UNIVERSITY OF CALIFORNIA, IRVINE

Designing Diegetic Elements in Tangible and Bodily Interactive Narratives

DISSERTATION

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DOCTOR OF PHILOSOPHY

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by

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LIST OF ACRONYMS

BTJ	A Breathtaking Journey
CE	Character Engagement
CI	Character Identification
GW	Gaming Wearables
GWO	Gummy's Way Out
LMA	Laban Movement Analysis
RQ	Research Questions
RtD	Research through Design
SR	Shiva's Rangoli
TEI	Tangible, Embedded, and Embodied Interaction
TNFT	The Next Fairy tale
UCI	University of California Irvine
UTO	Universal Threshold Object

GLOSSARY

Affect	An emotional state represented by the combination of arousal (high energy vs. low energy) and valence (pleasure vs. displeasure)
Affective affordances	Aspects of actions and objects that can help readers express/enact, feel, and impact affective states in the narrative
Affective sync	When the reader and the character both feel pleasure/displeasure together, from a narrative and physiological perspective
Affordances	All actionable possibilities with an object based on the user's physical capabilities
Allegiance	Form a positive judgment about the character's behavior, that is aligning and agreeing with their goals and actions and rooting for them
Alliance	Develop an understanding of the character's goals, actions, feelings, and motivations
Antagonist	The villain of the narrative
Attributes	Levers that shape how an action is experienced, providing more ways of representing actions and consequences that can lead to more buy in, add more stakes, and make readers feel their actions more.
Backlead	A series of strategies that actors can use in an interactive theater piece to help put an audience member at ease and encourage them to perform in the moment. Here backleading refers to guidance cues given to readers to help them perform a role.
Behavioral mimicking	Actions that readers take to mimic what the character does. The reader's body and the character's body are doing the same thing
Body tethers	Design hooks that remind readers THEIR body is in the story world, and is diegetic
Character engagement	Understand and adopt character goals and motives, feel for the character and root for them, feel what the character feels affectively, or take the character's identity
Complex but performatively rich actions	Actions that provide more performative and interpretive options to readers. These actions are not complicated because their consequences are difficult to predict or understand
Complexity of system	Complexities of interaction that readers have to navigate before they can fully engage with the stories. For ex:

	understanding one's role, how to perform, what action leads to what consequence
Complexity of the interface mapping	How difficult it is for the reader to understand the mapping between the action and consequence and predict the impact of their actions
Degrees of interaction	Different ways of interacting with the system like picking up tangible objects or walking around in VR
Desired actions	Actions that help readers stay in their role, aid story coherence, and build CE. Any action the designer hopes the reader would take (Ex: eating healthy food to help Gummy in GWO).
Diegetic	Elements that exist inside the story world. In TEI, tangible diegetic objects are objects that can be a part of the real world and the story world.
Intermediate-level design knowledge	Design knowledge that is not universally applicable and generalized, but still abstract enough to be applied to settings similar to where the design knowledge was produced
Internal role	When readers are positioned inside the story world as opposed to outside of it.
Lived body, Leib	Body as a conduit of lived experiences, which is different from seeing the body as an object in the mirror
Localized sensations	Sensations that cause one to experience the body as theirs (touch, pain, proprioception, kinesthetic sensation, and temperature perception)
Mapping between action and consequence	What action of the reader leads to what consequence in the narrative
Masks	Techniques that actors use to get into and stay in character. If one talks and acts like the character, wears their clothes, and moves and speaks the same, they can experience transformation.
Mistakes	Unintended negative consequences that the reader's action may cause, like unintentionally harming the character.
Modes of feedback	Different modalities through which the system gives feedback like audio, video, among others
Ontological role	When readers can impact the story world and leave a traceable history
Open choices	Choices where readers are not backled much, but rather are encouraged to explore
Protagonist	The main character or 'hero' of the narrative
Rangoli	Colorful patterns that are made on the floor with colored powder and flowers, among other things

React	While performing a role, react refers to acting immediately to external stimuli, without thinking critically
Semantic affordances	Aspects of actions and objects that convey semantic (meanings/ associations) values attached to them
Sensorily perceived and physically performed affordances	Aspects of an action that focus on how an action feels sensorily, and how the action is performed physically, and the action's sensorial, physical, and spatial impact
Suspension of disbelief	Buying into something in the narrative that does not seem possible
System boundary	Imaginary space of the narrative system outside of which actions are not possible. Hitting a system boundary would be like hearing a repeated dialogue or not being able to progress with the story.
Threshold point	Number of times readers are willing to make the same choice without feeling like their choices will not play out in the story and they must follow the character's lead to proceed

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ABSTRACT OF THE DISSERTATION

Designing Diegetic Elements in Tangible and Bodily Interactive Narratives

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Interactive narratives that use tangible and bodily interactions can facilitate multi-sensory, performative, emotional, and lived experiences. Tangible and bodily interactions can be leveraged through diegetic elements as they exist both in the reader's reality and the fictional world, providing readers a way to enter the story world. To unlock the potential of diegesis as a design concept in interactive narratives further, I give design guidelines focusing on three less investigated areas. I explore how diegetic elements can help readers take internal (positioned inside the story world) and ontological (actions impact story world) roles, provide support for character engagement, and help readers navigate possible complexities of novel interactive narrative systems.

I explore these topics through the design and user analysis of three of my storytelling systems – Shiva's Rangoli, the Next Fairy Tale, and Gummy's Way Out. Shiva's Rangoli is a tangible interactive narrative where the reader takes the protagonist's role and impacts his affective state through a diegetic interface and diegetic ambient effects. The Next Fairy Tale is a VR experience where the reader takes a character's role by performing diegetic actions like casting spells as they converse with and understand the antagonist's point of view. Gummy's Way Out (GWO) is a food-based interactive narrative where the reader eats a gummy bear and then helps him find his way out of their body by consuming various diegetic food items and performing different bodily actions.

I provide design guidelines for creating diegetic elements that use tangible and bodily interactions. I describe how *affordances* and *attributes* can leverage the sensory, affective, and semantic aspects of actions with diegetic objects and the body, to provide logically convincing

narrative consequences to actions, and help readers feel the impact of their actions sensorily and emotionally while taking internal-ontological roles. I describe how character engagement can be built by endowing readers with responsibility, aligning their goals and interests with the character's, sharing and negotiating diegetic elements with the character, and applying affordances to help readers wear a *mask* and take a role. Lastly, I identify and recommend how to help readers navigate complexities of the system like - understanding who their character is, how to perform the role and take *desired* actions, and what consequences their actions may cause. This dissertation provides insight into how diegetic elements can help readers step into, enact, impact, and experience the narrative world in a sensory, emotional, and lived way.

Keywords: Diegetic; Diegesis; Tangible interactive narratives; Interactive storytelling; Lived body; Tangibles

Chapter 1. Introduction

We have always been surrounded by stories. Stories detail histories, cultures, and world views. They transport us into magical lands, allowing us to leave our world behind momentarily. They serve as tools for entertainment and creative stimulation. We tell stories to articulate our thoughts and opinions. Stories move us, evolve us, and the ones that touch us the most, we carry with us forever.

Technology has transformed the art of storytelling by carving a path for *interactive* narratives as seen in digital games and in mixed reality. Interactive narratives are stories where readers are not just passive consumers of the story, but are participants in the narrative, either exploring or impacting the story world. Often interactivity is understood as giving readers stakes in story progression, that is, their actions lead to different branching pathways in the story's plot ("*Choose Your Own Adventure*," 2021; *Interactive TV Shows and Movies on Netflix*, 2021). There are also other ways in which a story can be interactive, which do not require giving readers control over the story' plot like allowing the reader to explore a non-linear story, different character viewpoints, deepening story arcs, enacting a character's role, and deciding *how* rather than *what* action is performed (Kors et al., 2016; Mazalek et al., 2002; J. H. Murray, 2016; K. Tanenbaum & Tanenbaum, 2009). At the crux of it all, in interactive narratives, the reader's actions lead to a response or consequence in the story world.

Why are interactive narratives worth exploring? They can help us derive complex and different meanings, reflect on our beliefs, and broaden our world views by showing different perspectives and possible selves, all of which can impact self-growth (Green & Jenkins, 2014). By performing a character's role in the interactive narrative, we can more directly integrate the character's perspective into our own life experience (J. H. Murray, 2016), and understand character motivations (Cohen, 2001). By enacting rather than witnessing a story, we can internalize and personalize the story (Green & Jenkins, 2014). Besides these benefits, we must explore the art of interactive narratives as we need stories to be told in every medium that we can master, because stories allow us to explore who we are and reimagine who we might become (J. H. Murray 2016).

Digital mediums (desktops, mobile phones) have been widely used to deliver interactive narratives. Interactive stories can transport the reader into the story world but digital systems that use the screen, mouse, and keyboard often create a boundary between the reader and the story, as they demand readers to focus on the screen and interface, instead of weaving their actions into the narrative experience. The reader's actions are often reduced to clicking or pressing keys to impact the story world, which does not engage the reader's body and senses in the narrative. In response, the tangible, embedded, and embodied interaction field (TEI) encourages the use of tangible objects and bodily interactions as mechanisms to interact with the story, rather than using traditional screen-based interfaces, breaking the screen barrier and allowing readers to experience the story world in a multi-sensorial way (Mazalek et al., 2002).

Tangible and bodily interactions can provide multi-sensory, performative, and *lived* experiences, allowing readers to enact and live out events in their beloved fictional worlds. For example, imagine exploring and enacting scenes in the story world through meaningful tangible objects from the narrative (like a magic wand). Imagine drinking a shrinking potion, tasting the strange liquid, and watching everything around grow bigger (perhaps in VR). If we compare these examples to pressing a button and watching these scenes play out on a digital screen, the former can engage readers in sensory, physical, and emotional pleasures, allowing them to feel the action and live the consequence, whereas the latter only lets them consume the scene. Tangible and bodily interactions can help readers *feel* the story world more, experience their actions and narrative consequences more deeply, and perhaps add more stakes and buy-in as compared to digital interactions.

One concept that has been used to bring tangible objects and bodily interactions into interactive narratives is *diegesis*. In film media, diegetic elements refer to things that exist within the world of the film's narrative (Bordwell & Thompson, 1997). In TEI narratives, diegetic objects refer to things that exist in the narrative world as well as the real world (Harley et al., 2016; Mazalek et al., 2001; T. J. Tanenbaum & Tanenbaum, 2011). I first came across this concept while reading Mazalek's work on *genieBottles ,* a narrative system consisting of three beautifully crafted glass bottles (Mazalek et al., 2001). When readers open these bottles, they hear different genies come out to tell their stories. The bottles are *diegetic* as they exist in the reader's reality and exist in the story world as homes to the genies. I was struck by the simplicity and transportive capabilities of this idea as the glass bottles connected the reader's reality to the genies' world.

The *Reading Glove* is another example that uses diegetic objects to bring readers closer to the character (K. Tanenbaum et al., 2011). Readers interact with unique objects the protagonist once interacted with to traverse through a non-linear thriller story about a spy. A Breathtaking Journey is a VR narrative experience, where readers play the role of a refugee, escaping behind the back of a truck (Kors et al., 2016). At a critical moment, they are asked to hold their breaths, so they are not caught. If the reader is quiet and not breathing, they escape, otherwise they are captured. In this example, the reader's breath is diegetic and is not only weaved into the fictional world but is also pivotal in deciding the fate of the reader, while also allowing the reader to experience the tension of the refugee to some degree.

These few examples illustrate the power of diegesis to bridge the reader's reality and the story world, connect readers to characters, and engage the reader's body, creating sensory and emotional experiences. Although the concept of diegesis in tangible narrative has existed for the past few decades, there are very few common design guidelines for creating diegetic elements. Most works focus on creating novel interactive narrative experiences that apply diegesis, many times focusing only on the technical aspects of the system. To unlock the potential of diegesis in tangible interactive narratives further, we must explore design knowledge that can help designers and storytellers leverage this compelling concept.

In this dissertation, I provide design guidelines for creating diegetic elements in tangible and bodily interactive narratives. I focus on a few less explored topics in diegetic narratives as explained in the section below.

1.1. Research Overview and Research Questions

While interacting with a narrative, readers can either take internal or external roles, and ontological or exploratory roles (*Game Studies 0101: Ryan: Beyond Myth and Metaphor: The Case of Narrative in Digital Media*, 2001). In internal roles, readers are positioned inside the story world, and in external roles, they are positioned outside of it. In exploratory roles, readers may explore or rearrange parts of the story, but their actions do not impact the narrative world. In ontological roles, the reader's actions impact the story world and leave a traceable history. In the examples above, *genieBottles* and the *Reading Glove*, both put readers in external-exploratory roles as they are not a part of the story world and can only explore and re-arrange

events in the story, whereas *A Breathtaking Journey* puts the reader in an internal-ontological role as they play the refugee's role inside the story world and can impact the character's fate.

