hone the development skills I would eventually call on to create *Playtime for Punctum.*

Figure 3: This Book Belongs to Lucas

The first meaningful project completed with Vuforia was a prototype completed as part of the CFC Media Lab summer retreat, an experience called *This Book Belongs to Lucas* (see Figure 3). The prototype was an exploration using Vuforia and volumetric video, and it taught me that Vuforia and phone-based AR applications were not media I wanted to pursue to create the kind of work I wanted to do. I found the phone far too limiting as an interface; technological

considerations made it difficult to deploy to users, and the need to focus on the phone screen meant that users would tend to not pay much attention to the physical objects that were part of the experience - glued to their phones, they would scan the object for AR hotspots but not engage with the plot or find themselves immersed in any meaningful way.

I began to look elsewhere for mixed reality storytelling opportunities. I played with SparkAR, but as it is locked into Facebook's ecosystem it is not appropriate for storytelling. ARCore and ARToolKit were both very code heavy, and since I already knew a bit of Unity I found Vuforia the most intuitive. However, due to Vuforia being based on image targeting, augmentations would need to be based on legible images in actual space (see Figure 4)

Figure 4: AR Window using Vuforia on Android. Left is the augmentation seen on a phone screen; right is the target image without augmentation.

All of these were phone-based, and after the CFC prototype I was interested in delivering in a mixed reality context to a participant without the constraints of the mobile phone. I began to look for a way to achieve mixed reality that surrounds the body.

Candidate Technologies

I looked around my contacts for the leading MR headsets available - Hololens and Magic Leap. I had used a Hololens 1 as part of research for a project at a former workplace and found it lacking - the augmentable field of view was quite small and it wasn't able to achieve the all-around situated MR that I was looking for. I tried to get a Magic Leap, but was not able to. Later research suggested that Magic Leap (at the time of writing) suffers from the same issues that made Hololens unsuitable for my purposes.

The first thing I tried was to deploy Vuforia on VR headsets with built-in passthrough video. Oculus uses passthrough video as a safety precaution, showing the user a black and white image of their surroundings when they stray too far from the playable area. Vive uses cameras for tracking purposes, and Vive Pro has stereoscopic cameras that are accessible to developers. While I wasn't able to access the Oculus or Vive cameras as a developer, I was able to achieve passthrough video with the Vive Pro. Vuforia works with Vive Pro passthrough video, but there is a lot of warping and the virtual images don't line up with the targets.

Tech Troubles: Windows Mixed Reality

> Oculus and Vive are well documented and accessible to developers. I was able to experiment with headsets from both of these ecosystems, as well as a Windows Mixed Reality (WMR) headset. This was a very unfriendly piece of technology, locked to development, despite having integrations built in to Unity. While developing for Oculus and Vive were simple and painless, WMR was completely inaccessible to me.

In addition to the warped image issue, it was clear that using Vuforia on a VR headset was a waste of the resources available. Vuforia is a relatively simple resource-light AR solution, while the VR ecosystem is capable of much more. I began looking into VR development tools that would help me achieve my vision of passthrough video unconstrained by the target-oriented needs of Vuforia. While discussing this with Dr Haru Ji, my primary advisor, she suggested the ZedMini Camera, which she was able to provide through her connection to ALICE Lab and Dr Graham Wakefield at York University. ZedMini has a strong integration with Unity, and research

revealed that it also had some integration with LeapMotion for hand tracking. LeapMotion was inexpensive, so one was procured. Some simple setup later and I had a technology stack that, at the time, I considered a jury-rigged Magic Leap (see Technology Stack). Experiments with Vuforia revealed that Vuforia did not work well with Zed. While Vuforia does work with Zed out of the box, it only displays on one lens in the headset, which is a very disorienting experience. Rather than pursue a solution, Vuforia was shelved as a candidate tool in favour of the native VR development accessible through Unity. Of the available VR hardware, Vive was chosen due to its accessibility through OCAD AV and its Vive Tracker hardware ecosystem.

Tech Trouble: VR Deprecations

> In January 2020 Unity deprecated support for SteamVR and Vive as part of a process to change the way the engine integrates XR plugins. This came as a shock to me, who had not been keeping up with missives from the company, and I had to spend some time downgrading my software and fixing legacy scripts. Since then I have been careful not to update any of my software, as the framework that *Playtime for Punctum* was built on is no longer supported by new versions of Unity.

Foreseeing that I would need to generate art assets, and knowing that I am not a particularly gifted 3D modeller, I experimented with photogrammetry. I discovered some aesthetic value in failed photograms, appreciating the dreamlike warping effect (see Figure 5) While these effects did not make it into the production, I plan on experimenting further (see Next Steps).

Figure 5: Experiment with Failed Photogram in VR

The Lynx R1 from Lynx (a VR headset with onboard stereoscopic passthrough video) was announced in February 2020. Oculus Quest announced support for onboard hand tracking at the same time. These hardware solutions were not available when the Zed + Leap rig was completed in September of 2019.

Technology Stack

After experimenting with augmented reality tools and technologies, a specific technology stack emerged. A combination of technology that situates the participant in an augmentable real space, and activates their body as a controller for virtual elements, the rig that forms the technological foundation of this research brings together live video, body tracking, and virtual elements. The rig consists of:

- Vive virtual reality head-mounted display and tracking system by HTC
- ZedMini stereoscopic depth camera by Sterolabs
- Leap Motion hand tracking controller by Ultraleap, formerly Leap Motion Inc.

The hardware is mounted on and affixed by a custom-designed 3d-printed rig, remixed from individual designs freely-available online (at Thingiverse.com) (Figure 6), into a single unit that can be worn by a player (Figure 7).

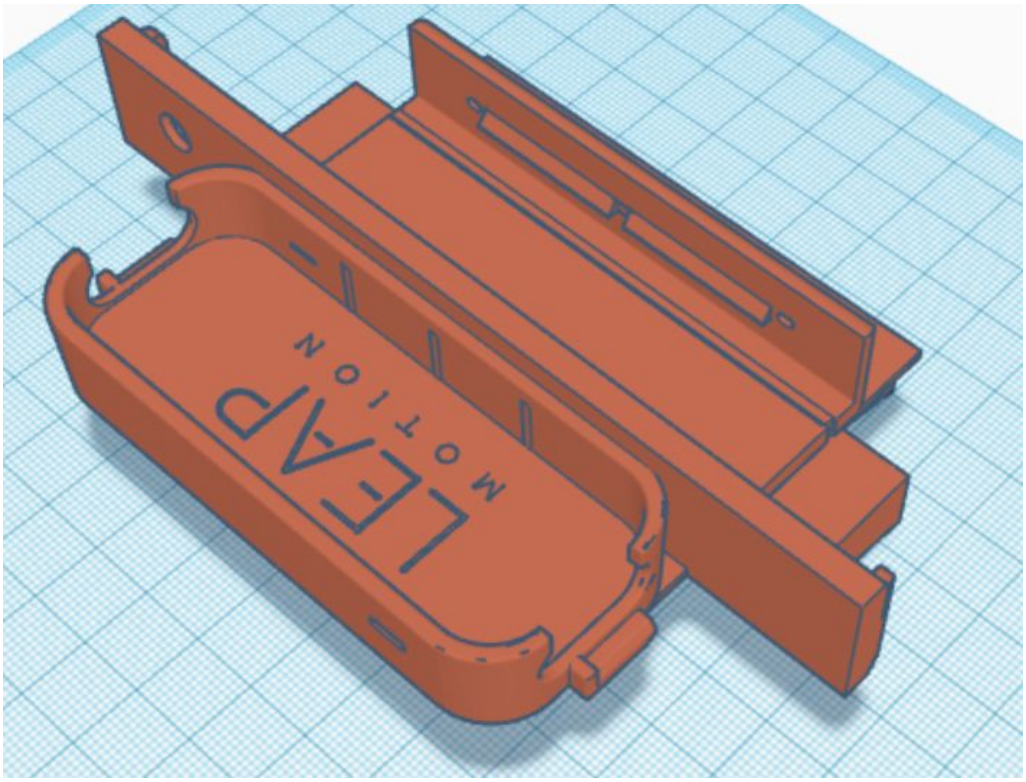

Figure 6: 3D model of the mounting rig, remixed by the author. Original Zed mount by Thingiverse user Myzhar; original Leap Motion mount by LeapMotion.

Figure 7: the technology stack assembled. Zed Mini top, Leap Motion below, mounted on 3d-printed PLA rig, HTC Vive behind

The technology stack combines one-on-one active-audience theatre with best practices derived from video and escape games to assert an experience that places the player at the centre. A VR headset - in this case, a Vive - provides a stable and relatively low-encumbrance wearable to allow virtual and computational elements to be experienced. A stereoscopic camera - in this case, the Zed Mini - captures visual and depth data and passes it through the VR headset to each eye, keeping the player psychologically located in the real-space setting. A hand tracking sensor - in this case, the LeapMotion - tracks the player's hands and situates them as game objects in the virtual ecosystem. This allows the player's hands to be endowed with properties that affect the virtual objects, be augmented, and used as a gesture-based interface.

Once familiar with the technology stack, a tool kit was assembled in Unity of common elements that would recur in an augmented architecture/performance scenario. This consisted primarily of colliders rigged to receive input or to collide with virtual elements. These colliders could be quickly overlaid on real-world elements, or attached to a Vive tracker or controller for real-space mobility. A Unity Store asset, *The Essential Leap-Motion Gesture Detection* plugin by user The Great Alpaca, was used as the basis for a gesture-based interface. Replacing the button input of a controller, in-game functions could now be mapped to user gestures instead. I also prototyped the tracking of a visible game object parented to a controller, as I expected at this time to make use of volumetric video in real space.

Tech Troubles: Volumetric Video and Zed

> Experiments with using volumetric video yielded interesting results. Placing volumetric video in VR was a simple process, with most of the labour done as part of a conventional film production process (lighting, filming, post-production). Unity's support for DepthKit's volumetric video is robust and reliable, and there were few issues with purely VR sketches. Unfortunately, once volumetric video was integrated with the technology stack, the video began to behave erratically. It would lag and hitch, especially when tracking the video as a child of controllers. More experimentation is necessary to determine if this was a bandwidth issue, an issue with processing power, or a matter of conflict with the

hardware stack. For now, volumetric video was disqualified from inclusion in the production.

Then I wrote a series of code scripts that I expected to recur in the design, based on common theatre and film transitions: fade to/from black, fade game objects in and out, adjust colours, swap game object locations. I intended for this to form the basic engine in which to design the final product. This step was an opportunity to experiment with the C# language and discover the structures and tricks that would form the skeleton of *Playtime for Punctum* virtual architecture.

Game Sketches

The sketch is a valuable vehicle for exploring and communicating ideas, distinct from the process of making (Buxton, 105). Bill Buxton suggests that the definition of a sketch ought to include the following attributes:

- *Quick*
- *Timely*
- *Inexpensive*
- *Disposable*
- *Plentiful*
- *Clear Vocabulary*
- *Distinct Gesture*
- *Minimal Detail*
- *Appropriate Degree of Refinement*
- *Suggest and Explore Rather than Confirm*
- *Ambiguity* (136)

These criteria situate the series of experiments I created based on the technology stack and the insights that arose from the workshops as game sketches (Figure 8). I was not concerned with generating strong prototypes, but rather with exploring interesting ways of deploying the technology and the experiences that could be generated, trusting to emotion and intuition (as invoked by Chapman & Sawchuk) to indicate which revelations were worth expansion. This process exemplifies the research-for-creation phase of the project, as it was concerned with the

gathering and clarification of tools, skills, and insights, rather than the production of artwork or prototypes.

Figure 8: Examples of Game Sketches. Clockwise from top left: AR TiltBrush Rebuild; AR Painting with Fingers, Physics Experimentation with Hand-based Interactions, Hand-Tracking Apple Picking, Augmented Costume

Workshop Process Journal

Taking Koenitz' IDN framework as inspiration, I developed a workshop to be deployed to a group of improvisors in order to generate and explore potential applications of the technology stack. Koenitz' IDN model resembles the process of devising theatre using the collective creation methodology. In Koenitz' framework a product is instantiated by running a process through a system; in collective creation a production is devised by running through a process of structured exercises. In both frameworks a system of potentialities is generated, and a process of exploration and decision-making is undertaken, before a final product is instantiated.

The workshop starts by asking participants to create *Concepts* (a high-level theme for the scene, loosely replacing Koenitz' Environment - see Interactivity), *Elements* (actual objects, places, characters and things in the scene, loosely replacing Koenitz' Assets) and *Interactions* (the means of interaction within the node, loosely replacing Koenitz' Settings). Participants brainstorm things to fill these roles. Once all the ingredients were brainstormed, scenes would be assembled by participants - one each of Concept, Element, and Interaction - and improvised through until a strong meaning had been discovered. Finally the scenes would be arranged as nodes on a narrative map which would then be improvised through again in order to find thematic and narrative relationships between them (Figure 9).

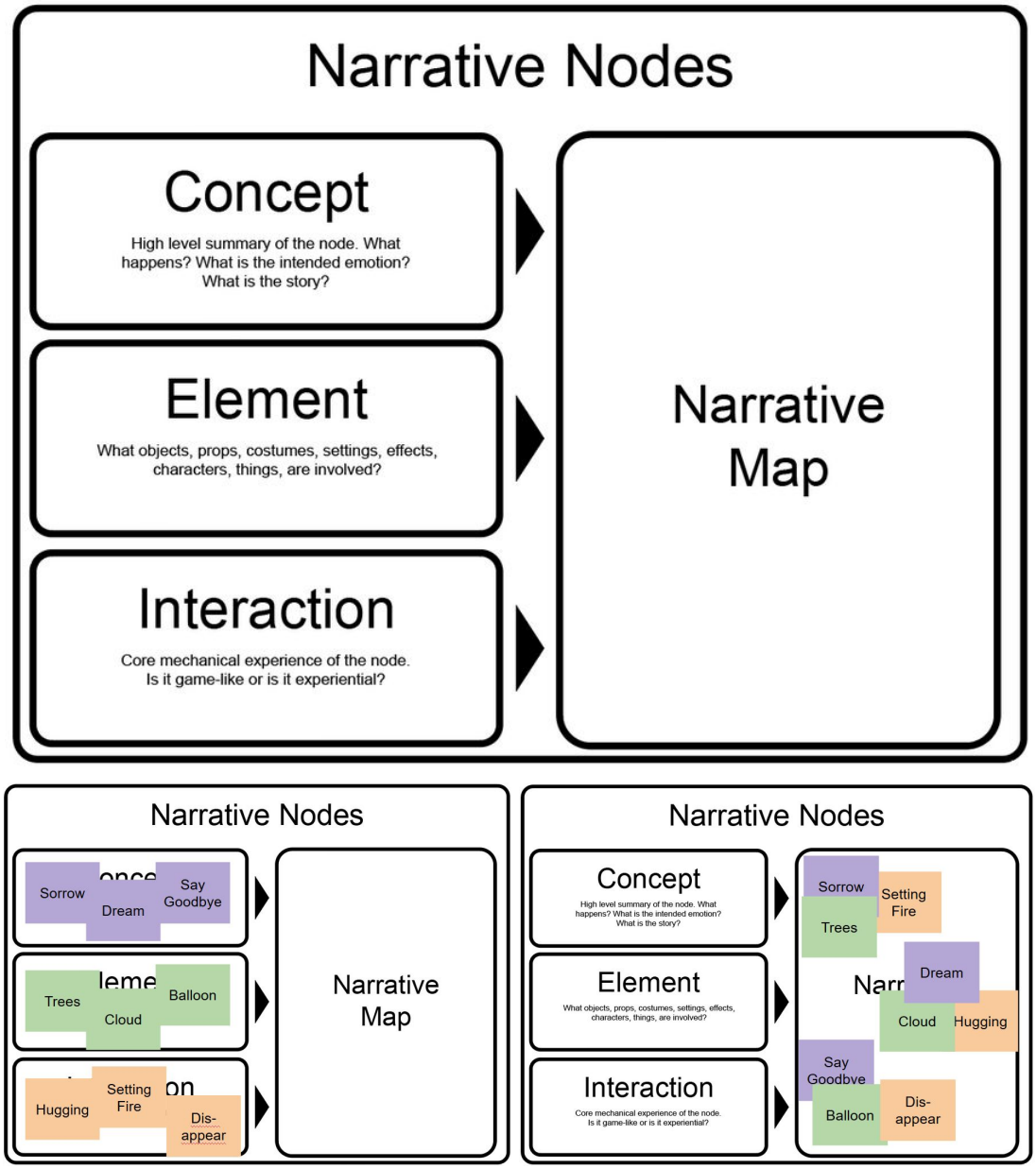

Figure 9: Workshop scene construction framework

This process was conceived of as the main improvisational crux of the workshop, but the whole workshop process needed to be structured. Performance studies theories Dwight Conquergood's writing about nontraditional ways of knowing, which he breaks down alternatively as *artistry, analysis, activism; creativity, critique, citizenship*; and as *imagination, inquiry, intervention* inspired this framework. Broadly, the workshop was structured around the foundation of imagination, inquiry, intervention, with each word forming the inspiration for a phase.

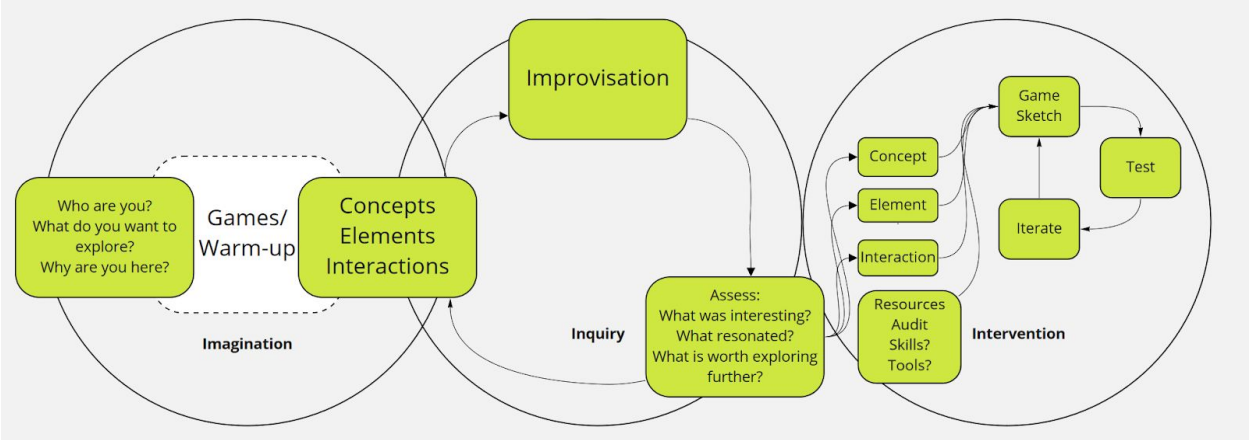

Figure 10: Workshop structure

The workshop, envisioned as a three-part process (Figure 10), would begin with a process of unstructured creation and play, framed by the term *imagination*. In this phase participants would meet one another, discuss their history, goals and wants, warm up with games, and begin to brainstorm interesting and relevant ingredients for exploration in scenes. The second phase would be based around *inquiry*, and would consist of the Koenitz-derived improv structure described above along with a space for assessment of the discoveries made in it. The goal of this phase is to land on a single concept, *interaction*, and element that the collective agrees form a strong narrative and experiential core of an experience worth expanding. After assessment, the brainstorm and improv process can be repeated to further clarify the relationship between nodes on the narrative map and begin to codify scenes and elements for capture in a script - in other words, the iterative improvisation process at the core of collective creation.

The third phase, *intervention*, involves the practical development of the idea landed on in phase two. The creation process begins in earnest, with an audit of the resources available to the collective, the devising of a low-fi prototype (through bodystorming, if the technology is not available), assigning of roles, and the testing, iteration, and development of the final product. This phase most closely aligns to conventional research by design methodologies and hierarchical theatrical models, such as those practiced by Outside the March (see Expert Interviews).

Expert Interviews

Interview sessions were conducted with professional creators of interactive theatre in Toronto, all of whom are familiar with and incorporate collective creation in their respective practices.

- Mitchell Cushman and Rosamund Small of Outside the March. Their process cleaves most closely to conventional playmaking. Their productions are based primarily on a playwright's text. A hierarchical structure is applied to the production, involving the assigning of roles and responsibilities to key team members. Productions are generally produced within a singular creative vision belonging to a director.
- Michael Mori of Tapestry Opera. Tapestry's process can be described as starting with an emotion or thematic prompt, then bringing in collaborators as necessary in order to develop the concept. The vision and work produced by collaborators may fundamentally alter the initial concept. Michael described Tapestry's practice as "expanding circles".
- Rachel Kennedy of Theatre Ontario. Trained in collective creation, Rachel has been a director or consultant on dozens of devised and immersive productions. Her practice most closely aligns with the stated definition of collective creation, which is dedicated to producing work without hierarchy and keeping creative and literal ownership of a production distributed among the company.

These interviews highlighted the different processes available by professionals, engaged in creating similar works. A luxury afforded by having a sizable budget and formalized structure is the ability of an organization to delegate roles and responsibilities. This structured organizational format tends to concentrate artistic agency in relatively few people, while unstructured collectives tend to be more democratic in terms of who has ownership of creative aspects of production, and how that creative agency is allocated.

Workshop One

I identified the type of people I wanted to reach out to as participants: performers familiar with improvisation who were interested in getting involved with mixed reality as a performance element, but had little to no exposure to the technology and no clear path to incorporating it in their own practice. Posters (see Appendix C: Workshop Documentation) were placed in

locations judged to be frequented by people who fit the bill; OCADU grad and main campuses, Ryerson theatre and digital media buildings, York theatre and film buildings, University of Toronto theatre buildings, and the Second City training centre. The workshop was also shared over academic networks, such as through connections at York's ALICE Lab, and word of mouth through the researcher's own network.

The first workshop was convened on November 23rd, 2019, with six participants from various backgrounds including improvisation, fine art, computer science, and creative writing. The structure of the workshop detailed above in Workshop Process Journal was followed. First, the technology was showcased to the participants. Then improv games were played to warm up and a brief introductory discussion was conducted. Then, for three minutes each, as many concepts, interactions, and elements as possible were brainstormed by the collective (Figure 11).