Many diegetic tangible narrative systems position readers in external-exploratory roles, and while this position allows them to explore the narrative world, the experience can often feel like a puzzle to be solved. There are very few works in tangible interactive narratives that position readers in internal-ontological roles, an area worth exploring (Harley et al., 2016). Internal roles allow readers to enact rather than witness the story, and ontological roles can give readers stakes in the story which can make them feel more responsible, invested, and in sync with the character's goals and emotions. Since diegetic elements connect the reader's reality to the fictional world, they can easily help readers take internal roles, that is, feel like they are inside the story world. Since diegetic elements exist inside the story world, they can be leveraged to help readers impact the story world, giving them ontological roles. In this dissertation, I explore how to position readers in internal-ontological roles through diegetic elements.

While designing for internal roles, bodily interactions can be leveraged to help readers not only feel like they are a part of the story world, but also feel the impact of their actions sensorily and emotionally. For example, in *A Breathtaking Journey*, the act of holding one's breath may have made readers feel the tension that was building up in the narrative. Such scenes can help readers enact, making the experience more lived. I explore how diegetic elements can help readers *feel* the impact of their actions more.

While creating ontological roles, designers need to think about what kind of diegetic actions the reader would take, and how those actions would impact the story world. However, creating these action-consequence pairs is not simple as the reader should be able to buy into why their actions lead to a particular consequence in the story world. For example, in *genieBottles*, the act of rubbing a lamp to awaken a genie is something that the reader can buy into because of their existing knowledge of fictional worlds. However, many interactive narratives (including my early works), focus more on including a diegetic interface and do not always have convincing narrative consequences to the reader's actions. This can lead to readers questioning why their actions led to the particular consequence, possibly breaking them out of the experience. I explore these concepts further through my first research question:

RQ1: How can different diegetic elements be designed to position readers in internal roles (inside the story world) and ontological (impact story world) roles such that they feel the impact of their actions, and buy into why their actions cause a particular consequence?

I clarify narrative consequences do not always mean impacting the plot of the narrative. Plot-centric consequences can lead to problems of creating complex branching pathways and raise the reader's anxieties of the *path-not-taken* (Aarseth, 1994). I focus on consequences that define *how* an action is performed rather than *what* action is performed (Nay & Zagal, 2017; K. Tanenbaum & Tanenbaum, 2009).

The next topic I explore in this dissertation is how diegetic elements can support character engagement. Often while consuming a story, one may relate to the characters, understand what they are going through, empathize with them, and perhaps even identify with them. This phenomenon is called character engagement (Smith, 1995). Since diegetic elements bring readers closer to the story world, they can also bring them closer to the characters, and even support them in taking the character's role. For example, in the *Reading Glove*, participants reported feeling closer to the character, just by holding objects the character once interacted with. Character engagement is worth exploring as it can broaden one's perspective as people understand events in a different light, aid self-transformation, and facilitate empathy and intense emotional responses (Green & Jenkins, 2014; J. H. Murray, 2016; Pratte et al., 2021). Character engagement increases the pleasure of experiencing and connecting with a narrative, driving the art of storytelling further. However, this too is a less explored topic in tangible interactive narratives. Through my second research question, I explore how diegetic elements can support character engagement as readers interact with other characters or take a character's role. I describe the below-mentioned *aspects* of CE in section 2.3.

RQ2: How can diegetic elements support aspects of character engagement (CE) such as - understand and adopt character goals and motives, feel for the character and root for them, feel what the character feels affectively, or/and take the character's identity, when readers interact with another character or take a character's role?

Lastly, in this dissertation, I study how to help readers navigate various *complexities* that diegetic interactive narrative systems may have. Like with any novel system, readers must understand certain concepts before they can fully engage with the narrative such as - who their

character is, how to interact with the diegetic interface, how their actions impact the narrative, among other things. Moreover, readers must understand and remember all this information while they listen to the story, which can easily be overwhelming. If readers are not able to navigate the complexities, they may not be able to consume a coherent story, which may hinder character engagement. Furthermore, readers may spend most of their time deciphering and taking actions that are exploratory, rather than enacting and taking actions that are intentional. I explore this less investigated topic through my third research question. To narrow the scope further, I focus on complexities that may arise with respect to the previous two research questions – when readers take internal-ontological roles and during character engagement.

RQ3: what complexities might readers face while taking internal-ontological roles and engaging with characters in diegetic interactive narratives? How can readers be assisted to navigate these complexities such that they can intentionally impact and engage with the story?

1.2. Methods and Contributions

I followed a research through design approach to explore the three research questions. I designed, built, user-tested (experience, interviews), and analyzed three interactive narrative systems that leverage tangible and bodily interactions. Each system consists of different diegetic elements, ways of engaging with characters, and aspects of complexity.

Shiva's Rangoli (SR) is a tangible interactive storytelling installation where the reader takes the protagonist, Shiva's role, and impacts his affective state through a diegetic tangible interface. The tangible interface also helps the reader sculpt the diegetic ambience (lights, ambient sound, music, background video) of the space they are in, reflecting Shiva's emotional state. There are fewer guidance cues given to readers in SR. Readers must understand what elements of the system are diegetic, what their role is, and what actions lead to what consequences.

The Next Fairy tale VR (TNFT) is a VR pre-show experience to a Broadway play where readers are encouraged to understand the intentions of the antagonist of the play – Minerva. Readers take the role of Calliope, the queen of fairy godmothers, who is also Minerva's sister, and have a conversation with her during one of Minerva's pivotal life moments. They talk to Minerva by casting spells, which can change the affective tone of the dialogues exchanged between them, bringing out how Minerva feels. The system is full of diegetic backleading cues and diegetic

actions (like casting spells) to help readers play Calliope's role. While readers are given enough guidance, VR can be overwhelming, and so readers are given more structured support for navigating complexities such as understanding their role, their goals as Calliope, and how to interact with Minerva using spells.

Gummy's Way Out (GWO) is a food-based interactive narrative where the reader eats a gummy bear and then helps him find his way out through their body by consuming various diegetic food items and taking different bodily actions. In this system, the reader's body is placed in a diegetic role, and they are endowed with the well-being of the gummy bear. Constant guidance on how to help the gummy bear and the easy predictability of how food may impact the body, makes the complexities of the system easy to navigate. I created GWO after narrowing down my dissertation research questions, while SR and TNFT had similar but slightly different research goals. For this reason, the chapters on GWO are in more detail than those on SR and TNFT.

I analyzed the knowledge produced from all three systems along with the insights from existing works in literature, to provide design guidelines for the three research questions. For the first research question, I give guidelines on how *affordances* and *attributes* can be applied to leverage the sensory, affective, and semantic aspects of diegetic actions with tangible objects and the body. These *affordances* and *attributes* can provide logically convincing narrative consequences to the reader's diegetic actions, and help readers feel the impact of their actions sensorily and emotionally. For the second research question, I give guidelines on how readers can be endowed with responsibility so they have narrative stakes, how they may align with character goals and interests, how diegetic elements can help create conflicts and resolutions between the reader and the character, and how diegetic elements can help readers wear a *mask* to take a role. For the third research question, I identified complexities that readers may need to navigate - understand who their character is, how to perform the role and take *desired* actions, and what consequences their actions may cause (referred to as *mapping between action and consequence*). I describe how designers can help readers navigate these complexities through backleading cues, repeating information through various modalities, and by leveraging *affordances* and *attributes* to create logical and predictable narrative consequences to actions.

These design guidelines are not universal, rather they give intermediate-level design knowledge (Höök & Löwgren, 2012) and start to push the concept of diegesis further by providing

recommendations for creating diegetic elements that can facilitate internal-ontological roles, aspects of character engagement, and help readers navigate system complexities, while leveraging the rich capabilities that tangible and bodily interactions offer. These guidelines can be applied to TEI interactive narratives, VR narratives using tangible and bodily interactions, museum exhibits, interactive theater, interactive dining, and theme parks, among other places.

1.3. Navigating the Design Guidelines

The design guidelines are covered in chapters 9, 10, and 11 of the dissertation, they address RQ1, RQ2, and RQ3 respectively. Since there are a lot of guidelines, I have provided this note on how to read through them efficiently. The guidelines do not give a step-by-step process on how to create interactive narrative systems, but rather provide multiple insights spanning the three research questions.

I have represented the guidelines in a modular way in the form of multiple tables, throughout the three chapters. Each table contains guidelines addressing a particular topic, supported with examples. Above every table, there are guiding questions that can help designers think about how to apply the guidelines of that topic to their work. Each table can be understood and applied independently of the others. For a quick summary of the guidelines on a relevant topic, refer to the table, and for more details, refer to the paragraphs above the table.

If you are reading this dissertation looking for design insights, I would recommend, at the very least, reading chapter 9 on *affordances* and *attributes.* These guidelines are an important contribution of the dissertation, and they have a wide range of applications in the TEI field. They give insights on how to design diegetic actions that have logically convincing consequences in the narrative, and can help readers feel the impact of their actions sensorily and emotionally. However, designing diegetic actions is a thin slice of all that goes into creating a diegetic interactive narrative, so for more insights refer to chapters 10 and 11.

While this dissertation is best read in sequence, if you are short on time, I recommend prioritizing chapter 11 after reading chapter 9. Chapter 11 provides recommendations on how to help readers navigate the system's complexities. This topic is important, as consuming a coherent story without being overwhelmed is essential for a pleasurable experience. Lastly, to

make the narrative experience richer, I recommend reading chapter 10 which can help designers think about how readers can engage and build relationships with characters.

1.4. Chapter Outline

This dissertation has twelve chapters. Chapter 1: Introduction. Chapter 2: Background and context for tangible and body interactions, examples of diegetic interactive narratives that place readers in internal-ontological roles, definitions and design techniques for character engagement, and examples of complexities in diegetic narrative systems. Chapter 3: Research through design methods used for design and analysis. Chapter 4: SR design, study, findings, and design recommendations/takeaways. Chapter 5: TNFT design, study, findings, and design recommendations/takeaways. Chapter 6: GWO design and study. Chapter 7: GWO study findings. Chapter 8: GWO design recommendations/takeaways (sections of GWO are divided into three chapters due to a large number of insights). Chapters 9,10, and 11 give the design guidelines for RQ1, RQ2, and RQ3, respectively. These guidelines come from the analysis of all these three works and insights from the literature review. Chapter 12: Conclusion and future work. Throughout the dissertation, I have provided tables that summarize the main takeaways from the section.

A few clarifications on the terminologies used in the dissertation – I use the word 'reader' to refer to the participants experiencing the interactive narrative system. I have also used the terms interactive narratives and interactive storytelling interchangeably; they both refer to interactive stories where the readers either impact or explore the story. While interactive storytelling can also refer to creating stories, this dissertation is about story consumption, not story creation.

Chapter 2. Background

In section 2.1, I shortly describe the field of tangible, embedded, and embodied interaction (TEI) as it lays the foundation of this dissertation. I elaborate on applications of Merleau Ponty's theory of the *lived* body and Laban Movement Analysis in the field of HCI and bodily play, as these theories can be applied to leverage the sensory and performative capabilities of the body. In section 2.2, I focus on RQ1, I define diegesis and give examples of diegetic tangible and bodily storytelling works that place readers in internal-ontological roles. In section 2.3, I focus on RQ2, I describe character engagement and character identification from film literature and digital narrative games and discuss existing design techniques in this area. Lastly in section 2.4, I focus on RQ3, I illustrate the kinds of complexities that readers may face while interacting with such systems, giving examples from existing TEI diegetic storytelling works.

A note on the terminology: I use the word 'reader' to refer to the participants experiencing the interactive narrative system. Works in narratives-based games use 'player' and those from theater and film use 'audience'. While I generally refer to participants as 'readers', I switch to 'players' and 'audience' while talking about works from games, theater, and film.

2.1. TEI and body – Setting up the Field

In this section, I briefly describe the foundation work in the fields of tangible and embodied interaction (TEI) and HCI design for bodily experiences. I focus on Merleau-Ponty's phenomenology, the concept of the lived body, and Laban Movement Analysis as they have influenced my work in designing for bodily experiences.