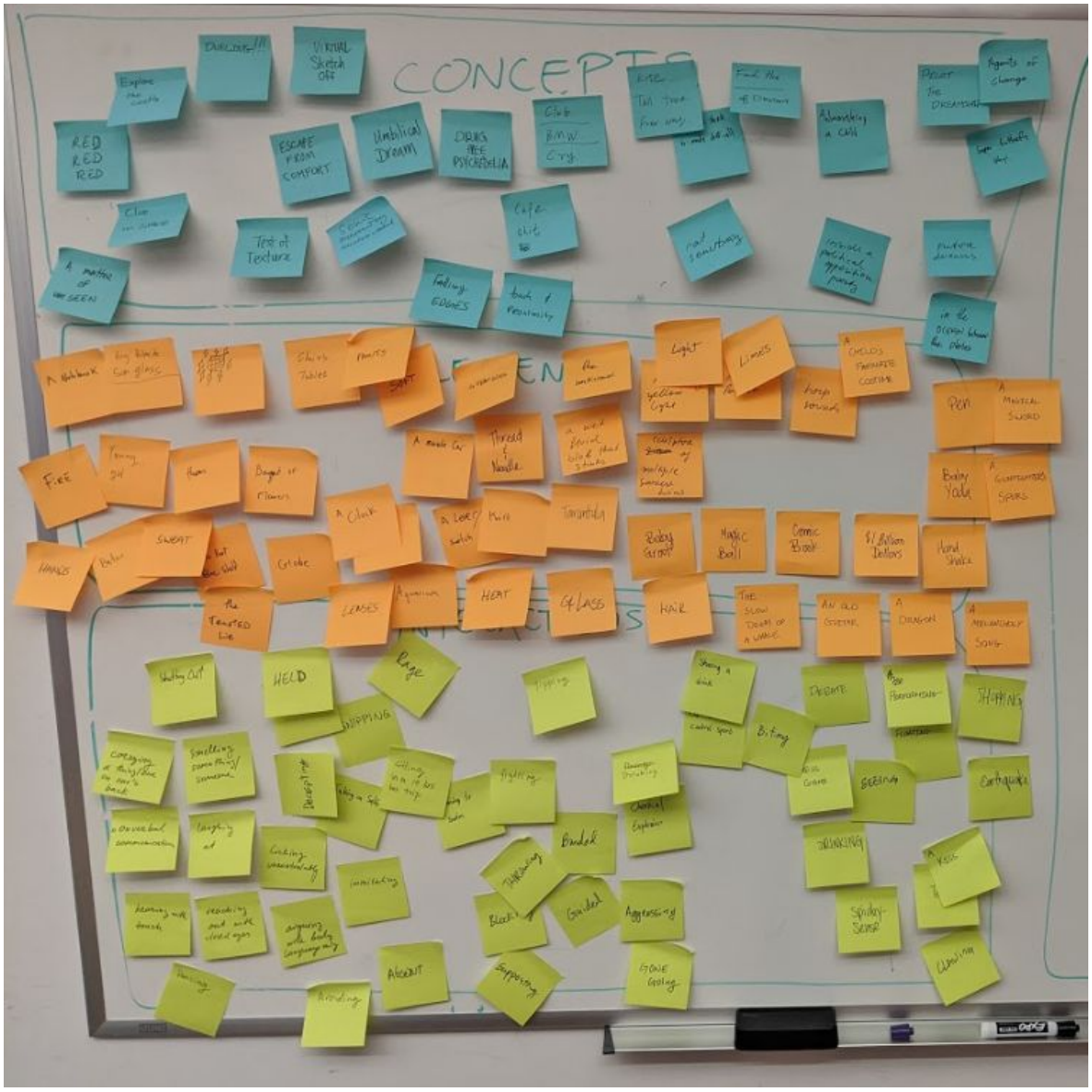

Figure 11: Workshop brainstorming outcomes

Once the brainstorming session was complete, the improvisation session began. Participants selected, or chose at random, three elements to make up an improvisational scene. Prompted by the technology as well as the scene elements, participants improvised brief interactions (Figure 12) until the scene found a logical conclusion or until the facilitator called a stop to it.

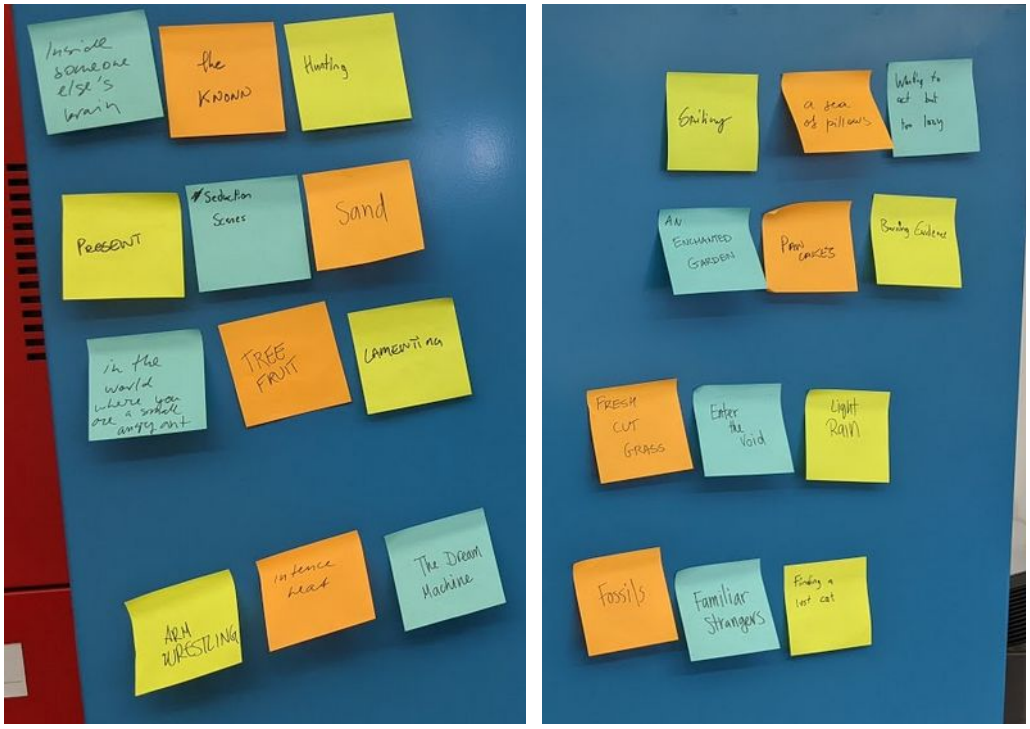

Fig 12: Workshop One scenes assembled

Some recurring imagery and elements were discovered through the improvisations:

- Using the environment to uncover or conceal something
- Scenes taking place outside of regular human scale
- Thoughts and intentions seen and made real
- Drinking and tasting
- Real-world elements integrated with the improvisation

In a debrief after the workshop, participants highlighted insights that they agreed on as being resonant among the group, emblematic of affordances of the technology that they found interesting:

- The ability to change the environment at will
- The ability for a player to act as a director of the scene, making meaning by arranging scene elements and environments; a directed montage
- The fact that a controller's function is not immediately clear but is also not intrinsically dictated; context might dictate the function of the controller change within a given scene

- It is an interesting experience as a player to interact with a performer who is not controlled by you in any meaningful sense; this is an unusual experience for a game context
- An absence of generated sound in the scenes was a weakness; they felt that sound would add an important element that was lacking

Workshop Two

Guided by the insights from Workshop One, I spent some time refining the Technology Stack. My intention was to create a tangible interface that could be used as the catalyst for improvisation that would lead to discovery of a narrative.

The prototype that was created for the second workshop consisted of two Unity scenes. The first was situated in a real environment using the Zed camera, and consisted of virtual cubes hidden in the environment. By reaching for a cube, the player would highlight it (Figure 13). Once highlighted, the player could make a fist gesture which would cause it to be activated, changing it to gold. Once two cubes were activated, virtual lights would be added to the scene, and once all three were activated the scene would transition into the next area.

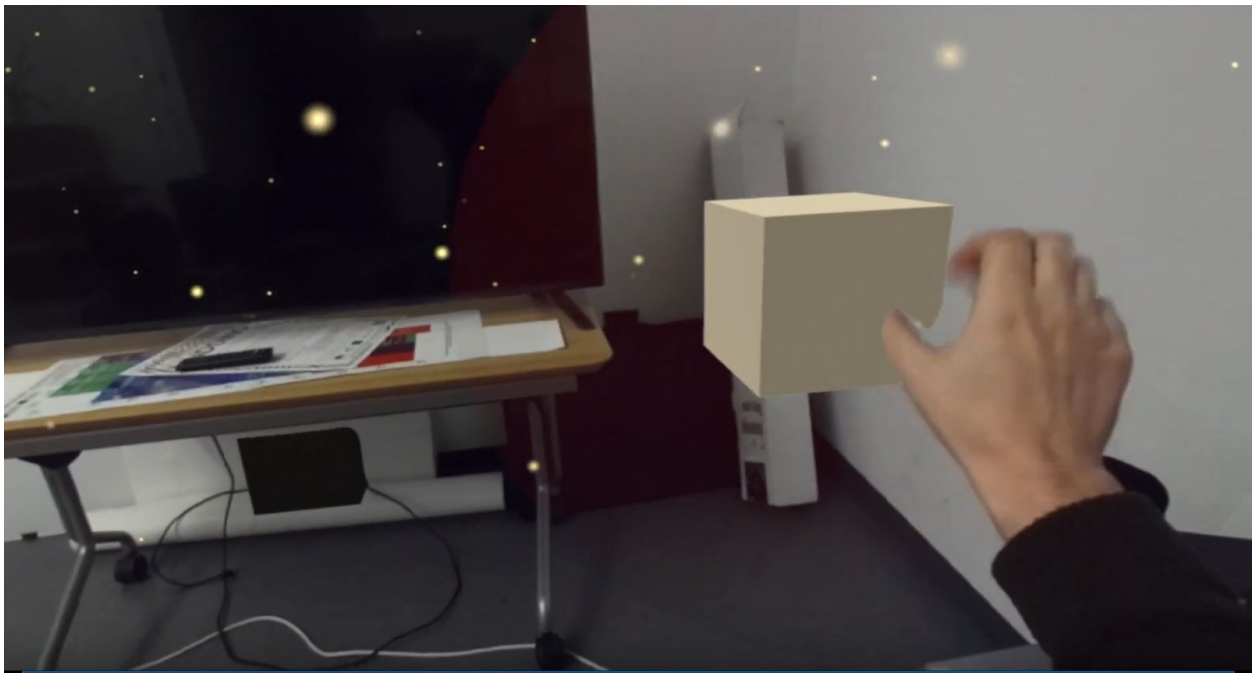

Figure 13: Gesture-based interface prototype

The second area was situated entirely in virtual space, and showcased a photogram of a real room along with a volumetric video clip attached to a controller. Three trigger cubes were also situated in this space; when interacted with in the same manner as the first scene, the photogram room faded away to reveal an impossible setting: a massive statue plummeting through space, surrounded by debris (Figure 14).

Figure 14: wide angle view of the fully-virtual gesture prototype. The player's view is located in the box visible in the middle of the image

The intent behind this prototype was to demonstrate the technology and gesture-based interface to the participants in the upcoming workshop, and to give them an idea of where my focus had been, and what kind of development could be done quickly.

A key observation from the first workshop was that participants were nervous around one another, as they were all strangers being asked to step out of their comfort zones. While most were familiar with improvisation and willing to do the exercises, the participants lacked the comfort and willingness to act in a risky manner that might have come from a pre-existing relationship. For this reason, I elected to return to my original plan and invited my prior collaborators who, this time, were available.