2.1.1. Tangibles 1.0

Ishii and Ulmer laid foundations for the TEI field by arguing how we simultaneously live in two worlds – the physical and the digital, but there is an absence of seamless coupling between them as we are connected to the digital realm largely through graphical user interfaces (GUIs) in boxes (laptops and desktops), which require focused attention (Ishii & Ullmer, 1997). They discussed how in real life we process information through haptic interactions with physical objects, yet most of our interactions with GUIs take place through screens. They suggested

seamlessly integrating digital into our environment via physical objects, interactive surfaces (walls, ceilings, etc.), and ambient media (light, sound). (Fernaeus et al., 2008) moved the tangibles field further by integrating the practice-oriented turn in HCI. They encouraged researchers to focus on the knowledge, sense-making, and creativity that tangible systems could facilitate. Many TEI researchers have explored the third wave of HCI which focuses on extending people's ability to create, reflect, and generate innovative ideas (Bødker, 2006). TEI researchers have created technologies for extending one's creativity (Ryokai et al., 2004), engaging with memories (Hoven, 2014), self-reflection (Mols et al., 2016), enchanted IOT (Wallace et al., 2018), and my focus area – interactive tangible storytelling (Harley et al., 2016), among others.

2.1.2. Bodily Experiences and HCI design

Alongside tangible objects, the human body offers rich multi-sensory interactive possibilities. Hutchins' work on distributed cognition set the ground for most work on tangible and body-based interactions in computing (Hutchins, 1995). (Klemmer et al., 2006) discussed that traditional computer systems see humans as no more than an eye, ear, and finger. They argued that technology should better integrate the human body as it is capable of rich performative actions and has an abundance of tacit knowledge (as seen with surgeons, jewelers, sculptors). This argument is relevant for interactive narratives as well, designs should allow readers to engage their whole bodies rather than just their eyes, ears, and fingers, creating a multi-sensory experience.

Diving deeper on how to design bodily experiences, (Svanæs, 2013) described Merleau-Ponty's phenomenology (Merleau-Ponty, 1996) from a lens of perception and the lived body, highlighting core concepts relevant to HCI design. (Svanæs, 2013) discussed that perception is directed - it is shaped by our actions, goals, and our intentions as directed by our tasks. They discussed Yarbus's classic study of how tasks impact eye movement (Yarbus, 2013). When asked to estimate the age of people in a painting, participants looked only at the people in the painting, and not at the artwork as a whole. (Svanæs, 2013) elaborated if those participants would have been asked to recall what else was in the painting, they would have been unable to do so, illustrating that we sense and focus on things based on our tasks. Perception involves the whole body, active senses, and can be mediated through artifacts like a walking stick and even technology. (Svanæs, 2013) further elaborated Merleau-Ponty's phenomenology on the lived

body – the body as experienced by the person, the 'lived' experience, which is different from seeing oneself in the mirror.

Merleau-Ponty's phenomenology has been widely used in tangible and bodily experiences in HCI. (Bakker et al., 2012) used the phenomenology in their work on embodied metaphors, to describe how metaphors from bodily lived experiences can support children's learning in abstract domains. (Schiphorst, 2009a) used Merleau-Ponty's phenomenology to explore how sensory-aesthetic appreciation could be cultivated through attention to our bodily experience. She created artifacts like Whisper (one person was listening to others heartbeat), and Soft (objects talking to each other through whimsical sounds, lights, vibrations) based on Laban Movement Analysis (LMA) (Laban & Lawrence, 1974). (Mueller, Byrne, et al., 2018) described how the 'lived' body could be leveraged in playful bodily experiences.

In my work, I argue for leveraging the 'lived' body, LMA, directedness of perception, and embodied metaphors, so readers can feel their actions sensorily while they interact and perform with their whole bodies in the story world.

2.1.3. Lived Body – Leib

Merleau-Ponty's phenomenology described the lived body – the body as experienced by the person, the 'lived' experience, which is different from seeing oneself in the mirror (Merleau-Ponty, 1996). Merleau-Ponty described the body through the German terms *Leib* as the 'lived body' and *Korper* as an organism (corpse). (Mueller, Byrne, et al., 2018) advocated for leveraging the Leib to design playful bodily experience. They argued that the lived body should be treated as a living, pulsating being, rather than treating it just as an object. For example, placing a big button that needs to be pressed with both hands, at a height above one's head level, would require a person to raise their arms. This would put people in a 'winner-pose' which is associated with positive experiences, which brings the Leib into perspective (how the person feels when they perform the action). They gave examples of works that leverage the lived body – Ava - an augmented e-bike that sped up when one leaned forward (Andres et al., 2016), LOLLio used a lollipop that dynamically changed its taste (Murer et al., 2013), Life Tree - a VR experience with a tree that changed colors based on the rhythm of the player's breath (Patibanda et al., 2017), among others.

(Mueller, Byrne, et al., 2018) further discussed that a person's focus can be brought to their lived body through perception and localized sensations (touch, pain, proprioception, kinesthetic sensation, and temperature perception), as these sensations enable people to experience their bodies as 'theirs' (Leib). Sensations can be driven from external modalities as well. For example, (Alam et al., 2013) created a haptic jacket that simulated actions such as touch, poke, hug, tickle through vibrations on different parts of the body. (Lopes et al., 2015) actuated human muscles to repel so that when the human hand approached the object, it looked as if the object did not want to be touched. (Akiyama et al., 2013) created a wearable where people could experience music alongside thermal changes, which elicited emotional responses.

(Svanæs, 2013) discussed Merleau-Ponty's description of abstract vs. concrete movements, another concept that can bring people's focus to their lived bodies. Movements made naturally as a part of daily life actions like walking are 'concrete'. However, if a person is intentionally asked to move their left foot in front of the right, outside the context of walking, the action becomes 'abstract', and forces people out of their habitual behaviors, bringing focus to their lived bodies.

(Mueller, Byrne, et al., 2018) elaborated that the lived body can also be leveraged by sensing and feeling emotions. They said that many works just sense emotions (like heart rate data), however, designers should not just stop at sensing, but also consider how one feels.

I apply the concept of the lived body to interactive narratives to help readers feel as if their bodies are a part of the narrative world, to help them *feel* the consequences of their actions, and to help them express and feel emotions in the narrative as well. To explore the connection between body movements and emotions further, I describe works that use Laban Movement Analysis.

2.1.4. Laban Movement Analysis

Laban Movement Analysis (LMA) is a method for interpreting human movement that has been widely used by dancers, actors, and even health professionals. LMA comprises five major components - body, space, effort, shape, and relationship (Laban & Lawrence, 1974). Prominent works that have used LMA in HCI focus on shape and effort to describe communication and gesture (Fagerberg et al., 2003; Schiphorst, 2009b; Zhao et al., 2013). Shape describes the

changing forms of the body in space in three different planes (table, door, and wheel) as shown in Figure 1 taken from (Fagerberg et al., 2003), who cite Davies (Davies, 2007).

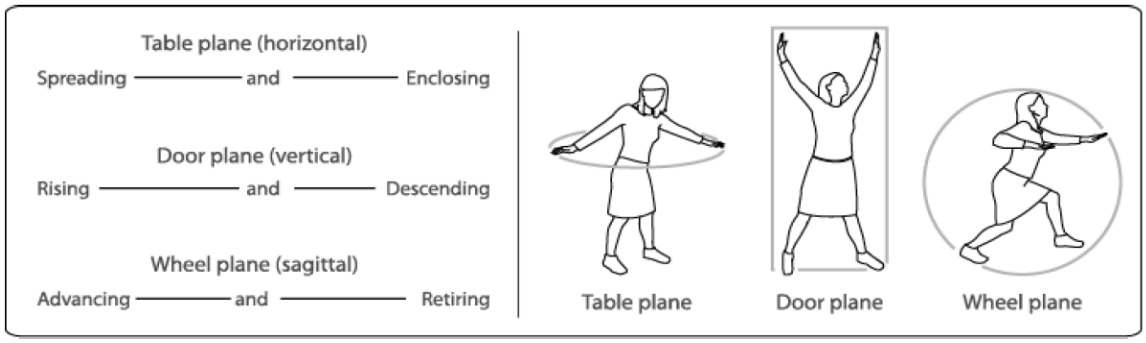
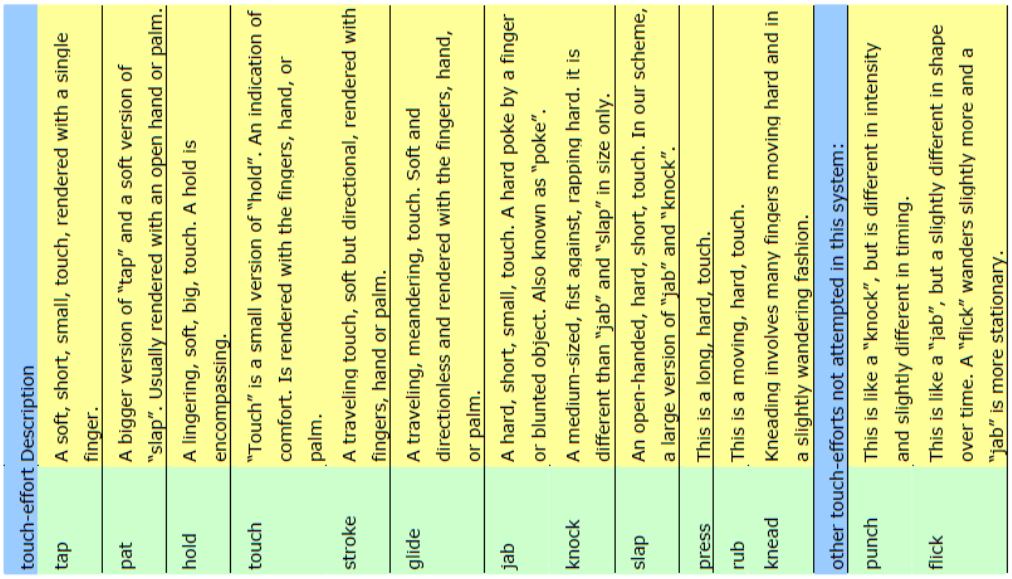


Figure 1: LMA shape dimension as shown in (Fagerberg et al., 2003), taken from (Davies, 2007)

Effort describes the dynamic qualities of movement in the form of weight (heavy or light), space (direct or indirect), and time (sudden or sustained). There are eight basic effort actions based on the combinations of the above three dimensions (Johnstone, 1992; Schiphorst et al., 2021):

- punching : sudden / heavy / direct
- slashing : sudden / heavy / indirect
- wringing : sustained / heavy / indirect
- stroking : sustained / light / indirect
- dabbing : sudden / light / direct
- smoothing : sustained / light / direct
- pushing : sustained / heavy / direct

LMA has been used to describe different ways of movement, how different actions carry various meanings, and how body movements can elicit emotions (Fagerberg et al., 2003; Schiphorst, 2009b). (Schiphorst, 2009b) applied LMA's effort dimension to describe how qualitative aspects of touch could be described computationally (Figure 2). They created soft tangible objects that communicated with the participant and each other through sound, vibrations, and light-based on different actions the participant took. These actions were mapped to touch (pressure, number, size, speed, and direction) and effort (weight, space, and time).



touch-effort	Description
tap	A soft, short, small, touch, rendered with a single finger.
pat	A bigger version of "tap" and a soft version of "slap". Usually rendered with an open hand or palm.
hold	A lingering, soft, big, touch. A hold is encompassing.
touch	"Touch" is a small version of "hold". An indication of comfort. Is rendered with the fingers, hand, or palm.
stroke	A traveling touch, soft but directional, rendered with fingers, hand or palm.
glide	A traveling, meandering, touch. Soft and directionless and rendered with the fingers, hand, or palm.
jab	A hard, short, small, touch. A hard poke by a finger or blunted object. Also known as "poke".
knock	A medium-sized, fist against, rapping hard. it is different than "jab" and "slap" in size only.
slap	An open-handed, hard, short, touch. In our scheme, a large version of "jab" and "knock".
press	This is a long, hard, touch.
rub	This is a moving, hard, touch.
knead	Kneading involves many fingers moving hard and in a slightly wandering fashion.
other touch-efforts not attempted in this system:	
punch	This is like a "knock", but is different in intensity and slightly different in timing.
flick	This is like a "jab", but a slightly different in shape over time. A "flick" wanders slightly more and a "jab" is more stationary.

Figure 2: Different tactile actions from (Schiphorst, 2009b)

(Fagerberg et al., 2003) mapped affective movements using LMA's dimensions of shape and effort, and the valence dimension (pleasure vs. displeasure) from Russel's circumplex model of Affect (Russell, 1980). They cited (Ekman et al., 2013) and described how emotions can be generated from different body movements – like moving when one is happy vs. moving when one is sad. Based on this theory, (Fagerberg et al., 2003) designed gestures (like shaking and swinging) for a mobile phone that users could perform to express different emotions while texting. In their work, they asked an actor to perform nine different emotions and described the actor's body movement through LMA. For example, they described anger as 'somewhat spreading, rising, and advancing movements', and sad as 'enclosing, descending and retiring movements'. They combined these descriptions with valence (pleasure vs displeasure) to design gestures that expressed different affective states. For example, emotions of displeasure were associated with strain and tension, while emotions of pleasure involved less strain and pressure. These gestures allowed users to represent a range of emotions while texting rather than representing just one emotion.

(Fagerberg et al., 2003; Schiphorst, 2009b) showed how LMA can be applied to design actions that carry different sentiments and emotions. In this dissertation, I describe how various diegetic bodily actions inspired by LMA, can help readers communicate different emotions and sentiments to characters. For example, punching a character carries different sentiments than patting or stroking them.

2.2. Diegetic Interactive Narratives and Internal-Ontological Roles

Tangible objects have long been used in interactive narratives to give readers a gateway to the story world. Often these objects are used to help readers explore or impact the narrative. Tangible objects and bodily actions in interactive narratives offer much more than a click of a button – they provide sensory and transportive experiences, allow readers to enact using meaningful narrative objects, and evoke emotional responses. A commonly used concept for using tangible objects in interactive narratives is '**diegesis'**.

In this section, I describe what diegesis is, works that use diegetic concepts, and the focus of this dissertation – designing diegetic elements for internal-ontological roles.

2.2.1. Defining Diegetic objects

The term 'diegesis' is widely used in film media. (Bordwell & Thompson, 1997) defined the term 'diegetic' as things that exist within the world of the film's narrative. For example, background music in a film is not diegetic as it is not a part of the story world, but if that same background music is playing on the radio in the film, the music becomes diegetic. The term diegesis has also been used to refer to the 'story in the voice of the narrator', often used while comparing it to mimesis (story that is enacted) (Halliwell, 2014). This is *not* how I use the term diegesis in this dissertation. I use the word diegesis to describe 'existing inside the story world' as used in film media.

This concept of diegesis has been extended to tangible interactive narratives as well. 'Diegetic objects' in tangible interactive narratives are objects that can exist in the narrative world as well as the real world (Harley et al., 2016; Mazalek et al., 2001; T. J. Tanenbaum & Tanenbaum, 2011). These diegetic objects in the real world are not just mere representations of objects in the story world, rather they *are* the objects in the story world.

Similar to diegetic objects, (J. H. Murray, 2016) coined the term 'threshold' objects that exist in reality and in fiction, allowing people to cross the threshold into the designed experience. (Bizzocchi et al., 2011) phrased 'narrativized interfaces' which refer to game interfaces that are integrated with the narrative of the game through 'look and feel' of the interface, behavioral mimicking, behavioral metaphors, and mixed reality interfaces. Diegetic objects are also similar

to the term 'boundary objects' - objects that inhabit several intersecting social worlds and satisfy the requirements of each of them (Star & Griesemer, 1989).

Figure 3: genieBottles (L) and the Reading Glove (R)

A classic example of a diegetic interactive narrative is *genieBottles* (Mazalek et al., 2001). Genie Bottles consists of three beautifully made glass bottles (Figure 3, left). Readers open these bottles and hear different genies come out to tell their stories. If two bottles or more are opened at the same time, the genies start talking to each other. The bottles are *diegetic* as they exist in the reader's physical world and are homes to the genies in the story. Another example is the Reading Glove (Figure 3, right), where readers interact with unique meaningful *diegetic* objects to traverse through a non-linear thriller story about a spy (Tanenbaum and Tanenbaum 2011). Readers expressed how they could identify with the main character by holding and interacting with objects that the character interacted with. Recently, diegetic objects have also been used in virtual reality narratives (VR) where the readers can touch these objects in reality and see a version of them in the VR story world as well (Harley et al., 2017).

The above works show how diegesis can give readers a gateway to the story world, feel a part of the narrative, and even connect with characters in the story. Even though the concept of diegesis has existed in theory for the past few decades, there is a dearth of common design guidelines for creating diegetic elements, beyond the use of threshold objects. Few works have started exploring recommendations. For example, (Echeverri & Wei, 2021) provide a typology to help think about artifacts for storytelling– the extent of diegesis, the closeness between where the action is performed and where the consequence takes place (embodiment), narrative function, and ways in which the artifact interacts with the environment. This work begins to

provide guidelines for creating artifacts for storytelling, but it also shows the relative scarcity of such design recommendations.

2.2.2. Defining Internal-Ontological Roles

(Harley et al., 2016) created a framework for tangible narratives where they categorized 21 pieces based on the primary users of a system, media, narrative function of the tangible objects, diegesis, narrative creation, narrative choice, and narrative position. The paper above provides a thorough literature review of tangibles and interactive narratives. (Chu & Mazalek, 2019) extended Harley's framework to include embodied narratives, giving an extensive literature review of interactive narratives with bodily interactions.

While (Harley et al., 2016) identified multiple interesting themes, the one that I focus on in this dissertation is the narrative position with respect to diegesis. (Harley et al., 2016) cited Ryan's definition of the narrative position and stated that readers can assume one of four narrative positions: external-exploratory, internal-exploratory, external-ontological, and internal-ontological (*Game Studies 0101: Ryan: Beyond Myth and Metaphor: The Case of Narrative in Digital Media*, 2001). Given below are the definitions:

Table 1: Narrative positions as described by Ryan

Narrative position	**Definition**	**Examples from different works**
Internal	Readers and their actions are situated inside the story world	Readers play the character in the story, or enter as themselves inside the story
External	Readers are situated outside the story world, removed from the characters	Readers are observers outside the story, or a God-like entity controlling the story
Exploratory	Readers uncover story events and might reorder story events	Readers explore non-linear narratives, character perspectives, deepening arcs
Ontological	Readers make decisions that alter the state of the story world, leaving traceable histories	Readers impact story outcomes, or actions lead to branching narratives

(Harley et al., 2016) found that very few interactive narratives leverage diegetic objects, and further encouraged their use. They also pointed out that there are very few systems that allow readers to take internal – ontological roles, a focus point of this dissertation.

Many interactive narrative systems position readers in external -exploratory roles, and while this allows them to engage with the narrative world, readers often treat these kinds of interactions as puzzles to be solved. On the flip side, internal roles allow readers to enact rather than witness which can lead to character identification, transformation, direct integration of the character's perspective into the reader's own life experiences, and broadening of the reader's perspective as they would understand events from their character's point of view (Green & Jenkins, 2014; J. H. Murray, 2016; T. J. Tanenbaum, 2015). Ontological roles can give readers stakes in the story which can make them feel more responsible, invested, and in sync with the character's goals and emotions (T. J. Tanenbaum, 2015). Taking ontological roles can help personalize the story, derive complex and different meanings (Green & Jenkins, 2014), and see one's own core beliefs, values, and judgements. For these reasons, internal-ontological roles in interactive narratives are worth exploring.

2.2.3. Examples of Diegetic Interactive Narratives

I describe works in the domain of tangible, bodily, interactive storytelling that focus on diegetic concepts and have inspired my thinking. I touch upon a few works that position readers in external-exploratory roles, but mostly focus on the ones that put readers in internal or/and ontological roles, as they are more relevant to the dissertation. For a larger literature review on TEI and storytelling, refer to (Chu & Mazalek, 2019; Harley et al., 2016).

I focus on works that involve story consumption rather than story creation. I follow (Harley et al., 2016) loose description of interactive narratives as pieces where there is a plot, character, or/and a narrative setting. Through these works, I illustrate topics in diegesis that have been explored and identify areas where there are more opportunities for research. I refer to these works again in Chapters 9,10, and 11 to provide supporting examples to my design guidelines.

A few significant early diegetic works that position readers in external-ontological roles are *genieBottles* (Mazalek et al., 2001), Every Object tells a Story (Holmquist et al., 2000), and the Reading Glove (T. J. Tanenbaum & Tanenbaum, 2011). In *genieBottles*, readers opened bottles and heard genies tell their stories. Readers were positioned outside the story world and while they could hear different narrative arcs, they could not impact the story in any way, putting them in external-ontological roles. In Every Object Tells a Story, objects had memories that the

reader could access. Each object held a different perspective of the same event. Here too, the reader was in an external-exploratory role. The Reading Glove, a non-linear thriller narrative about a spy also positioned readers in external-exploratory roles, as they pieced together the protagonist's story by interacting with objects he once interacted with (K. Tanenbaum et al., 2011). A few participants in the Reading Glove reported feeling connected to the character because of the diegetic objects, feeling what the character was going through. (Dagan, 2018) took the idea of the Reading Glove further, where the reader wore the coat of a character, and rummaged through the pockets to find different objects, and heard the character's stories related to those objects. Wearing a character's cloak and rummaging through it feels personal and can connect readers to the characters. the Reading Glove and the cloakroom design showed that meaningful diegetic objects belonging to the character can establish character connection.

A few works use multi-sensory experiences to mimic the sensory environment of the story world. While this design concept can place readers in internal roles as they enter the narrative world, their interactions are largely exploratory, at times even passive. (Harley et al., 2018) discussed how tangible materials in VR can mimic sensory environments and create passive interactions. They created a beach day in VR and surrounded the player with real sand, a drink, and warmth. (Wiseman et al. 2017) re-created Flatland, a 2D world with only sound and touch as the prominent senses (Figure 4). They invited audience members to a dark interactive theatrical experience where the audience could not see but hear narratives from the story world by interacting with diegetic pieces like pipes and windows, among others. In the House of Eternal Returns, guests explored rooms, entered portals in hidden spaces like the inside of a washing machine, and played with interactive light and musical objects to explore a mystery story (Figure 4)(*Meow Wolf - An Immersive Experiences Company*, 2021)

The rest of this section focuses on the few works that position readers in internal-ontological roles. Tangible Comics enabled a full-body interaction performance where the participant saw their performance on a projection screen (Samanci et al., 2007). The participant played the role of a female egg in the reproductive system, bringing focus to the feminist perspective of procreation. They used diegetic objects and gestures such as jumping from the ovary to the fallopian tube, waving to mimic the movement of the hairy structures in a fallopian tube, and holding a sperm to see the possible child. This work shows the potential of using full-body interaction to mimic and perform the character's (egg's) actions.

Figure 4: (L) Snippets from dark interactive theater (Wiseman et al. 2017) and (R) Meow Wolf 's House of Eternal Returns

Universal Threshold Object (UTO) introduced a haptic handheld controller for interactive television narratives. (Chu et al., 2015) demonstrated its potential with an interactive narrative piece based on the TV Show American Horror Story, where readers took the protagonist's role. In the first scene, UTO looked like a flashlight on TV, and readers used it to navigate their way. The UTO / flashlight vibrated in a heartbeat-like pattern to signify the protagonist's heartbeat. If the reader navigated to the desired area (where the plot moved forward), the diegetic heartbeat vibrations grew stronger, whereas if the reader navigated to undesired areas, the vibrations slowed down. In the second scene, readers found the protagonist's husband hung by a rope. The UTO turned into the rope on the screen and readers could either save the husband by holding on to the rope / UTO tightly or kill him by loosening their grip. However, in both cases, the husband ended up dying, true to the show's plot. This work shows how readers can be given ontological roles without changing the overall plot. The authors reported that participants had trouble understanding what the vibrations meant. They recommended including verbal and audio cues, alongside the haptic cues. While this work shows the potential of internal-ontological roles through diegetic actions like gripping the rope, the authors focused more on designing for haptic and gesture-based interactions, less so on the diegetic gestures.

(Clifton et al., 2013) created Don't Open that Door, another gesture-based interactive TV experience based on the horror show *Supernatural*. The reader entered the experience as themselves, interacted with various characters, and made choices that led to branching pathways, positioning them in internal-ontological roles. In one of the scenarios, a character asked the reader to draw a circle with salt around themselves to be safe, a *Supernatural* standard. The authors described their findings from the study and mentioned that since many

people had not seen the show before, they questioned the character's intentions and did not understand why they had to draw a circle. The authors also described that the lack of scenario setting made participants feel distracted as they kept asking for more context. These findings show that while designing for internal roles, readers must be given context about the story world and their role. In another scenario, a character asked the reader to take their hand, holding their own hand out (Figure 5). The authors described that the verbal, visual, and mimetic cues together helped guide the reader to take the character's hand. This early work gives few insights on how to help readers perform a role and desired actions– the need for context and multiple cues.

Figure 5: Hand gesture from Don't Open that Door

(Harley et al., 2017) explored the use of diegetic tangible objects in virtual reality narratives. In one of the interaction scenarios, the reader entered a forest and interacted with a tangible, furry, squirrel which they could hold in reality and see in VR (Figure 6). In the scene, the squirrel was panicking, and the reader could feel the squirrel's heart rate quicken through haptic interactions. They could also stroke and pet the squirrel to calm it down, feeling the heart rate slowing down as well. In another scenario, readers interacted with a cube that they could hold in reality and see in VR. They were asked to save the forest by solving a puzzle on the cube – by tapping the faces of the cube in the correct sequence to play the forest song. Harley et al. reported that participants found the interaction with the squirrel most immersive and reported the squirrel felt lifelike and real, as the squirrel's heartbeat reacted to their actions, unlike the cube. I also hypothesize that the act of stroking the squirrel to calm it down is more believable than tapping the cube to save the forest. The cube interaction may have required more suspension of disbelief. The comparison of these examples shows that designing for ontological roles is not simple - how do we design actions that lead to believable impacts?