Workshop two was less structured than the first. It was a showcase of the prototype and an informal discussion structured like the kickoff meeting of a theatre production. The narrative of

the production had not yet been established, and deciding on a strong narrative foundation was the stated goal of the workshop. The workshop began with a playwriting exercise. I was asked to return to the idea I had liked the most, break it down into foundational Who-What-Where-When-Why, and work from there. Beginning with a concept I had been working on for an immersive theatre piece, I highlighted core features of the story I was most energized by and which spoke the clearest to me. Upon reflection, this had not been a decision informed by a methodological framework and was a clue that this research was not, in fact, a collective creation intervention.

Several concepts were discussed before arriving at the one which would form the narrative of the final production: a child being asked to move out of their childhood home, and leaving their imaginary friend (embodied by the player) behind. This concept was clear, afforded a lot of opportunities for interactions, and had a clear role for a player without asking too much information be front-loaded. We brainstormed interactions - games that could be played by the child character and the player - and I began creating a short list of narratively and technologically interesting ones.

From there, the conversation pivoted into one of feasibility. What were the requirements, outside of narrative, that needed to be met? Based on the work done thus far, and the outcome of experiments with the technology, the following were settled on as constraints:
The performance

- Uses the Zed/Leap/Vive rig
- Exists in one room
- Should take into the account the limitations afforded by the hardware
- Has a performer besides the player
- Will be 5-10 minutes in length
- Includes strong aesthetics, but should remain simple
- Should be easily deployable in multiple locations

The workshop ended with a discussion and establishment of a series of tasks and a workback schedule. Ultimately Workshop Two was more practical than the exploratory Workshop One, and more in keeping with conventional production processes than a strictly collective creation process might be.

Production Process Journal

With the solidification of the technological stack and the completion of the exploratory workshops, production on the performance began. The workshops highlighted specific goals that remained in the forefront of production:

- The environment, real and virtual, would be used to engender play opportunities
- Scale would be considered
- Be concerned with the theme of thoughts made real
- Let the player change the environment
- Let players make discoveries rather than be made to follow instructions
- Stick with subjects that are energizing for myself as a director and developer
- Consider the practical necessities of development

Putting the player in the role of the imaginary friend of a child fulfilled these goals.

It was important to lock down a clear visual style early, as the visual fidelity of the augmentations would have a large impact on participant experience. Visual design is not an area in which I have much expertise (I tend to use free online assets or photograms when I need a custom asset) so I enlisted the help of a visual designer, colleague Priya Bandodkar. To help solidify the visual style and assist Priya in her work, I put together a mood board (Figure 15).

Figure 15: example moodboard of children's artwork. Source: Wikimedia Commons

I researched artwork available online made by children aged 1-10, and took a brief informal survey of the kinds of images children like to make. I found images from children about the intended age of my main character, featuring themselves in fanciful situations: the kinds of images that form the core of the experience as the interface is a series of drawings, and the art style echoes this. Then I took a look at the emerging subgenre of children's drawings being rendered as 3D or real objects - adult artists take children's drawings and treat them like concept art, creating fully realized high-resolution images and/or 3D objects of them. This transition forms the core of the visual style. Once this was complete, Priya created two visual style tests of a 3D object: one as a solid object, and one with a measure of transparency (Figure 16). When comparing the two in virtual space it was determined that the opaque texture more strongly evoked the sense of kid-scribbled-artwork.

Figure 16: Art style test. Left fish is opaque between scribbles; right fish is transparent between scribbles

I wrote a draft of a script which was not subtle. It was an exploration of the emotional journey, the game flow, and to determine the assets that would be needed. On reflection, it was clear that this script was an example of creation-as-research undertaken in an effort to discover what about it was worth exploring further. From this first script I extracted all the assets and interactions that would need development, and listed them in a matrix to determine their complexity and help keep the scope narrow. A second draft of the script was more focused on the journey that the child, now named Abby, went through, with each game played with the player teaching her a lesson about how to be self-sufficient. A third draft of the script removed references to Abby's family, decisively removing suggestions of abuse that hung around the periphery of prior drafts. It brought Abby's age closer to that of the performer, making her a young adult, and adjusting the context of the narrative to match: now it was about a young adult rediscovering her childhood imaginary friend rather than a child being forced to end their relationship with one.

From that script I finalized the component list and drafted a document as an educational supplement for the actor. I reached out to a prior collaborator, Natalie Scagnetto, to play Abby. The script, as well as an onboarding document (Appendix C) were given to her.

Rehearsal Process Journal

After the first draft of the code structure was completed, rehearsal began with performer Natalie Scagnetto. Beginning the rehearsal process clearly highlighted the necessity of having technological development locked, and introduced the single largest stumbling block encountered into the improv-heavy collective creation ethos that guided the process. Without a polished and functional technological structure, effective rehearsal tended to be blocked. Exploration would grind to a halt when a bug or technological hitch was encountered, which prevented the performer from inhabiting the fiction. Early rehearsal was, due to the unpolished state of the technology stack, not useful as rehearsal - though it was effective as bug testing for the technology, highlighting necessary tweaks for clarity and usability for the performer.

Calibrating the virtual elements to align with real-world architecture took up a considerable amount of time. By building a virtual room to scale with the actual space and marking (or "spiking", in theatre parlance) the sites where virtual elements were to be located, a process emerged whereby the virtual elements could be aligned to the actual ones. Initially the process was manual: the experience would be loaded and advanced to the point where the virtual elements became visible, the technician would look through the headset, adjust the virtual object in Unity until it aligned with the spike, and then that object's transform would be saved (Figure 17).

Figure 17: Interactive virtual space overlaid on actual objects and user hand, visualized

As the actual space development was located in, rehearsal took place in, and the final performance deployed in were all different, it was important to develop a system whereby the augmented role-play could be quickly calibrated and redeployed for any space. By conceiving of real-world architecture as simple primitive shapes in the Unity engine, and applying any qualities the production requires them to have (such as physics interactions) to those primitives, the required augmentations can be quickly implemented manually. This also allows for the real space to be measured and rebuilt to-scale in Unity, ensuring that as long as real spaces are set up to the same scale, with the same key furniture, the experience can be deployed anywhere (Figure 18) with a minimum of recalibration.

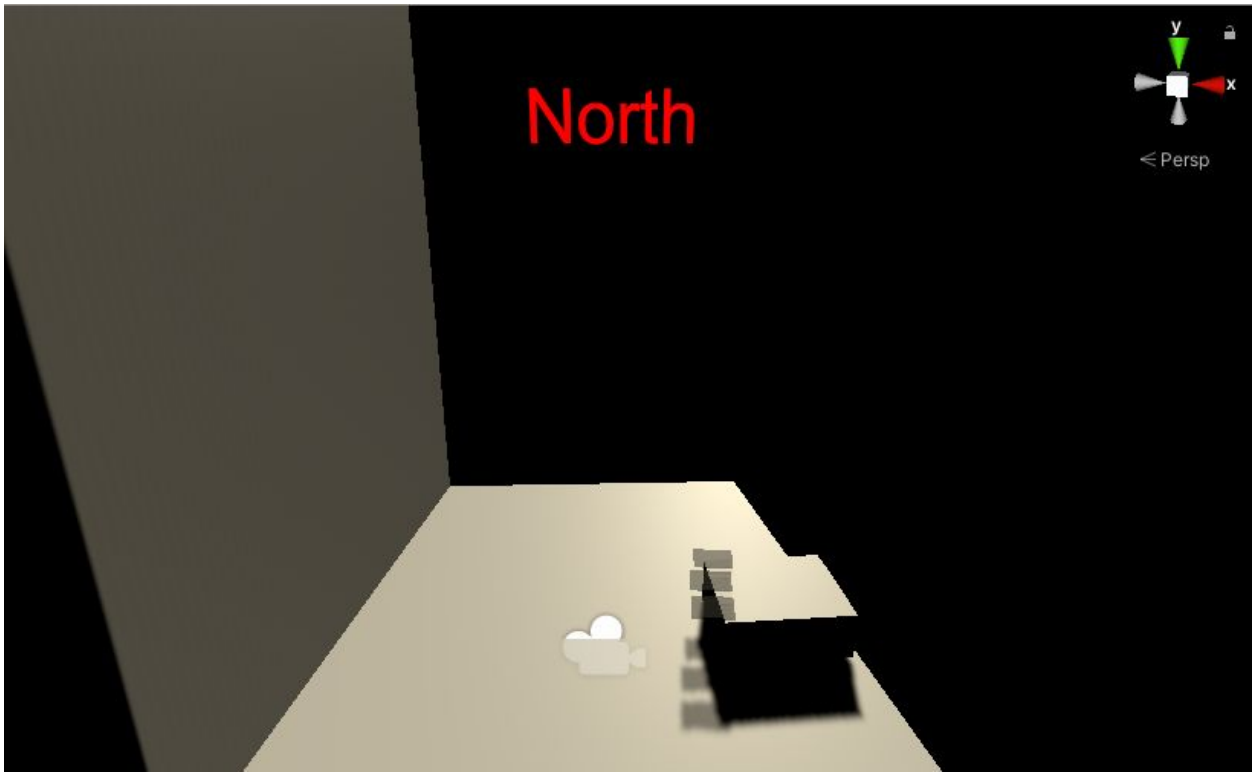

Figure 18: Unity layout of Playtime for Punctum. Walls, floors, ceilings, and table surface are approximated by primitives. "North" is used to help orient and align the virtual space to the physical space.

Tech Troubles: Cable Woes

Zed Mini has very specific requirements of its connection cable. It requires a USB-C to USB-3.0 port cable, but not any cable with these ports will do. According to Sterolabs' support website: "the ZED Mini uses both USB 3.0 and 2.0 to send video and motion sensor data. Some extension cables which have only USB 3.0 internal wires or fiber extenders will not work with ZED Mini." Some trial and error was required in order to find a cable that fit the bill; the cable that was acquired was only three feet long. Since it was important that the player not be tethered, I looked for an extension cable. Stereolabs recommends the FireNEX-uLINK-C cable for the Zed Mini. After acquiring this cable and using it for several weeks, it failed without warning. Stereolabs support replied to explain that it is difficult to make a long reliable USB 3.0 cable, as Zed Mini outputs a lot of data, and the slightest deficiency in the cable can cause a

transfer problem. Stereolabs noted that this is a known issue for VR developers working with Zed Mini, as they move a lot while using the camera, and the constant movement puts stress on the cable. Ultimately I had to source a second cable from Stereolabs.

Once the issues of technological stability and calibration were solved, rehearsal could go on as intended. This process emerged as a fairly conventional rehearsal process undertaken under the auspices of collective creation: a dialogue emerged between director and performer, iterating the specifics of the script based on discoveries that arose from exploration. For example, it was decided that Abby's role as written lacked emotional authenticity and that the character was serving mostly as a tutorial for the player. An exploration emerged through the next few passes of rehearsal that explored the character's motivations and desires, informed by the performer's understanding of the character, and those insights became part of the script. Additionally, prompts to get the players involved in the role-play portion of the experience were tried in rehearsals. The prompts that became enshrined in the text emerged from rehearsal, and were determined to be the strongest prompts from the dozens that emerged from improvisation.