(Kors et al., 2016) created A Breathtaking Journey, a rare example that used diegetic bodily actions to help readers play a role. This VR experience focused on empathy building, where the reader played the role of a refugee trying to escape. In one of the scenes, a patrol inspected the truck's cargo in which the reader was hiding (Figure 6). The reader was instructed to stay quiet and not breathe. The reader's breath was tracked and if they were not quiet and breathing, they were captured. While the paper mostly focuses on empathy building through an interactive narrative, and not on diegesis, this particular example shows how the reader's breath can be diegetically used to place them in an internal role.

Figure 6: (L) The squirrel from (Harley et al., 2017) and (R) A Breathtaking Journey (Kors et al., 2016)

Recent work by (Harley et al., 2021) focused on sound-based diegetic interactions in VR. In one of the scenarios, the reader was invited into a wizard's workshop where they were asked to help the wizard create rain by producing a rainy soundscape. The reader created wind by moving their hands across the worktable, the faster they moved, the stronger the winds became. To add water to the soundscape, readers picked up and shook a jug of water, creating a sloshing sound. Pouring the water out, created splashing sounds all around the workshop. In another scenario, readers could localize ambient sounds (like sounds of the forest, birdsongs, etc.) in an orb, and could move these orbs and the sound they contained to different zones/locations. (Harley et al., 2021) illustrated how different physical actions (like moving hands), their sensations (like winds), and their sounds (like pouring) could be integrated as diegetic actions to impact the narrative.

(Harley et al., 2019) created a smartphone VR experience, so people were not limited by the constraints of space and could move around while interacting with a story. They used the capabilities of the mobile phone in a diegetic way like receiving text messages from a non-player

character. The reader was guided to certain locations through audio and text messages, where they saw portals (through VR). The portals converted the physical space of the reader into a diegetic one as the story world bled into the reader's reality.

(Jung et al., 2021) brainstormed gaming wearables. Although this piece does not strictly fall into storytelling, many of their examples could be used to position the diegetic body in an interactive narrative. A few examples they hypothesized were - a wearable wig where pulling a braid activated their character's shield, a wizard cloak that turned one invisible if their heart rate were low and they stayed calm, a fireball spell that got bigger when one's heart rate was low, and an actual health potion that one could drink to raise their character's health. These examples show how one's clothes, heart rate, and drinking potions can position the body in a diegetic role. The table below gives a summary of these works and insights relevant to the dissertation.

Table 2: Summary of relevant interactive narrative works

Project	**Interaction**	**Insight**
The Reading Glove	Readers hold objects the character held to traverse through a non-linear story	Use diegetic meaningful objects to help readers connect to the character
Recreation of Flatland	Readers explore stories of a 2D world in the dark through touching installations	Mimic the sensory environment of the story world to place readers inside it
Tangible Comics	Readers take the role of a female egg and use diegetic gestures like jumping and waving to travel through the reproductive system	Use full-body interaction to mimic and perform the character's actions
Universal Threshold Object (UTO) - a handheld device for interactive TV	UTO turns into a flashlight and vibrates to mimic the character's fastening heart rate. UTO turns into a rope which the reader can grip tightly or loosely to decide the fate of a character	Use verbal and audio cues, alongside haptic cues to help readers understand what the vibrations mean. Use diegetic *actions* like gripping a rope to give readers ontological roles
Don't Open that Door - Interactive TV experience.	Readers are asked to create a salt ring around themselves in the story for safety. Readers are asked to take the hand of the character, where the character held out her own hand as well.	Setting context, scenario, and role description is important as participants questioned why they were being asked to create a salt ring. Use verbal, visual, and mimetic cues together to help readers take actions like taking the character's hand
Tangible-VR – VR experience with tangibles	Readers stroke a squirrel (in reality, and in VR) to lower its heart rate and calm it down. They	The act of stroking a squirrel to calm it down is meaningful but tapping a pattern on a cube to save the forest

	tap a pattern on a cube to play the forest song and save the forest	requires more suspension of disbelief. How can we design actions that have believable impacts?
A Breathtaking Journey – a VR experience	Readers play the role of a refugee traveling in the back of a truck. They are asked to hold their breath, so they are not caught by the patrol.	Use the diegetic body like the reader's breath to place them in an internal role. Holding one's breath connects to panic and fear the character may be feeling.
Sound-based diegetic interactions in VR	Readers create wind by moving their hands across the worktable, the faster they move, the stronger the winds become. Readers localize ambient sounds in an orb, which can be moved to different zones/locations	Use different physical actions (like moving hands), their sensations (like winds), and their sounds (like pouring) as diegetic actions to impact the narrative.
Mobile Realities - smart-phone VR experience	Readers receive texts from a character, see portals through VR in physical spaces they are guided to	Use functionalities of the mobile phone to give diegetic cues. Physical spaces can be diegetic as well, as the portals from the story world bled into the real world.
Gaming Wearables (GW)	A wearable wig where pulling a braid activates their character's shield, a wizard cloak that turns one invisible if their heart rate is low (calm), and an actual health potion that one can drink to raise their character's health.	Use the reader's clothes, heart rate, and the act of consumption to position the body in a diegetic role.

2.2.4. Focus of the Dissertation – RQ1

(Harley et al., 2016) pointed out the dearth of narrative systems using diegetic objects and placing readers in internal-ontological roles. The few works listed above that do use diegesis and position readers in internal-ontological roles do not focus their design and evaluation on these topics, a key focus area of this dissertation.

While designing for ontological roles, designers need to think about what kind of diegetic actions the reader would take, and how those actions would impact the story world. Some action-consequence pairs may be more realistic and convincing than others. For example, (Harley et al., 2017) reported participants found the act of stroking the squirrel to calm its heart rate down immersive and realistic, more so than tapping the cube to save the forest. While there may have been other reasons for this finding, the act of stroking a squirrel to calm it down

feels more logically convincing than tapping a cube pattern to save the forest. If the readers feel that the action has a logically convincing impact, and they may buy into why their actions cause a particular consequence more. Similar to the above examples, holding one's breath to not get captured (Kors et al., 2016), and rubbing a lamp to hear a genie (Mazalek et al., 2001), are both reasonable and believable consequences to actions. However, tapping sides of a cube to save the forest (Harley et al., 2017), pulling a wig's braid to activate a shield (Jung et al., 2021), a flashlight that vibrates to show an increased heart rate when pointed in the right direction (Chu et al., 2015), and creating a salt ring to protect oneself without any context of the story (Clifton et al., 2013), are all scenarios where the readers may question why their actions led to the particular consequence, which may require more suspension of disbelief, and even distract readers enough to break them out of the experience. I advocate readers should not be left questioning why their actions caused a particular consequence in the story. Therefore, one of the questions I focus on in the dissertation is – while for designing ontological roles, how can we create diegetic actions that lead to convincing and believable consequences in the story?

As described by Ryan, many works place readers in ontological roles by giving them the ability to impact the story by choosing between branching pathways (Don't Open that Door, a Breathtaking Journey). I extend this definition of ontological roles and focus on non-plot-centric aspects that the reader can impact in the story world, while still leaving a traceable history like impacting the affective response or well-being of a character. Branching pathways often require the authors to complete the cumbersome task of creating many branching plots while delivering a coherent narrative, which can lead to combinatorial explosions (Stern, 2008). Branching pathways can also create anxiety in the reader for the path not taken (Aarseth, 1994). I focus on ontological roles that allow readers to impact the narrative without changing the overall plot and outcome of the narrative, while still having stakes in the narrative, encouraging them to engage in the pleasures of sensory stimulation, enactment, and being a part of the story world, rather than thinking about the story paths they might be missing out on.

Very few works give insight into positioning readers in internal roles like – using multiple cues and context to help readers perform an action as a part of the story (Clifton et al., 2013) or using one's breath to place them in a role (Kors et al., 2016). While I broadly focus on how diegetic elements can position readers in internal roles, I also explore how the reader may *feel* the impact of their actions sensorily and emotionally. If readers feel their actions and consequences

as a part of the story world, it can help them take internal, and at times even ontological roles. For example, *A Breathtaking Journey* required readers to hold their breath, creating a sensation of fear and panic, similar to what the protagonist may be feeling, putting them in an internal role. In the wizard scenario (Harley et al., 2021), readers created winds by moving their hands across the worktable, feeling the wind on their hands as well. This sensation may have reminded them that their actions were a part of the story world, again placing them in internal-ontological roles. While most works sensorily mimic the story's environment to place readers in internal roles, these two examples demonstrate how diegetic actions and the way they *feel* can be used to place readers in internal-ontological roles. Tangible interactions have the unique strength of engaging people's bodies and senses, which can be leveraged in interactive narratives, as described in the above examples. In the dissertation, I explore how to design diegetic actions that readers can feel sensorily and emotionally, using theories on designing for the body from section 2.1 – lived body, and LMA.

Lastly, while there is a consensus on how diegetic / threshold/boundary objects can connect readers to the story world, other diegetic elements such as one's body, wearables, cues, and actions have received less attention. I identify and discuss how other diegetic elements besides objects can place readers in internal-ontological roles. The focus points listed in this section form the first research question of this dissertation:

RQ1: How can different diegetic elements be designed to position readers in internal roles (inside the story world) and ontological (impact story world) roles such that they feel the impact of their actions, and buy into why their actions cause a particular consequence?

2.3. Character Engagement

In this section, I describe what character engagement and identification is, why it is a worthwhile research topic, and how researchers have designed for the phenomena. I use both concepts of character engagement and identification when readers play the role of a character or engage with other characters in the narrative.

2.3.1. Defining Character Engagement

Often while watching a movie or reading, one may relate to the characters, understand what they are going through, empathize with them, and maybe even lose one's sense of self. This phenomenon is called character engagement or character identification and is linked to broadening one's perspective and building empathy (Cohen, 2001; Green & Jenkins, 2014; Smith, 1995). Character engagement and identification can occur in an interactive narrative as well (Lankoski, 2011).

Cohen summarized work by Freud, Wollheim, and Bettelheim on character identification and defined it as – "identification is an imaginative experience in which a person surrenders consciousness of his or her own identity and experiences the world through someone else's point of view…The varying intensity of identification reflects the extent to which one exchanges his or her own perspective for that of another and is able to forget him- or herself (Cohen, 2001)." However, Smith argued that most character identification in films does not require a person to forget their self-identity (Smith, 1995). For example, one reacts to a character being in a situation rather than thinking of themselves as the character in that situation. This is why while watching a film, one does not personally fear the antagonist, but feels anxiety for the protagonist. Smith continued, that people can understand a character's state and point of view without replicating those feelings directly. Instead of character *identification*, Smith used the term character *engagement* (CE) – a combination of sympathy / central imagining and empathy / acentral imaging. Sympathy is cognitive as one forms a viewpoint on how they feel about the character and their actions. Empathy is not cognitive and is more to do with reacting to a character's environment and situation, describing the viewer's affective response to the character. I use the term character engagement (CE) in the dissertation as it is a useful concept for when readers are engaging with a second character.

Smith described empathy as voluntary simulation and involuntary mimicking. Voluntary simulation is when a viewer predicts and mimics the character's behavior and feelings, and involuntary simulation is when the viewer unconsciously mirrors bodily and facial movements of the character like smiling when the character smiles, also known as affective mimicry. Empathy relies more on reacting to a character's situation rather than cognitively forming a judgement about them.

Smith elaborated that to achieve sympathy with a character, one must achieve recognition – construct and interpret the character's personality, which is a combination of 1) **alliance** - develop an understanding of the character's goals, actions, feelings, and motivations and 2) **allegiance** – form a positive judgement about the character's behavior, that is aligning and agreeing with their goals and actions and rooting for them. Allegiance is both cognitive and affective. For example, being angry at a character's action requires one to recognize the action is undesirable (cognitive) and be affectively aroused by the action (empathy). In this way, empathy feeds into sympathy. In summary, Smith said to achieve sympathy one must understand the character and their goals, make judgements about the character, and respond cognitively and affectively to their situations. Given below is a part of a snippet from (Smith, 1995) describing character engagement.

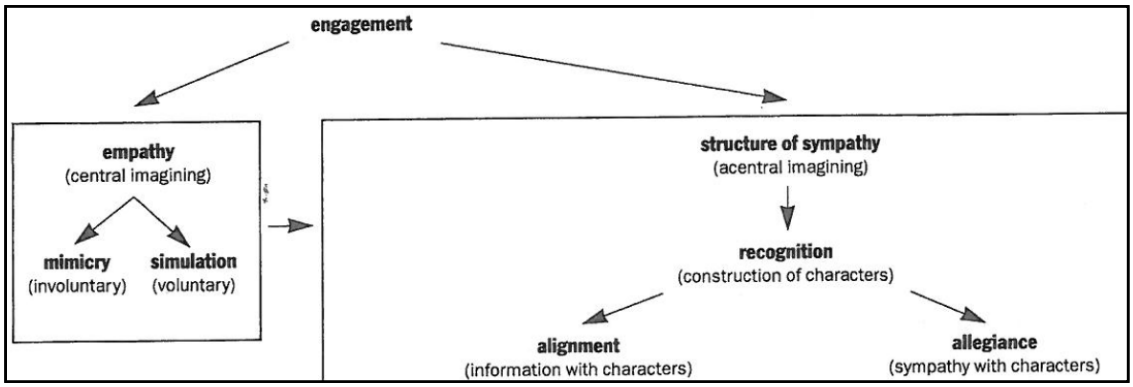


Figure 7: Part of a snippet from Smith illustrating character engagement (Smith, 1995)

Similar to Smith's concept of sympathy, (Pratte et al., 2021) cited (Levenson & Ruef, 1992) and described *cognitive empathy* as knowing or understanding what a person is feeling by imaging their internal state. Like Smith's concept of empathy, they termed *affective empathy* as feeling what the other is feeling. Both cognitive and affective empathy allows a person to compassionately respond to the other.

While Smith wrote about CE from a film perspective, (Lankoski, 2011) argued that Smith's theory can be applied to digital games. Lankoski stated that in games, players experience goal-related engagement which is about the player reaching their goals (an 'I' experience), and they experience empathetic engagement, which is about reacting to the character through recognition, alliance, and allegiance. Based on this work, I too apply Smith's work to interactive and tangible narratives. Lankoski further elaborated the emotions of the player and character

can be correlated if the player's goals are presented as the goals of the character. These shared goals are a mechanism for empathy, as the player may feel for the character's success or failure.

In the dissertation, I explore how diegetic elements can support character engagement when one is playing as the character (1st person perspective) or interacting with another character (2nd person perspective). Based on the above-mentioned literature, the concepts I use are:

- Understand character's goals, motives, knowledge, actions (alliance (Smith, 1995))
- Align and adopt character goals, root for them, feel for their success/failures, feel for the character (allegiance – both cognitive and empathetic components (Smith, 1995))
    - Note: Although Smith does not write about 'adopting' goals as it does not make sense while viewing a film, goal adoption is relevant in interactive narratives
- Feel what the character feels affectively (empathy – central imagining (Smith, 1995), affective empathy (Levenson & Ruef, 1992))

Smith argued that viewers do not need to forget their identities and take on the character's identity for CE. However, while Smith's argument works when viewing films, for interactive narratives it is worthwhile to revisit character identification theories that argue for the temporary loss of self-identity especially when readers are enacting the role of the character.

2.3.2. Defining Character Identification and Transformation

As mentioned earlier, (Cohen, 2001) described character identification as an imaginative experience where one surrenders their identity and experiences the world from someone else's point of view. (Green & Jenkins, 2014) and (Tal-Or & Cohen, 2010) described that character identification is about sharing the character's knowledge, adopting the character's goals (cognitive empathy components, similar to Smith's alliance and allegiance), and sharing the character's emotions (affective empathy component, similar to Smith's empathy). Cohen argued that identification is not an emotion, rather a loss of self-awareness and temporary replacement with heightened emotional and cognitive connection with the character. Similar to character identification, (T. J. Tanenbaum, 2015), cited (J. H. Murray, 2016), and described transformation as "Putting your own identity to a pause and experiencing the world from a new point of view, experiencing the story like we were that person". She described bleed as the phenomenon where the player and character emotions are in sync, and one feels what the character feels.

In this dissertation, I use Smith's concepts of CE when a reader interacts with another character in the system. I also use theories of CI, specifically when a reader plays a character's role. Hence, when I refer to CE, I also add the last point:

- Understand character's goals, motives, knowledge, actions (alliance (Smith, 1995))
- Align and adopt character goals, root for them, feel for their success/failures, feel for the character (allegiance – both cognitive and empathetic components (Smith, 1995))
    - Note: Although Smith does not write about 'adopting' goals as it does not make sense while viewing a film, goal adoption is relevant in interactive narratives
- Feel what the character feels affectively (empathy (Smith, 1995), affective empathy (Levenson & Ruef, 1992), **bleed from transformation (T. J. Tanenbaum, 2015)**)
- **Take the character's identity when the reader plays the character's role (transformation, surrender identity and adopt other's (Tal-Or & Cohen, 2010), (T. J. Tanenbaum, 2015), (J. H. Murray, 2016))**

2.3.3. Importance of Character Engagement and Identification

(Cohen, 2001) discussed that character identification could lead to new possibilities of understanding the world, change attitudes, increase enjoyment, and facilitate intense emotional responses. (Green & Jenkins, 2014) elaborated that character identification could broaden the reader's perspective temporarily as they would understand events in a different light. These possibilities can apply to character engagement as well, as Smith argued that understanding the character's perspective and building sympathy and empathy does not require one to suspend their identity and take another's.

(J. H. Murray, 2016) stated that enactment of a role could lead to self-transformation, giving examples in psychotherapy. Murray elaborated that readers want to care about characters and make sense of the events in order to understand how their own lives can be expanded. (T. J. Tanenbaum, 2015) described how transformation could help us project ourselves in foreign situations, escaping reality, and seeing things from another's eyes. She discussed that transformation is pleasurable, persuasive, and allows us to experience a range of emotions like fear, love, anger, and catharsis.

(Pratte et al., 2021) differentiated between first person and second person perspective during roleplay for evoking sympathy. They elaborated that a first-person perspective where the user is playing the role of the character, may bring more understanding of the scenario, but it can also lead the user to question 'what would I do if I were in this situation', potentially causing them to empathize with only themselves. They argued that a second-person perspective where the user is interacting with the character, can evoke sympathy and encourage the user to question one's own attitude towards the character.

Lastly, character engagement is important to study because it increases our pleasure of experiencing and connecting with a narrative, driving the art of storytelling further. For these reasons, I found character engagement to be a worthwhile topic to explore in diegetic interactive narratives.

2.3.4. Designing for Character Engagement and Identification

I describe a few works that discuss how to design for character engagement and identification. I have used and expanded these concepts in my work.

Character Backstories and Endowment

(Smith, 1995) wrote that for recognition and alliance, one must know the character's goals, motivations, and personality. One way to understand this is by exploring backstories. (Lankoski, 2011) described digital games often help players understand the character through personal objects like diaries, the character's visual appearance and clothes, and even cut scenes. I explore the use of meaningful and personal character objects and scenarios to help readers understand the character more.

(T. J. Tanenbaum, 2015) further elaborated players must consent to the reality of the story world to help them act as the character (transformation). One way to do so is by *endowing* them with the character's backstory, history, responsibility, and network of personal relationships. Endowing players gives them responsibility to impact the story world meaningfully. Moreover, giving players the opportunity to impact the story gives them more stakes, which may make them more invested in what happens to the character, more in-tune with the character's motivation, goals, and emotions, all of which can lead to character identification (K. Tanenbaum

and Tanenbaum 2010). The next question that comes up then is, in what ways can readers impact the story and the characters?

Impacting and having Agency over the Story World and Characters

Giving readers the ability to impact the story world and characters (ontological roles) can lead to feelings of responsibility, investment, and character engagement. Many works consider 'impacting the narrative' as a way to provide branching pathways that often lead to combinatorial explosions (Stern, 2008) and the anxiety of the path not taken (Aarseth, 1994). However, 'impact' does not only have to mean branching pathways.

(J. H. Murray, 2016) formulated agency (choice) in terms of making 'meaningful choices. (K. Tanenbaum & Tanenbaum, 2009) reframed agency as 'commitment to meaning'. They advocated for shifting the emphasis away from the outcome of a choice and towards the intention that underlies the choice and receiving a satisfying response to the action. Similarly, (Harrell & Zhu, 2009) said that agency is about intention and not just action. For example, "hitting a ball is an action, falling down the stairs is not". They said, "What is significant sometimes is not *what* the story is, but rather *how* the story is told". (Nay & Zagal, 2017) discussed how 'inconsequential choices' that delivered the same outcome irrespective of the choice could help players reflect on the motive of their actions, shifting the focus to reflection on morals rather than what outcome to choose. They gave different examples, one where the player character gets attacked by a stray dog, who ends up mortally wounded. Players can decide to end the dog's suffering quickly or walk away and leave it to die slowly. In both cases, the dog dies, and hence the choice is inconsequential to the plot, but the choice constructs the character's personality. While the plot does not change, I argue this choice is still ontological as it leaves a traceable history of who the player character is – brave and forgiving or timid and vindictive. This construction of character personality is crucial for how one perceives the character for building allegiance and CE. Similarly, (Bizzocchi, 2007) said that players could be given agency over the character, story world, emotion, narrative interface, and micro-narrative instead of the grand narrative arc.

The above-mentioned works and examples point to ways in which choices can be ontological without impacting the overall plot of the story. In my works, readers can impact character well-being and their affective states, but not the overall plot while still leaving a traceable history.

This gives readers responsibility, and the ability to construct the character's personality, both of which can lead to character engagement.

Lastly, (Harrell & Zhu, 2009) elaborated how limited agency could convey a sense of confinement or helplessness. (Pratte et al., 2021) also describe that limiting the user's agency allows users to feel the frustrations and challenges of the character, creating empathy.

Character Personality

A character that is likable is easier to identify and engage with than a character that is not likable. Lankoski elaborated that a character's positive traits and evaluation are the basis of allegiance. For example, if players liked and had to protect their character, they would feel fear when the character was in danger, but if they did not like the character, they may feel frustrated. Lankoski also discussed that people react to game characters in ways similar to real people, and affective mimicry occurs with game characters as well. (Pratte et al., 2021) pointed out that affective mimicry is dependent on how much one likes the character. (Roberts et al., 2009) used theories of influence from the field of social psychology and behavioral economics to shape player experiences. They described concepts such as liking, reciprocation, and social proof, among others. Liking means the more we like someone, the more we are willing to fulfill their requests. Reciprocation is about give and take, when someone does something we feel obliged to return the favor. Social proof refers to the concept that we look to others to determine appropriate actions, especially those similar to us. These research pieces suggest that likable characters and social theories can be used to develop CE.

Masks, Scripts, and Behavioral mimicking

(T. J. Tanenbaum, 2015) described design poetics to help readers transform into the character. Based on (Johnstone, 1992) work on improv, and (J. Murray, 1997) discussion of masks, she described how seeing oneself in a 'mask' can lead to identity transformation. That is, if one talks and acts like the character, wears their clothes, and moves and speaks the same, they can experience transformation. Losing the sense of one's identity is a vital step in this process.

(Bizzocchi, Lin, and Tanenbaum 2011) described *behavioral mimicking* as a way to perform one's avatar's actions in digital games. Behavioral mimicking is when the physical behavior of the player's gameplay interactions mimics real-life actions, where the player's body and the

character's body are doing the same thing. This encourages readers to move from just controlling a screen-based avatar to fully enacting the character's movements. They also wrote about behavioral metaphors, which only suggest connections to real-world behavior. Behavioral mimicking can help readers take diegetic actions to perform the role of the character.

(J. H. Murray, 2016) stated the importance of giving *scripts* and goals to players, to help them understand their character and how to perform actions. (T. J. Tanenbaum, 2015) took the concept of scripts further and elaborated players should be able to practice their *scripts* in situated *rehearsals,* that is, getting into character by practicing how to perform in low-pressure environments before they need to enact during high-stakes situations.

Bleed and Emotional Sync between the Reader and Character

(Pratte et al., 2021) cited (Levenson & Ruef, 1992) and described affective empathy as feeling what the character feels. (Pratte et al., 2021) elaborated that external sensations like limiting sensory information, mobility limitations, and physiological data like the heart rate can make us experience what the character feels. (T. J. Tanenbaum, 2015) described bleed – when the emotions of the player and character are in sync. She continues that this emotional sync allows players to *react,* that is, act without thinking too much, bypassing logic, and following critical impulses. Tanenbaum advocated that such reactions could help readers inhabit the character's role. Emotional sync between the reader and character can help readers feel what the character feels, possibly creating empathy and even taking their role.

Desired Actions

Designers may want players to take certain *desired* actions that aid the narrative experience. (Riedl et al., 2003) proposed different strategies to guide players towards such desired actions, or away from actions that might "break" the narrative coherence. In a similar way, (T. J. Tanenbaum, 2015) wrote about subversive actions that players may take to understand the boundaries of the system. She advocated for seeing players not as agents of chaos trying to break the system, but rather people who are trying to understand and experience a coherent story as well. Tanenbaum also wrote about scripts to help players take desired actions, make meaningful choices, and reduce performance anxiety while enacting a role. (Ray, 2010) discussed model-based and exploratory learners, where the former want *desired* actions to be modelled to them, and the latter prefer to learn through exploration. These works point to the

argument that guiding players and readers to *desired actions* can help them engage or transform into the character and experience the story coherently.