Tech Troubles: Obsolescence

Technology advances at such a great rate that most of the pieces of the technology stack were practically obsolete by the time this research was completed. As mentioned, Unity's support for XR integration changed during production, rendering much of the code unusable on new versions of the software and requiring updates to the hardware's firmware and support. At the time of this writing in April 2020 the LeapMotion has been made obsolete by the inclusion of hand tracking in Hololens 2 and Oculus. Zed Mini has been replaced by Zed 2. As such, this particular intervention exists as a distinct artefact of its time, as it must run on legacy versions of its platforms. An update to any of the engines might break it. This raises questions about the nature of digital archiving: how might this performance be preserved? If the developers of Unity or Zed or LeapMotion stop supporting their devices (which is likely in the case of LeapMotion, which has been sold to a haptics company and I predict will

soon cease as a standalone product) and the legacy code no longer available online, this production will exist only on the hard drives of the computers used in its creation and its online repository (see Appendix D). It will be code for devices that are no longer manufactured, and when the devices fail, the code will cease to function, serving no purpose except as a record that it once existed.

Chapter 4: *Playtime for Punctum*

This synopsis and analysis reflects the state of Playtime for Punctum *at the time of writing.*

Synopsis

The player is in a black void, surrounded by winking lights. Their body is represented in the void by a pair of virtual hands overlaid on the space where their own hands would be. The virtual hands are purple and textured with scribbles, as if scrawled by a child. The player can reach a large stone suspended ahead of them - grasping it causes the void to fade away and the experience to begin.

The player finds themself in a bare bedroom. A young woman, Abby, is packing up her childhood room. She does not notice the player. Soon, she uncovers three large stones painted with childlike imagery of a purple figure in a variety of poses and situations. She reflects for a moment, looks up, and notices the player for the first time. She is happy to see them: the player is Punctum, Abby's childhood imaginary friend who she had all but forgotten about. Discovering the stones reminded her of the games they played together. Abby and Punctum would make up a game, and Abby would paint stones as mementos.

Abby arranges the stones in front of the player and invites them to touch. By grasping a stone, the imaginary game depicted is invoked and fills the space. The player is invited to play along with Abby in each of three games, in whichever order they prefer. The first is a game of hide-and-seek among tall grass that reacts to the player's touch, moving aside as if thick underbrush. Several virtual hiding places exist, and Abby conceals herself and invites the player to move through the augmented space in order to find her. The second game involves a tall virtual tower that Abby climbs inside: she claims to be trapped. Large virtual boulders appear next to Punctum that can be tossed at the tower to knock it, and surrounding vegetation, down, freeing Abby. The final game is a game of finger painting: virtual paint bottles appear that the player can dip their finger into and leave streaks of virtual paint in the air. Abby incorporates her body as part of the artwork. The game ends when Abby invites Punctum to take a picture: there is the sound of a shutter snapping, and then the painting disappears.

Once all the games have been played, Abby admits that she has to finish packing and leave. Now that she's found the stones, she promises not to forget Punctum again. As a means of sealing the promise, she offers a painted stone of her own to Punctum. A stone with an image of the painting that the player made appears in their hand as the void that started the experience returns. This time, however, the player is not alone: they are holding the virtual stone with the image they made, indicating that Abby will soon return to play again.

Analysis

A live performer shares the space with the player, affording an extra layer of interactivity beyond what is suggested by the purely-virtual elements. The performer serves as a guide as well as narrative source of the piece and can assist the player if means of interaction are unclear. The inclusion of the performer allows for potential interactions that are more nuanced than a virtual interaction might be. For example, at one moment in *Playtime for Punctum*, the player and the performer take part in a game of hide and seek. Virtual objects fill the space: tall grass, a hollow log, a large overturned bucket; the performer uses the virtual objects to conceal themselves from the player. The objects react to the player's touch: the tall grass moves aside when prodded, the player needs to stoop and crawl in order to look inside the log, and the bucket can be overturned with a push. The performer's actions affect the player's experience, and unlike the hard-coded physical reactions of the virtual objects, the performer's actions are not totally pre-determined. The flexibility afforded by the improvisational setting means the experience is never predictable. The performer may say anything, reply and react in any way, hide anywhere, move, or choose to use the virtual object in unexpected ways. There remains a clear boundary, in order to avoid the discomfort suggested by Murray, in that the physical boundary of the performance space is clearly demarcated. The player's relationship to the performer in *Playtime for Punctum* is made clear early on: the performer is a guide and facilitator. Thematically, the player character is wholly dependent on the performer's character for their existence.

The technological structure of the production emerged as a hybrid of conventional theatre structure (a "stack" of linear cues, pre-programmed and manually triggered one after another by a stage manager) with the player-driven decision web of interactive digital narrative (see Figure 19). The result is a dynamic system that requires the copresence of both a player and a

performer, in which meaning is made by the player's active assessment of their own liveness in relation to the augmentations. Without a performer the interactive elements lack context and emotional weight; without a player there is no one to interact with the technology (as the performer is situated as a part of the algorithm, not a beneficiary of it).

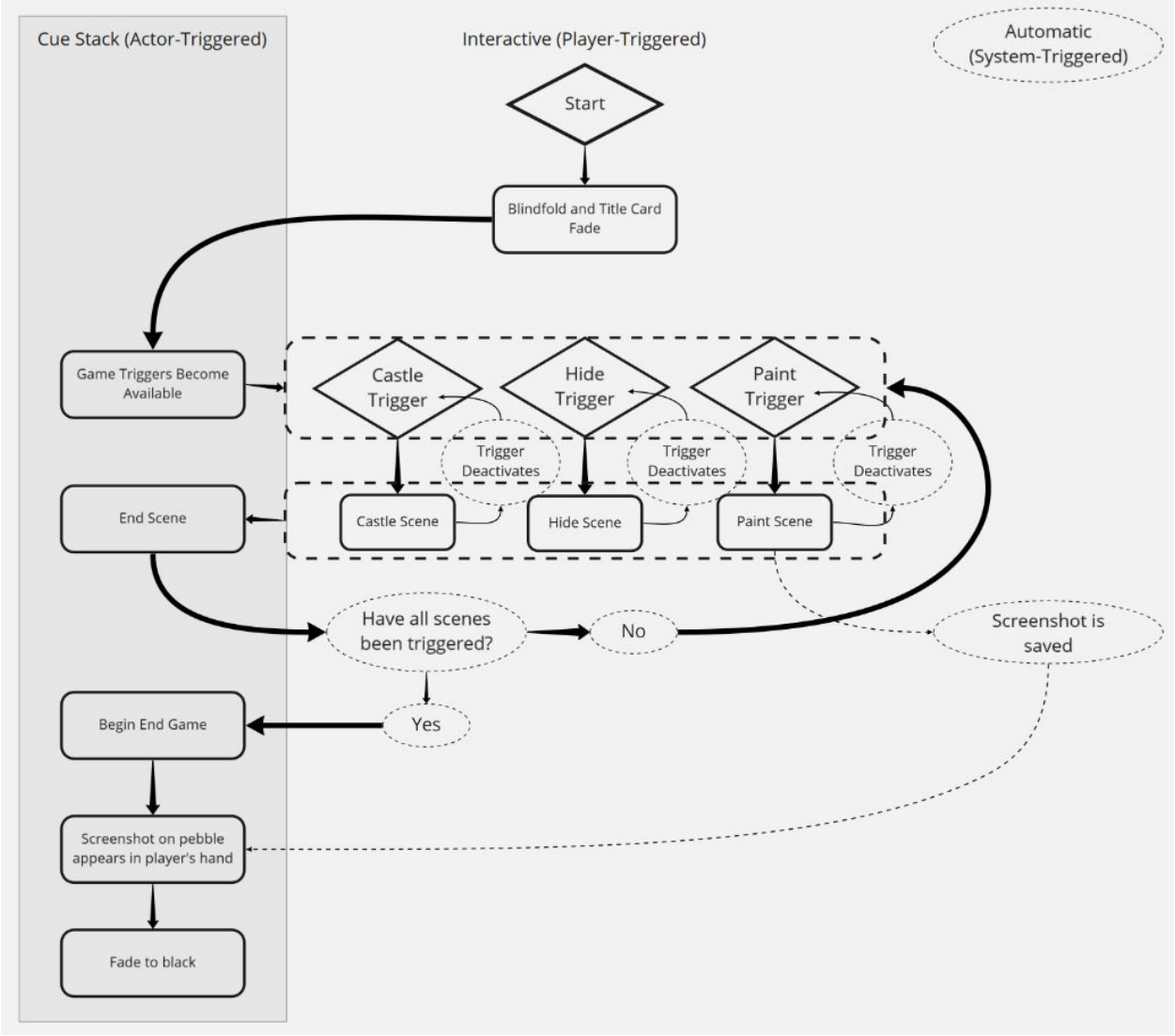

Figure 19: Visualisation of Playtime for Punctum *'s technological structure*

A script structured in the conventional manner was created in order to communicate the needs of the narrative to the performer in a familiar way. That script became an impediment to the play-focused rehearsal period when the time came, as a commitment to the written word got in the way of improvisations. Paidic play seems to be easier to induce in interactions without clear

win states that are intrinsically rewarding. Thus the linear format of a structured script was kept, with space in the centre for unguided interactivity, keeping the familiar narrative arc but affording space for the player to assert agency in interactive portions. Furthermore, the improvisational nature of the dialogue allows for player agency in how the spoken narrative unfolds, though structurally the experience remains constant regardless of how it unfolds.

The interplay of the player's and performer's choices with the interactions with virtual objects, which are in turn mediated by the virtual objects' relationships to the real space and the performer, gives augmented role-play a unique experiential potential. The outcomes of instantiation of the IDN system are more nuanced than a system that excludes a performer, as the meaning extracted by the player is made in relation to the performance, which, as it is possessed of liveness, carries intuitive cues beyond those that are stored in the code. A minute performative decision, by either the performer or the player, may alter the system, affording the system a means of generating a wholly unique meaning in that distinct instantiation. Furthermore, Groys' assertion that interactive art tends to put viewers in conflict with invisible rules inherent in the code is addressed by the flexibility of the network. While rules do govern the function of the interactive elements, the way in which they are interacted with are not prohibitive, and the addition of the performer means that there is an additional level of reaction to the system to mediate the experience. The player interacts with the system, which reacts to the player, and then the performer can legitimize any outcome arrived at through improvisation.

The relationship between actual and virtual objects are front and centre in an augmented role-play. It is augmented objects and spaces that are on display, and serve as the subject of the installation. "Minimal and conceptual art of the 1960s had, however, taken the decisive step in the direction of representing thought processes by taking pure thinking as its object and thus aestheticizing it" (Groys, 144). In an augmented role-play this aestheticization of thought is brought to the forefront and demands the player engage with it, as thoughts represented by objects are created by the player's interaction. The virtual object ceases to be virtual in the Deleuzian sense and is actualized by virtue of its situation as a distinct sensory object with a clear relationship to actuality. There remains the question of perception: for the player, the virtual elements are actualized, while for the actor they remain purely virtual, existing entirely in their imagination and memory of their stage direction in rehearsal.

Central to the experience of the augmented role-play is the depth of the player's integration with the performance. Improvisational prompts offered by the performer early in the experience offer the player a chance to take on the character to a degree to which they are comfortable, with the performer adjusting their performance as necessary. This distance of engagement itself becomes a subject of the performance, as the relationship between the player and the performer is the narrative core of the experience. The player's integration with the system with a touch and gesture-based interaction engine diminishes the indexing of the interface, in order to keep the performance accessible.