Based on these works, I define *desired* actions as actions that the designer hopes the reader would take to aid story coherence, stay in character, and build CE.

2.3.5. Focus of the Dissertation – RQ2

There are possibilities for character engagement when readers take internal-ontological roles in tangible, bodily interactive narratives. Based on the previous sections, I summarize Character engagement (CE) as: understand and adopt character goals and motives, feel for the character and root for them, feel what the character feels affectively, or take the character's identity.

A few examples from section 2.2.3 touch upon aspects of character engagement but do not delve into the topic through the design or study. In UTO, readers felt the protagonist's heart rate through the flashlight as their own, an attempt to identify with the character's fear. Similarly, in BTJ, the reader held their breath when the truck was patrolled, which may have led to feelings of fear, tension, and possibly empathy. In the Reading Glove, readers held diegetic objects that the character once interacted with, possibly leading to an emotional connection with the character. (Dagan, 2018) explored how wearing a character's cloak and rummaging through personal items may lead to a connection with the character. In the squirrel scenario by (Harley et al., 2017), readers could feel and impact the squirrel's heart rate which may lead to feelings of responsibility and sympathy. These works show the potential for creating opportunities for character engagement when readers play the role of the character, or impact and interact with another character through diegetic actions and objects. Designing for CE is not only important for building a relationship with the character, but also for readers to understand their role in the story, without which they may feel lost (Clifton et al., 2013). I focus on how diegetic elements can help engage readers with characters from both first-person and second-person perspectives, which leads to RQ2:

RQ2: How can diegetic elements support aspects of character engagement (CE) such as - understand and adopt character goals and motives, feel for the character and root for them, feel what the character feels affectively, or/and take the character's identity, when readers interact with another character or take a character's role?

2.4. Complexities of Diegetic Interactive Narratives

In this section, I describe some of the complexities that can creep up while interacting with narratives. I give examples of works that touch upon this topic, and describe my focus area in navigating complexities relevant to RQ1 and RQ2.

2.4.1. Defining Complexities

Based on the previous sections in chapter 2, I advocate readers must navigate through certain *complexities* of the system before they can fully engage with the narrative. I do not attempt to uncover all the complexities that these systems may have, I focus on the ones relevant to RQ1 and RQ2 of the dissertation.

A few works write about concepts that readers need to understand to engage with the story. While taking internal roles readers must comprehend who their character is and their goals (Smith, 1995), how to perform (T. J. Tanenbaum, 2015), and take *desired* actions for staying in character (Riedl et al., 2003; T. J. Tanenbaum, 2015). While taking ontological roles, readers must understand what consequences their actions may cause in the story world (Nay & Zagal, 2017; K. Tanenbaum & Tanenbaum, 2009). I term these concepts that readers need to understand (and more that unraveled in my research) as *complexities* of the system.

Readers must traverse through all these complexities while comprehending the story, often in multi-sensory environments. All these elements compete for the reader's attention. However, very few works in the tangible interactive narrative community write about complexities.

Why is navigating complexities important? Readers may not fully understand and engage with the narrative if they spend most of their time figuring out how the system works and what their role is. For example, (Clifton et al., 2013) described how lack of context left participants questioning their role and the purpose of actions they were asked to perform. Character engagement can also become more difficult if the reader largely stays involved with deciphering complexities. For example, (Lankoski, 2011) described that a high cognitive load in controlling a character can prevent affective mimicry. Furthermore, (T. J. Tanenbaum, 2015) described that proper guidance cues can help reduce the player's performance anxiety while taking a role.

The basic principle of the TEI field is to create interfaces that require less cognitive effort so we can interact with technological interfaces in ways that feel natural rather than requiring focused attention (Ishii & Ullmer, 1997). (Svanæs, 2013) also described how embodied perception removes unnecessary levels of interactions and the contact between the user and the digital world becomes more direct. While TEI interactive narratives bring readers closer to the narrative world through diegetic objects, there are very few works that discuss one of the core concepts in the TEI field - ways to decrease the cognitive effort required to untangle the complexities present in interactive narratives. For these reasons, I find the topic of navigating complexities in diegetic interactive stories is worth exploring.

2.4.2. Examples of Navigation Complexities in TEI and Storytelling

Although scarce, few diegetic tangible narrative works provide insights in navigating system complexities.

In Don't Open that Door, the authors discussed how the lack of context and scenario setting left people confused about their role (Clifton et al., 2013). Moreover, they struggled with taking actions such as not knowing how to turn the doorknob, and when they did and did not have agency. Viewers also questioned the character's intentions when asked to create a salt ring due to a lack of knowledge about the show and their relationship to the character. On the contrary, the gesture and guidance provided to take the character's hand worked well as it provided audio-visual cues alongside the character stretching out her hand for the viewer as well. In UTO, the authors mentioned that readers misinterpreted the vibrations on the remote and did not understand that it was the character's heartbeat (Chu et al., 2015). Both these works advocated for the use of multiple cues (audio, video, haptic, mimetic) to help readers perform actions and get feedback.

These works show that people need context and guidance before they can fully engage with the narrative. However, most works do not focus on ways to provide such guidance. For example, how would readers know how to perform actions and what narrative consequences they would lead to like - gripping a rope (Chu et al., 2015), moving hands across the table (Harley et al., 2021), tapping sides of the cube, or stroking the squirrel (Harley et al., 2017)? Furthermore, how

would readers know their role and how to perform like the refugee *in A Breathtaking Journey* (Kors et al., 2016)? What guidance does the reader need and how often?

2.4.3. Focus of the Dissertation – RQ3

Before readers can fully engage with the narrative and characters, they must navigate through the complexities of the system – they must understand concepts such as who their character is, how to perform the role, and what consequences their actions may cause, among other things. Helping readers navigate these complexities can help them engage with the story, characters, and feel less overwhelmed. In my three works, I consistently saw the need to guide readers so they could spend less time deciphering things and more time engaging with the story. The dearth of work in tangible interactive narratives addressing these concerns leads me to RQ3:

RQ3: what complexities might readers face while taking internal-ontological roles and engaging with characters in diegetic interactive narratives? How can readers be assisted to navigate these complexities such that they can intentionally impact and engage with the story?

Most works in the TEI and interactive narrative field provide snippets of narrative experiences rather than full story experiences, mostly because those snippets may be sufficient for their research goals. However, many such snippets are short and novel, and do not offer a deeper lens into the complexities of experiencing a full story. I have created experiences with complete narratives as they can give more insight into the complexities that readers navigate, and how to keep them engaged in longer experiences when the novelty may wear off.

2.5. Summary

There is a dearth of common design guidelines for creating diegetic elements in tangible and bodily interactive narratives. There are very few works that use diegetic elements and place readers in internal-ontological (Harley et al., 2016). Internal roles position readers inside the story world that can enable them to enact and broaden their perspective (Green & Jenkins, 2014; J. H. Murray, 2016). Ontological roles allow readers to impact the story world, leaving a traceable history, which can give them stakes, make them feel more responsible and invested. In my work, I extend the definition of ontological roles to include non-plot centric aspects that the reader can impact in the story world, while still leaving a traceable history like impacting the

affective response or well-being of a character, to avoid the problem of combinatorial explosions through branching narratives (Aarseth, 1994).

While designing for ontological roles, I explore how the reader's actions can have a *logically convincing* impact in the story world, that is, readers buy into why their actions cause a particular consequence. While designing for internal roles, I explore how readers may feel as if their bodies are a part of the narrative world, by feeling the sensorial and affective consequences of their actions. I apply theories of the 'lived' body (Merleau-Ponty, 1996) and Laban Movement Analysis (Laban & Lawrence, 1974). Lastly, I also focus on how diegetic elements besides 'objects' such as the body, guidance cues, and actions can help connect readers to the story world.

Internal-ontological roles give readers the opportunity to engage and identify with the character, again a less explored topic in tangible and bodily interactive narratives. Character engagement (CE) can be from a first-person perspective, that is, identifying with the character that the reader is performing as, or CE can be from a second-person perspective, that is engaging with a character one is interacting with. I focus on both these perspectives in the dissertation and define CE as:

- Understand character's goals, motives, knowledge, actions (alliance (Smith, 1995))
- Align and adopt character goals, root for them, feel for their success/failures, feel for the character (allegiance – both cognitive and empathetic components (Smith, 1995))
- Feel what the character feels affectively (empathy (Smith, 1995), affective empathy (Levenson & Ruef, 1992), bleed from transformation (T. J. Tanenbaum, 2015))
- Take the character's identity when the reader plays the character's role (transformation, surrender identity and adopt other's (Tal-Or & Cohen, 2010), (T. J. Tanenbaum, 2015), (J. H. Murray, 2016))

Character engagement is worth exploring as it can lead to new possibilities of understanding the world, change attitudes, increase enjoyment, and facilitate intense emotional responses (Cohen, 2001). A few design techniques that have been used for character engagement are - understanding character backstories, endowing readers with responsibility, creating likable characters, wearing masks, practicing scripts, behavioral mimicking, syncing emotions of character and reader, and guiding readers to the desired actions for performing the role. I

explore how diegetic elements can help support character engagement by applying the above design techniques.

Before readers can fully engage with the narrative and characters, they must navigate through the complexities of the system, a topic that very few works explore. Readers may not fully understand and engage with the narrative if they spend most of their time figuring out how the system works and what their role is. I focus on how to help readers navigate some complexities such as - understand who their character is (Smith, 1995), how to perform the role and take desired actions (Riedl et al., 2003; T. J. Tanenbaum, 2015), and what consequences their actions may cause in the story world (Nay & Zagal, 2017; K. Tanenbaum & Tanenbaum, 2009), among others that were revealed in the evaluation of my three works. Helping readers navigate these complexities can help them engage with the story, characters, and feel less overwhelmed.

Chapter 3. Methods

I follow a research through design approach (RtD) in my work. RtD is a research approach that uses the methods of design practice for generating new knowledge (Zimmerman & Forlizzi, 2014). While methods used in RtD can differ, they commonly follow the process of selecting a problem worth investigating, designing, evaluating in the lab or in the field, reflecting and disseminating knowledge, and repeating (Zimmerman & Forlizzi, 2014).

Different forms of knowledge can be produced through RtD – the design of artifact itself can communicate design knowledge and broaden the design space (Zimmerman & Forlizzi, 2014), the analysis of designed artifacts through the evaluation can provide 'implications for design' often found in HCI design papers (Zimmerman et al., 2010), and designing and analyzing the same research questions through multiple different artifacts can produce more abstracted and applicable knowledge such as design patterns (Zimmerman & Forlizzi, 2014). The goal of this kind of knowledge is not to provide universal truths, but rather broaden the design space and give insights into the preferred state of an artifact (Zimmerman & Forlizzi, 2014).

Since my aim is to provide design recommendations for diegetic systems, I follow an RtD approach. I analyzed current literature and framed my research questions to focus on less addressed spaces (chapter 2). I designed, created, and user-tested three storytelling systems sequentially to provide design insights into the three research questions. Each system touches upon different diegetic elements, ways of roleplaying, and elements of complexities. I then analyzed the knowledge produced from all the three systems together, along with the insights that the literature review provided. From this overall analysis, I created *design guidelines* to answer my RQs, which designers can use while creating diegetic storytelling systems.

The design guidelines come from my design practice and research experience creating tangible and bodily interactive narratives over the past five years. My work has been published and demonstrated in peer-reviewed conferences (Gupta et al., 2019, 2020, 2021). The design guidelines capture my tacit knowledge produced through the design, user evaluation, analysis, and design reflection of the three storytelling systems I created. The design guidelines are

abstract enough to provide design insights beyond the three systems, and are also supported with concrete examples, giving designers actionable recommendations. The guidelines do not claim objective truth, nor are they universally applicable. Since interactive narrative systems are all unique, each guideline may not hold true in every scenario. Rather, these design guidelines capture my tacit knowledge and provide insights and inspiration to designers creating tangible and bodily diegetic interactive narratives, so they do not have to start their thinking process from scratch. In the sections below, I describe my process and rationale in more detail.

3.1. Research Questions

In chapter 2 I described how I narrowed down my research questions (RQs) and why they are important to study. The RQs are:

RQ1: How can different diegetic elements be designed to position readers in internal roles (inside the story world) and ontological (impact story world) roles such that they feel the impact of their actions, and buy into why their actions cause a particular consequence?