Chapter 5: Conclusion

Reflections on Research-Creation

This research was undertaken with completely different goals in mind; with different research questions, intended methodologies, and outcomes. The one aspect that remained constant was the intent of creating a performance format using a technology stack to allow a player to be situated inside it. What emerged was a reflection on a process that was chaotic and exploratory, characterised by periods of intense skill-gathering and sketching, experimenting, and interrogating.

The structure of the first workshop was a feint in the direction that the research was taking at the time: adapting conventional design frameworks from interactive narrative and theatre to form a hybrid process. In that it was not particularly successful, especially as this direction of the research was abandoned, but it did serve as a structure for a workshop that was successful in interrogating the technology stack and inspiring further development. A workshop that uses participant-generated prompts to explore potential uses of a technology stack, and using those insights to drive sketching, proved valuable in bringing varied perspectives to bear.

Conventional techniques proved most effective when undertaking conventional tasks, such as scriptwriting or developing with code. Best practices of long-established disciplines need not be challenged; rather it is the artist's opportunity to offload some of the onus of deciding how to proceed and trust to the tried-and-true.

Shifting Roles

Mindfulness of the relationship of the artist to their role should be maintained, especially when exploring new technology. There is a tension between the roles that the artist must take on, exemplified by the effective grind to a halt of the design process when the time comes to develop technological components of the production. The role of the director/playwright, taken on in the early phases, when the needs of the production are still being explored, affords flexibility and allows for varied perspectives and shifting of plans. The role of developer

necessitates a measured, planned, structured approach, as does the role of producer when the time comes to schedule, install, and mount a production. There is little room for adjustment when the realities of working with code mean the work required to make a slight adjustment might require a complete overhaul of the tools, or when tight scheduling and planning is required to make sure schedules work out and components are sourced and installed. Fewer opportunities for play are allowed when the necessities of development are encountered.

It is fitting that the nature of roles was so central to the process of research-creation in generating augmented role-play. Role-play based user research interventions led to a creation process characterised by creator roles that constantly shifted, resulting in an installation that asks the player to actively engage in role-playing.

Affordances of Augmented Role-Play

Augmented role-play benefits from the indexing of the real space as a means of interface between real and virtual elements. The blend of real and virtual allows for the relationship between architecture and narrative to be explored through the architecture of the space in which it is situated as an interface. The narrative of the performance is informed by, and informs, the architecture and the choices and affordances available to the player. Meaning can be made through the juxtaposition of action, object, and effect - a sort of embodied, augmented montage. Augmented role-play also affords access to the language of film and games; common editing techniques like fades and montage can be used in ways that are likely familiar to most participants. For example, *Playtime for Punctum* begins and ends with fades from and to black, indicating a transition to and from the fiction in the same way a film might.

The augmented performance and play space represented by augmented role-play is distinct from a player-driven collaboration, such as the Multi-User Domains (MUDs) of the early internet or a performance arranged and executed over *Second Life* (Linden Lab), which are fictional realities shared in a relatively equal way between all participants; all players participate with an equal expectation of agency. Augmented role-play makes a distinction between performer, who affects the role of a Non-Player Character (NPC) and has particular roles and expectations upon them, and player, who is the intended recipient of the experience and thus the experiential focus. An NPC performer must necessarily have more information and

understanding of the reality and functioning of the game than a player while also being limited in their agency. For example, in *Playtime for Punctum,* the performer is not experiencing the virtual augmentations in the same way the player, but merely pretending through performance that they are. Nor are they invested with the capacity to make choices within the fiction. They are a game piece rather than an equal sharer of the fiction. The role of the player in an escape game - physically present, driving the narrative through choices in an experience that demonstrates liveness, with a large degree of freedom allowed them with regards to how much their own selves are incorporated into the fiction - is a close analogue to the role of the player in an augmented role-play.

Next Steps

While testing has begun in the context of *Playtime for Punctum*, further testing in further performances are upcoming. In addition to developing different narrative and non-narrative experiences in the augmented role-play format, research should be undertaken to determine the levels of familiarity inherent in people who are hobbyists of various related disciplines, such as role playing, video gaming, or immersive theatre.

At launch, an intention of the research was to develop a workshop format that could help make the technology behind augmented role-play more accessible to artists unfamiliar with code and technology solutions. This part of the research was discarded when other elements were identified as more interesting, but expanding accessibility of creative technology solutions to artists is still an area of interest. The play-based affordances of augmented role-play may be attractive to artists.

As technology advances, experiences like augmented role-play will become more powerful and easy to deploy. The technology stack of Zed and Leap attached to a Vive is obsolete already, replaced by passthrough VR headsets and onboard hand tracking. Wireless options and more powerful microcomputers might allow for untethered experiences. Budgetary constraints limited the scope of this research, as only technology accessible to me as a researcher with minimal budget was within reach. More expensive technology stacks, such as the Unity-Optitrack-Vive stack used in *Draw Me Close*, might allow for more complex interactions that reveal new insights. Sophisticated camera tracking removes the need for sensors, allowing

augmentations to be situated in a direct relationship to physical objects. There is further exploration to be done in exploring how insights from augmented role-play might be applied to gaming, theatre, and other augmented reality projects, especially as new technology develops.

Summary

Augmented role-play is suitable for play and exploration inside the unusual context of real architecture, augmented with virtuality. It seems an unsuitable substitute for the kinds of experience one finds in VR games, as fine control of virtual objects are (with this technology stack) difficult to achieve from a developer perspective and difficult to learn from a player perspective. It suggests methods of interaction outside of common screen-based ones, and affords exploration with the body. The interaction between real and virtual objects allows for discoveries of interactions unintended by designers, affords players bodily and narrative agency, and players can make experiences for themselves regardless of the designers' intention. In the highly structured, limited space of digital narrative, augmented role-play is an opportunity for exploration and experimentation of the possibilities inherent in the body, and in the relationship between actual and virtual environments..

The flexibility of the toolset allows a distinct experience to be created for specific sites, as virtual primitives stand in for real-world architecture, endowing them with physical properties. It is a simple matter to calibrate an augmented role-play for a new location. This affords exciting opportunities when designing with specific locations in mind, as real-world characteristics, properties, and historical contexts can be brought to bear on the design of virtual elements, bringing about novel meanings.

As increasingly sophisticated technology stacks develop, artworks that challenge the relationship between participant and performer, drawing meaning from interactions between actual and virtual space, may become more widespread. Insights from this research-creation process and this augmented role-play intervention will be useful in determining best practices for these emerging disciplines.

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Appendices

Appendix A: Glossary

The following terms take on specific meanings in the context of this thesis research.

Audience-participant

The recipient of the experience, expected to take an active role in the performance in some way.

Augmented role-play

An experience that places the audience at the centre of a digitally-augmented narrative experience that exists in both real and virtual space, and requires a degree of participation by the audience-participant.

Augmented space

Actual space with virtual augmentations visibly related to particular elements within it.

Collective creation

A collaborative devised theatre ethos involving democratizing a group of creators who improvise around a theme until a performance emergers.

Controller

Any physical device that can serve as an interface to virtual objects. Commonly refers to the interface of a video game, such as a gamepad.

Cue

A trigger made by a stage manager (or in the case of augmented role-play, a performer) that causes an effect to occur.

Cue stack

A pre-programmed sequence of cues that activate in sequence throughout a performance.

Element

Any perceptible piece of the performance.

Game sketch

An electronic exploration that meets Bill Buxton's definition of a sketch (see Game Sketches)

Gesture

A physical motion made by a human agent, capable of being detected by a technology stack.

Immersion

"Pleasurable surrender of the mind to an imaginative world" (Murray)

Liveness

"a paradoxical experience that the work can offer in that the live performance of the work is fleeting and only of the moment, never to be repeated in any form, yet it also lasts in the receiver's embodied memory of the event, a pleasurable and/or disquieting impression that remains" (Machon)

Ludus

The structures that govern the environment that play takes place in - in other words, the rules of the game.

NPC

Non-Player Character. A character whose role is played by a performer or a virtual agent; not a player or audience-participant.

Paidia

Spontaneous, unstructured, ungoverned play.

Player

The term "player" is used in this paper synonymously with "audience-participant".

Performer

A human actor engaged as part of the system - not the subject of it.

Script

Spoken words and stage directions of the performance in text form. Not to be confused with a code script.

Spike

A signifier in a space to indicate where a prop or piece of stage decorations must be located.

Appendix B: Workshop Documentation

Workshop Plans

Template by Suzanne Stein v1 October 9 2019

Workshop 1: Brain and Bodystorming

Details

Date: TBD
Time: TBD
Duration: 90 minutes
Who: 4-6 participants
Facilitators: Nick Alexander
Assistant Facilitators : 0
Other Support roles: *None at this time*
Notes on space:
space must include access to a computer with the necessary programs installed: Unity with ZedSDK and SteamVR, and must have a space arranged using Vive sensors (approx 10x10ft)

Goals:

- Workshop 1:
    - Explore generative affordances of the technology and lay the groundwork for workshop 2.
    - Generate 3-5 strong scenes with clearly experienced MR components.
    - Generate actionable steps for iterating on MR components
    - Generate content for use in Workshop 2

Agenda:

- 5 mins. **Intro**
    - Welcome, introductions, confidentiality discussion,
    - goal
        - first of three workshops
            - Imagination
                - this is *imagination*, the goal is to play and be generative
            - Inquiry
            - Intervention
- 20 mins **Demo + Playtime**
    - Participants to freely explore the MR components to familiarize themselves with the interactions and possibilities
- 5 mins **improv warmup**
    - Game: throw a ball, throw a knife, throw a baby, throw an angry cat
    - Game: walk in a circle, when you “feel” the time is right, change directions
- 10 mins **Brainstorming**
    - As fast as possible, generate stacks of the following on slips of paper

    - 3 mins each:
        - Concepts (stories, plots, myths, literature)
        - Interactions between agents (interesting ways of using the technology)
        - Elements (real-world objects that might be interesting to incorporate into MR)
- 20 mins **Bodystorming**
    - Mixing and matching the generated ideas, improvise short scenes
- 15 mins **Redux with MR**
    - Return to strong scenes with the option of utilising MR elements
- 10 min. **Discussion**
    - discuss and evaluate what has occurred
- 5 mins **Questionnaire**
    - Brief questionnaire to capture the effectiveness of the workshop
- **Total time:** 90 mins

Inputs:

- Paper/post its
- Pencils
- White board & Markers
- Computer
- Vive kit w/ controllers & sensors
- ZEDMini camera w/ head mount
- Webcam for video documentation
- Camera for photo documentation

Outputs:

- Video of the event
- Photographs of the event
- Questionnaire responses
- Generated brainstorm paper responses
- Bodystormed scenes
- Observational notes

Key questions:

- *What improvisational techniques best interface with the MR technology?*
- *How effective is the brainstorm phase in generating useful bodystorming prompts?*

Next steps after workshop:

- Upload and save all digital documentation (photo and video) on secure server
- delete digital documentation from devices
- Scan and digitize consent forms on secure server
- Digitize brainstorm responses and all notes, observational or generated, on secure server
- shred paper consent forms and all paper notes
- Create action items for iterating on MR components
- Capture successful scenes in a brief written summary

Workshop 2: Exploratory Bodystorming

Details

Date: TBD
Time: TBD
Duration: 90 minutes
Who: 4-6 participants
Facilitators: Nick Alexander
Assistant Facilitators : 0
Other Support roles: *None at this time*
Notes on space:
space must include access to a computer with the necessary programs installed: Unity with ZedSDK and SteamVR, and must have a space arranged using Vive sensors (approx 10x10ft)

Goals:

- Workshop 2:
    - Arrange scenes from Workshop 1 into loose script and user flow
    - Generate actionable steps for iterating on MR components
    - Develop scenes ready for synthesis in Workshop 3

Agenda:

- 5 mins. **Intro**
    - Welcome, introductions, confidentiality discussion, goal
- 20 mins **Playtime + Refresher**
    - Participants are given a recap on the previous workshop, and given a chance to play with the newly iterated MR interactions
- 10 mins **Remount scenes**
    - Walk through, perform, and discuss successful scenes from Workshop 1
- 30 mins **Rework scenes**
    - With new insights gleaned from discussion and new MR tech, explore and rework scenes. Find strong story beats and meaningful moments.
    - Begin to capture scenes in script form
    - If necessary, create new scenes with elements cut or discovered
- 10 mins **Video Recording**
    - Video recording of strongest iteration of each scene
- 10 min. **Discussion**
    - discuss and evaluate what has occurred
- 5 mins **Questionnaire**
    - Brief questionnaire to capture the effectiveness of the workshop
- **Total time:** 90 mins

Inputs:

- Paper/post its
- Pencils
- White board & Markers
- Computer
- Vive kit w/ controllers & sensors
- ZEDMini camera w/ head mount

- Webcam for video documentation
- Camera for photo documentation

Outputs:

- Video of the event
- Photographs of the event
- Questionnaire responses
- Rough script notes
- Final video of each scene
- Observational notes

Key questions:

- *What kind of effect does this iterative process have on the development of the scenes?*
- *How effective is this process in developing mixed reality interactions?*
- *How well is the technology incorporated into the workshop setting?*

Next steps after workshop:

- Upload and save all digital documentation (photo and video) on secure server
- delete digital documentation from devices
- Scan and digitize consent forms on secure server
- Digitize brainstorm responses and all notes, observational or generated, on secure server
- shred paper consent forms and all paper notes
- Create action items for iterating on MR components

Workshop 3: Synthesis

Details

Date: TBD
Time: TBD
Duration: 90 minutes
Who: 4-6 participants
Facilitators: Nick Alexander
Assistant Facilitators : 0
Other Support roles: *None at this time*
Notes on space:
space must include access to a computer with the necessary programs installed: Unity with ZedSDK and SteamVR, and must have a space arranged using Vive sensors (approx 10x10ft)

Goals:

- Workshop 3:
    - Develop scenes from Workshop 2 to a state where they are ready for rehearsal and production
    - Determine how to integrate scenes and technology into performance space

Agenda:

- 5 mins. **Intro**
    - Welcome, introductions, confidentiality discussion, goal
- 20 mins **Refresher**
    - Previous scenes are performed at current fidelity with MR interactions included, at best possible fidelity

- 40 mins **Rework scenes**
    - With new insights gleaned from discussion and new MR tech, explore and rework scenes. Find strong story beats and meaningful moments.
    - Begin to capture scenes in script form
    - If necessary, create new scenes with elements cut or discovered
- 10 mins **Video Recording**
    - Video recording of "final" production
- 10 min. **Discussion**
    - discuss and evaluate what has occurred
- 5 mins **Questionnaire**
    - Brief questionnaire to capture the effectiveness of the workshop
- **Total time:** 90 mins

Inputs:

- Paper/post its
- Pencils
- White board & Markers
- Computer
- Vive kit w/ controllers & sensors
- ZEDMini camera w/ head mount
- Webcam for video documentation
- Camera for photo documentation

Outputs:

- Video of the event
- Photographs of the event
- Questionnaire responses
- Rough script notes
- Final video of each scene
- Observational notes

Key questions:

- *How effective has this process been at devising a MR experience?*
- *What gaps exist? What other design needs to be done?*
- *To what extent can this be a collaborative devised experience, and to what extent must a single person make creative decisions?*

Next steps after workshop:

- Upload and save all digital documentation (photo and video) on secure server
- delete digital documentation from devices
- Scan and digitize consent forms on secure server
- Digitize brainstorm responses and all notes, observational or generated, on secure server
- shred paper consent forms and all paper notes
- Create action items for iterating on MR components
- Schedule rehearsal times

Workshop Posters

Augmented Performance

YOU ARE INVITED TO TAKE PART
IN A MIXED REALITY EXPERIENCE

to explore how devised theatre techniques
might be used to create mixed reality experiences

This research is part of a Masters of Design thesis at OCAD University

If you are interested in participating please contact
Principal Investigator Nick Alexander by email
[redacted]*@student.ocadu.ca*
for more information

OCAD UNIVERSITY

This research has recieved clearance for user testing from OCAD University's Research Ethics Board

Icons created by Smalllike and Jugalbandi from the Noun Project

Workshop Feedback Questionnaires

Workshop: User Feedback

* Required

1. **How often do you use Virtual Reality (VR) technology?** *
   Mark only one oval.
   - ◯ Never experienced VR before
   - ◯ Once or twice per year
   - ◯ Once or twice per month
   - ◯ Once or twice per week
   - ◯ Every day

2. **How often do you use Augmented Reality (AR) technology?** *
   Mark only one oval.
   - ◯ Never experienced AR before
   - ◯ Once or twice per year
   - ◯ Once or twice per month
   - ◯ Once or twice per week
   - ◯ Every day

3. **How comfortable were you when wearing the VR headset?** *
   Mark only one oval.

	1	2	3	4	5	
Not at all comfortable	◯	◯	◯	◯	◯	Completely comfortable

4. **What did you find most frustrating about the experience of this workshop?** *

5. **What did you find most interesting about the experience of this workshop?** *

6. **How might the Augmented and Virtual Reality technology you explored be better integrated into the workshop?**

7. **Any other thoughts?**

Mixed Reality Performance: User Feedback

* Required

1. **Describe how this experience made you feel.** *

2. **How often do you use Virtual Reality (VR) technology?** *

Mark only one oval.

- ◯ Never experienced VR before
- ◯ Once or twice per year
- ◯ Once or twice per month
- ◯ Once or twice per week
- ◯ Every day

3. **How often do you use Augmented Reality (AR) technology?** *

Mark only one oval.

- ◯ Never experienced AR before
- ◯ Once or twice per year
- ◯ Once or twice per month
- ◯ Once or twice per week
- ◯ Every day

4. **How comfortable were you when wearing the VR headset?** *

Mark only one oval.

	1	2	3	4	5	
Not at all comfortable	◯	◯	◯	◯	◯	Completely comfortable

5. **What, in your opinion, was the story of this experience?** *

6. **What did you find most frustrating about the experience?** *

7. **What did you find most interesting about the experience?** *

8. **If you could remove one feature what would it be?**

9. **If you could add one feature what would it be?**

10. **Any other thoughts?**

Expert Interview Discussion Guide

- How would you define immersion (in as few words as possible)?
- What distinguishes immersive theatre from non-immersive theatre?

- What is your process for devising an immersive experience?
- What are the key ways that devising an immersive experience differ from devising traditional theatre?
- In what ways are the group/collective activated in devising an immersive experience?
- What specific methods, models, and/or techniques have you found most effective in developing immersive experiences?
- What specific methods, models, and techniques have you adapted from other disciplines in devising immersive experiences?
- What sort of studio-based exercises might you consider applying to devising immersive experiences?
- How much interaction and player agency is appropriate in the context of an immersive experience?
- What are the limitations or pitfalls of immersive experiences?
- What kind of documentation do you use when devising immersive experiences?
- What is the relationship that improvisation has to devising immersive performances? / How is improvisation deployed in devising immersive performances?
- How would you go about increasing accessibility to immersive design?
- What technology have you utilized in your practice?
- What technology have you considered utilizing, but been unable to deploy?
- What is an experience you have really wanted to deploy, but have been unable to due to technical or budgetary considerations?
- What does mixed reality mean to you?
- How might you deploy mixed reality in an immersive experience?
- What are the limitations of mixed reality?

Appendix C: Performer Material

Script

INTRO
The player is in an interstitial screen, like a blindfold. They see motes of light flitting about.
TRIGGER: GAME START
The blindfold fades away, revealing a young woman bustling around a bare room.

TITLE CARD
Playtime for Pebble

Over the next few moments, the title card fades away.
She is putting things in boxes - toys, clothes, kids' books - she is packing up her childhood bedroom. Most of the place is cleaned out now. Cardboard boxes are stacked against the wall. [the orientation of the boxes serve as spikes for some of the virtual elements that the actor will need to interact with]

The woman, ABBY, 19, does not seem aware of the player.

As she packs, she moves some papers, and goes still. She has revealed a small stack of three smooth stones, painted with childish artwork. After taking a moment to consider the stones, she says out loud, as if realizing something long forgotten.

ABBY
Pebble!

She pulls in a breath and looks up, directly at the player. She approaches.

ABBY
Hi Pebble! It's me, it's Abby. Do you remember me?

PEBBLE
[Player has a chance to respond]

ABBY

Pebble, my imaginary friend. Wow, I haven't thought of you in years. When I found the stones you gave me, it all came rushing back.

Abby runs back to the stones and gathers them in her arms. One by one she puts the stones down on a table near the player.

ABBY (CONT'D)
We'd make up games together, and then I'd find stones, and I'd paint the games we played. It was our thing.

She smiles. It stops being a memory of a childish fancy and becomes truth again.

ABBY (CONT'D)
The game stays in the stone. Like a memory.

She gets an idea.

ABBY (CONT'D)
I can't stay much longer. I have to finish packing. But before I go, want to play again? For old time's sake?

She puts her hand on one of the stones.

ABBY (CONT'D)
When we both hold the stone, the game comes out. Remember?

PEBBLE
[Player has a chance to respond]

ABBY
Which do you want to play first?

Whichever the player selects, they lay their hand on it. Abby does too [making sure that the stone doesn't move].

CASTLE
Castle, trees, rocks appear.
Abby rushes over to the boxes.

ABBY
I loved this one! I would make forts out of boxes and blankets and pretend that I was trapped in a tower.

She points at the rocks near Pebble.

ABBY (CONT'D)
And you were a giant! You'd toss boulders at the castle until you knocked it down and set me free!

She hops into the castle, raising her arms!

ABBY (CONT'D)
Get me out! Knock it down! Toss those boulders, giant Pebble!
She laughs with joy as Pebble struggles to knock the tower down. There is some banter if/as Pebble picks up trees or knocks the tower down with their hands.

TRIGGER: END GAME
There is a sound as the scenery fades away. Abby picks up the stone and cradles it.

ABBY
You always got me out. I was so lucky to have a friend like you back then.

Tenderly, she takes the stone to her suitcase and tucks it inside.
[PEBBLE chooses a new stone]

HIDE & SEEK
The room is filled with tall grass, a hollow log, a large ball, and a big bucket.

ABBY
I didn't play much with the other kids, but I loved playing Hide and Seek with you, Pebble!

She walks off into the grass.

ABBY(CONT'D)
We'd pretend we were tiny, running between blades of grass, hiding under rocks and twigs!

Once she has enough distance, she calls back:

ABBY(CONT'D)

Come find me, Pebble!

She tries to stay out of sight as Pebble fumbles around. Eventually, she hides underneath the bucket [or, if the bucket has been moved, inside the hollow log]

ABBY
You found me! You always found me.

TRIGGER: END GAME
The scenery fades away. Abby picks up the rock and cradles it.

ABBY
No matter where I was, you were always there to find me if I was lost.

She carries the stone like a precious object to her suitcase and tucks it away.
[PEBBLE chooses a new stone]

FINGERPAINTING
Three narrow paint vessels appear near the player.
Abby claps her hands in delight.

ABBY
I loved fingerpainting together! It was so much fun to scribble and get messy.

She lifts a single finger, demonstrating.

ABBY (CONT'D)
Remember how we used to do it? Dip your finger in the paint, then reach out and make a mess!

Pebble has some time to get comfortable with it.

ABBY
Can you put me in the picture? How should I stand?

PEBBLE
[Has a chance to direct Abby]

Once Pebble is happy with the image:
ABBY

Let's take a picture! I always painted the stones, but now you've painted something! I want to remember it.

Abby shows Pebble how to take a picture.

ABBY (CONT'D)
Ready? 3... 2... 1…

TRIGGER: Screenshot, then the painting disappears.
Abby goes to the stone and carefully packs it.

A stone begins to appear in Pebble's hand.

ABBY (CONT'D)
You used to give me stones with our games. So I'm going to give you one now. Hold it tight and remember my promise. I'm not going to forget you. You'll be close to me as long as I live.

The stone appears. It has the screenshot that was taken during the painting game.

TRIGGER: GAME END
The scenery begins to fade away, all except for the stone. Abby turns to leave.

ABBY
See you soon, Pebble.

Actor Guide

The following was given to the performer as reference material in preparation for the rehearsal phase.

This is a story about the moment Abby grows up. Abby, now 9, has no friends at school and no confidence, because her parents pay little attention to her. Her mom left her dad (and her) when she was 5. Her dad works hard and leaves her alone much of the time - he is distant and not emotionally present. She met her imaginary friend, Punctum (a word her mom, a photographer, used), when she was 6. Punctum is what Abby needs because she gets his complete attention.

Abby's dad is not pleased about Punctum. He is worried that Abby isn't making friends, and is concerned that an imaginary friend will prevent her from developing normally. He's found a new job in Halifax, and is seizing the opportunity to force Abby to leave Punctum behind: he's told her that Punctum is tied to the house, and can't come with them when they move.

So Abby is packing up not just her stuff, but also her relationship with her imaginary friend. Her dad is too preoccupied to notice how much this is hurting Abby, or to notice that instead of packing she's desperately fitting in one last playtime with her only friend.

WHAT THIS IS

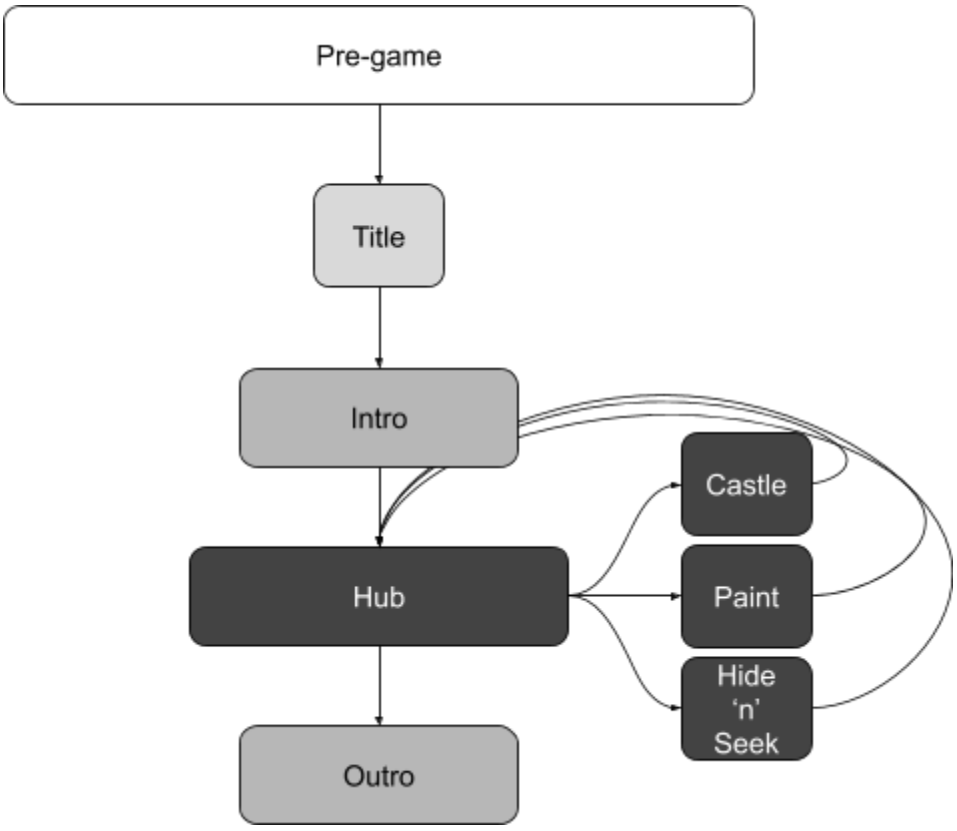
This is an experiment in embodied mixed-reality participatory performance, or *Augmented Role-Play.* A player is presented with augmented reality elements in the context of a live performance in a live space, and has relative freedom to do whatever they wish within the structured fiction.

The player takes the role of Punctum, the imaginary friend of 9 year-old Abby.

STRUCTURE

The experience is relatively linear; the only noteworthy shift is in the order players choose to play the AR games with Abby (and indeed if they get to all three).

- The pre-game is the preamble, fitting, and safety briefing
- The Title
    - The player is brought in, sightless, and seated on the bed. The performer will trigger the game start in this phase.
- The Intro
    - The setup, before the player is given any agency. Abby's strict dad is giving her five minutes to finish packing before they must leave the house and her imaginary friend, Punctum, behind. Instead, Abby decides to have one last playtime with Punctum as a way of dealing with the loss and asserting her agency.
- Hub
    - Once the intro is complete and the player may begin to affect the story, the game enters the Hub state. Before and after each AR game, the experience returns to the Hub state. Here no AR elements are active except for the poster triggers; these triggers are inactive outside of the Hub. Abby learns something new with each game, and does some processing in the Hub.



- Games
    - Castle

        - Abby is being held prison in a castle. Punctum, a giant, tosses boulders at it to knock it down and set her free.
    - Paint
        - Punctum fingerpaints in midair, making an image that incorporates Abby
    - Hide n Seek
        - Abby hides among virtual obstructions, and Punctum must find her.
- Outro
    - Abby decides that it's time to grow up, having had her last playtime with her friend. She promises that she will remember Punctum after she has gone.

MECHANICS

The player is seeing a stereoscopic video (that is, one image in each eye to account for depth perception) of their surroundings, and their hands are being tracked (meaning their hands replace the need for controllers). Their hands are being overlaid with a transparent virtual reality object, meaning they can collide with other VR objects.

Hands cannot be tracked if they are out of the player's sight; they will be informed during the Pre-Game that they will have a better time if they keep their hands in view as often as possible.

The performer cannot see the VR elements and will have to do some acting, relying on their improv skills and their knowledge of the game's layout to sell the fiction that they are part of the augmentations.

The performer has some control over how the game progresses. They will have a VR controller on their person; they can hold the trigger down for 3 seconds to cause the game to activate the next trigger in the sequence. An audible chime will be heard to indicate that the trigger has been accepted, and give the actor some indication of which AR scene is about to start.

The player activates games from the Hub by touching a poster on the wall, which has an image of the game to be played. The player must leave their hand on for 3 seconds in order to trigger it, to prevent accidental triggers. Once in games, control differs slightly:

- Castle
    - The player can batter the boulders around. Clever players will figure out that the boulders can be pinched to pick them up (but it's a little more fun to just bash 'em)
- Paint
    - The player's outstretched fingers will leave streaks of coloured paint in the air.
- Hide and Seek
    - The player's view will be somewhat obstructed by a series of virtual objects; they must look carefully in order to find a hiding Abby. (Players might be able to move the objects with their hands; still working)

When the player has dialogue in the script, they may answer any way they please and play along as much or as little as they wish; the script is written in such a way that it shouldn't matter too much what they say. *If the player does make a choice that drastically alters what Abby's dialogue should be, go with it and improv a proper response - just nudge things back toward the game flow structure.*

SAFETY

Safety is my number one concern. If there is anything I can do to help you feel more safe, let me know ASAP.

Player vision in the headset is not bad; their peripheral vision is limited and there are cables attaching them to a computer. The experience is designed so that players need to move as little as possible; the entire experience can be completed seated in the starting place. Players may move if they are comfortable. *Please do not, as part of an improv, ask the player to walk anywhere.*

There will be an attendant outside the game room. The attendant will be able to see the camera feed from the player's headset.

Players can end the game at any time by placing their arms above their head in an "X" - if this happens, end the game immediately and help them out of the headset, then escort them to the door where the attendant will take over.

Players will be asked not to make physical contact with the actor.

The actor can end the game at any time for any reason, indicating to the player with their arms above their head in an "X" that the game is over. Players will have consented that the actor making the X means the game is over, no questions asked. The attendant will take over and make sure the actor is comfortable before the games resume.

PLAYER QUESTIONS

Players may ask or do things that aren't covered in the script. Here are some expected questions or issues to arise and how to answer/what to do. If anything comes up that isn't covered, improv around it! Anything is acceptable as long as it doesn't contradict a necessary fact or break the game.

Where are you moving?

- Halifax

Why are you moving?

- Dad got a new job, in an office building. He can't do work at his home office anymore.

What does your dad do?

- He's a lawyer.

What kind of law?

- I don't know. He said he's not the kind of lawyer that goes to court.

Does he work a lot?

- Yes. He works in his office downstairs but he usually has the door closed and I'm not allowed in there.

Where is your mom?

- Mom left when I was 5. I don't see her. She doesn't talk to me or Dad.

What did your mom do for a living?

- She was a photographer.

What does Punctum mean?

- It's my best friend's name! It's also something I remember hearing Mom say.

Do you have any non-imaginary friends?

- No. I went to a new school when I was 6. The kids there already knew each other and didn't need to make any new friends.

Summary of DOs and DON'Ts

DO

- Encourage player roleplaying if the player seems to enjoy roleplaying
- Say yes to any new information the player offers as part of a roleplay
- Improv if you are not sure of an answer or an action
- Incorporate augmented elements into your performance to the best of your ability
- End the game immediately by making the X sign if you are uncomfortable
- End the game immediately if the player makes the X sign
- End the game if there is a technical problem

DON'T

- Ask the player to walk anywhere
- Force a player to roleplay who doesn't seem to enjoy roleplaying
- Touch the player
- Touch the headset
- Let the player do anything that makes you uncomfortable

Appendix D: Online Documentation

Development of *Playtime for Punctum* as a live performance in a public space was interrupted by the COVID-19 crisis in March 2020. As a result of the pandemic, it was no longer feasible to mount a performance, which would necessarily bring people into close proximity and afford the sharing of wearables.

In lieu of a gallery showcase, graduating members of the Digital Futures 2020 cohort documented their work online at dfthesis.com/2020.

Supporting documentation for this thesis created as part of this online showcase can be found at the above URL, or at playtime-for-punctum.format.com, including video documentation of the performance as it existed when production was halted, footage of AR experiments, and the code repository.

The code repository can be found at https://github.com/npyalex/Thesis

A remixable 3D model of the wearable rig mount can be found at https://www.tinkercad.com/things/4D4xXViRLnN

Playtime for Punctum was developed with, and runs on, Unity v2019.3.0f5, LeapMotion Model #LM-010, and ZedMini.