RQ2: How can diegetic elements support aspects of character engagement (CE) when readers interact with another character or take a character's role? The aspects of CE I focus on are:

- Understand character's goals, motives, knowledge, actions (alliance (Smith, 1995))
- Align and adopt character goals, root for them, feel for their success/failures, feel for the character (allegiance – both cognitive and empathetic components (Smith, 1995))
- Feel what the character feels affectively (empathy (Smith, 1995), affective empathy (Levenson & Ruef, 1992), bleed from transformation (T. J. Tanenbaum, 2015))
- Take the character's identity when the reader plays the character's role (transformation, surrender identity and adopt other's (Tal-Or & Cohen, 2010), (T. J. Tanenbaum, 2015), (J. H. Murray, 2016))

RQ3: what complexities might readers face while taking internal-ontological roles and engaging with characters in diegetic interactive narratives? How can readers be assisted in navigating these complexities such that they can intentionally impact and engage with the story?

3.2. My Three Storytelling Systems

I designed and built three storytelling systems, rather than evaluating pre-existing systems, so I could immerse myself in the design process and build and disseminate the tacit design knowledge produced. I evaluated the systems through user tests to determine how these systems were experienced and understood by participants. The three systems I created, and studies were – Shiva's Rangoli (SR), The Next Fairy tale VR (TNFT), and Gummy's Way Out (GWO). I designed and evaluated SR and TNFT before narrowing down my dissertation research questions. While both these projects had similar investigative goals to the dissertation, they were not built specifically to answer the RQs listed above. On the other hand, I created GWO with the intention of answering the three RQs above. For these reasons, the chapters on GWO are longer and in more detail than the ones on SR and TNFT.

3.2.1. Shiva's Rangoli

I created and evaluated Shiva's Rangoli from April 2017 – June 2018 (Gupta et al., 2019; Gupta & Tanenbaum, 2019). Shiva's Rangoli (SR) is a tangible interactive storytelling installation where the reader takes the protagonist, Shiva's role, and impacts his affective state through a diegetic tangible interface. The tangible interface also helps the reader sculpt the ambience (lights, ambient sound, music, background video) of the space they are in, reflecting Shiva's emotional state. There are less guidance cues given to readers in SR. They must understand what elements of the system are diegetic, what their role is, and what actions lead to what consequences, all while listening to two stories. Through SR, I investigated how different diegetic elements like the interface and ambient effects helped readers take internal-ontological roles (RQ1), if and why readers accepted Shiva's role as they impacted his affective state (RQ2), and how readers navigated through various complexities of understanding their role and agency (RQ3).

3.2.2. The Next Fairy Tale VR

The Next Fairy Tale (TNFT) is a VR interactive narrative pre-show experience for the Broadway play TNFT, which I designed and evaluated from January 2018 – March 2019 along with seven other team members (Gupta et al., 2020). TNFT was designed for readers to interact with and understand the antagonist – Minerva's point of view. Readers take the role of Calliope, the

queen of fairy godmothers, who is also Minerva's sister, and have a conversation with her during one of Minerva's pivotal life moments. They talk to Minerva by casting spells that can change the affective tone of the dialogues exchanged between them, bringing out how Minerva feels. Through TNFT, I investigated how different diegetic audio-visual cues and actions like using a wand helped readers take internal-ontological roles (RQ1), how readers accepted Calliope's role and what they felt towards Minerva (RQ2), and how readers navigated through the various complexities of performing their role while in VR (RQ3). This study focused more on RQ2 and RQ3 as the design draws on principles of acting theories to help readers roleplay, sympathize with Minerva, and provides insights on the cues and guideposts readers need to take a role. While this experience does not use tangible interactions, it does engage the body and has various diegetic elements that make this piece a useful addition to the dissertation.

3.2.3. Gummy's Way Out

Gummy's Way Out (GWO) is an interactive narrative experience that I created and evaluated from April 2020 – February 2021. In GWO, the reader eats a gummy bear and then helps him find his way out through their body by consuming various diegetic food items and taking different bodily actions. The reader's actions impact their narrative body in ways that either help or hinder Gummy's journey, endowing the reader with the well-being of Gummy and their body. Through GWO, I investigated how to position the body in a diegetic role to give readers internal-ontological roles (RQ1), how readers felt towards Gummy as they were endowed with his well-being (RQ2), and how they navigated the complexities of how various food items impacted their bodies and subsequently Gummy (RQ3). Based on the previous two projects, I designed GWO such that it was easier to navigate as readers were given constant guidance by Gummy, and could easily estimate how different food items would impact the body and hence Gummy based on basic existing nutritional knowledge. This project explores each research question in more detail as I pursued it after framing the dissertation RQs.

In every system, readers can impact the character's emotional state or well-being, but they can not change the plot of the story, as the stories largely do not have branching pathways.

3.3. Design and Evaluation Process of the Three Projects

In all three projects, I followed a similar process – design, pilot test and iterate, user study, and analyze. While each project went through 2-3 design iterations, the knowledge produced from them was very contextualized and specific to the project, and hence the design iterations are not a focus point of the dissertation. I focus more on the knowledge produced through the analysis of the user study of the final design and the subsequent reflection on design.

After designing a system, I conducted user studies in a controlled lab environment. During the study, I gave the participant context about the study, after which they experienced the system. I asked them to think out loud about what they were feeling and voice any sources of surprise or confusion. I took notes based on what they said out loud, any expected and unexpected interactions, and moments of high affective responses. After the story experience, I took semi-structured interviews to know more about the participant's experience in more detail. The user studies gave insight into the participants' point of view – how they felt the impact of their actions, which action-consequence pairs were more logically convincing and why, what helped them play a role, what they felt towards other characters and why, and how they navigated through the complexities of the systems.

After conducting the study, I analyzed the interview transcripts, think out loud and observation notes using open coding, axial coding, and by creating themes (Corbin & Strauss, 2014; Saldana, 2015). I coded the transcripts and notes line-by-line looking for both expected and unexpected occurrences. I also wrote analytical memos while coding. While coding, I kept combining and categorizing codes together looking for properties, dimensions, characteristics, conditions, and consequences of emerging phenomena (Corbin & Strauss, 2014). After coding all the data, I continued this organization and categorization process, until I had 100-200 categorized codes left to work with. I organized these categories further and started creating themes, moving into axial coding. I physically spread these categories out onto large sheets of paper and made affinity maps to create and tighten the themes further, drawing connections between them (Braun & Clarke, 2006; Lucero, 2015). I used these themes and my analytical memos to write the findings from the study, supporting examples through participant quotes to give rich descriptions (Creswell, 2003). I then thought about *design recommendations* from the affinity map, analytical memos, and design choices I had made. I reflected on what the findings gave

insight to, how those insights could be applied to the system, and how they could be abstracted such that they could be useful outside the context of the system being studied. I have discussed more details of the methods used for evaluating each system in the 'Study' section of chapters 4,5, and 6.

I now elaborate on the kind of knowledge the above-mentioned *design recommendations* give. Studies that use a similar RtD method that involves the design and user evaluation of a system refer to the produced design knowledge as implications, themes, opportunities, strategies, among other terms (Harley et al., 2017; Mueller, Byrne, et al., 2018; K. Tanenbaum et al., 2011; Zimmerman & Forlizzi, 2014). (Sas et al., 2014) define this form of design knowledge as 'abstractions of functionalities' which are not universal nor generalizable, but work towards 'naturalistic generalization'. Naturalistic generalization points to knowledge that is translatable, comparable, and 'fits' similar situations (Huberman & Miles, 2002). This knowledge is not reproducible as it is contextualized within a system but can still speak to other studies that have similar settings. (Isbister & Mueller, 2015) cite (Höök & Löwgren, 2012) and refer to this design knowledge that comes from design and evaluation of a system as 'intermediate-level design knowledge' which is not generalizable but abstracted enough to be applied outside the particular instance. Many works in the TEI field follow design and user evaluation processes to produce intermediate-level design knowledge – (Harley et al., 2017; Kors et al., 2016) gave design opportunities, (Chu et al., 2015) described design considerations, (K. Tanenbaum et al., 2011) elaborated design themes, and (Mueller, Byrne, et al., 2018) gave design strategies. Based on these prior works, I too presented the intermediate-design knowledge from the design and user evaluation of each system as design recommendations. The design recommendation sections of chapters 4,5,8 are split into three sections, describing concepts that speak to RQ1, RQ2, and RQ3.

3.4. Design Guidelines

I analyzed the design knowledge that came from the three projects together, alongside the insights from the literature review, and formulated design guidelines to answer my research questions. I have presented these guidelines in chapters 9,10, and 11 in the form of tables and guiding questions.

3.4.1. Defining Design Guidelines and Guiding Questions

Guidelines are one way of disseminating intermediate-level design knowledge (Isbister & Mueller, 2015). Commonly, design guidelines refer to recommendations for user interfaces with explanations and examples (SMITH, 1986). Some examples of guidelines are Google's material design (*Guidelines*, 2021) and Apple's Human Interface guidelines (*Human Interface Guidelines - Design - Apple Developer*, 2021). However, these examples are much more generalized and largely adopted than the guidelines presented in this dissertation. My work is closer to how (Isbister & Mueller, 2015) framed guidelines for their work on movement-based games. I refer to my design recommendations as guidelines, as they do not conform to the format of the more commonly used term 'design patterns', nor are they framed as recurrent problems like patterns (Dearden & Finlay, 2006). However, they are abstract enough to provide inspiration for systems outside the three that I studied.

I present the design guidelines in the form of tabular summaries and guiding questions that act as probes to help designers think about the concepts the guidelines are for. Other works using RtD approaches also present guiding questions for probing designers (Andres et al., 2020; Dagan et al., 2019; Maggioni et al., 2020).

3.4.2. Process of Forming Design Guidelines

I analyzed the design recommendations that came from the design and user evaluation of my three systems – SR, TNFT, and GWO, along with the insights from the literature review to formulate the overall design guidelines. During the analysis, I emphasized the design knowledge from my systems more than the insights from the literature review as that knowledge was rooted in the design practice and analysis that I conducted. I used examples from the literature review to support the claims made in the design guidelines, and to illustrate how the guidelines came from and could be applied to works outside the three systems I created.

I began by collecting all the design recommendations and insights from my works and the literature review. I then compared differences and similarities between the various design recommendation, by thinking about how each recommendation could be applied to my other systems. For example, in SR I recommended allowing people to represent a mix of emotions by crafting various ambient effects. I thought how this recommendation could be extended and

abstracted to be applicable to TNFT and GWO as well. I then did a thematic analysis on these extended guidelines and condensed them into unique themes. With a few more rounds of extending and thematizing, I came up with abstracted guidelines. I grouped guidelines of a particular topic in one table, creating multiple such tables for various topics. I ensured there was no overlap and that each table could be understood and applied independently of the others. I then thought of guiding questions for each table, that could help designers arrive at the concepts the design guidelines in each table were referring to. For example, in the above-mentioned case of representing a mix of emotions, a guiding question would be 'is the impact on the story world presented in a discrete way, or does it range across a spectrum?' I supported the design guidelines with numerous examples from my three systems and the literature review examples from chapter 2. This combination of design guidelines, guiding questions, and examples helped me make the design knowledge actionable for designers.

This method of combining design knowledge from various works that tackle similar research questions has been widely used by HCI RtD researchers (Benford et al., 2009; Buruk et al., 2019; Dagan et al., 2019; Isbister & Mueller, 2015; Mueller, Byrne, et al., 2018). (Sas et al., 2014) discussed how generalizability and 'external validity' of design implications can be increased by including insights from multiple projects targeted towards similar research questions. Here again, generalizability does not mean universal application, but abstraction that can allow designers working in similar areas to use the knowledge. (Sas et al., 2014) also elaborate that an actionable way of presenting design knowledge is through the combination of abstraction combined with instantiations (specific examples). The examples provide concrete design concepts, and the abstraction helps apply the knowledge across multiple situations. The design guidelines I present are abstracted and supported by concrete examples, making them actionable as well.

3.4.3. Contributions of the Design Guidelines

These design guidelines provide intermediate-level design knowledge (Höök & Löwgren, 2012), that is they do not claim objective truth, nor are they universally applicable, but they are abstract enough to provide design insights and inspiration beyond my three storytelling systems. These design guidelines capture insights from user evaluations, reflections on design choices,

and the tacit knowledge that I accumulated while working as a designer and researcher in the tangible storytelling field over the past five years.

(Sas et al., 2014) mention that design implications can be applied in settings similar to the ones where they were produced, and hence it is important to describe these settings. The details of the setting for my works are - tangible, and body-based interactive narratives where readers consume stories and take internal-ontological roles, while interacting with diegetic elements. In my systems, while taking internal roles, readers either took the role of a character or interacted with another character. Readers took ontological roles by taking actions that led to different consequences on the character's emotions and well-being, without changing the overall plot. Designers working with similar constraints in interactive storytelling systems can use these design guidelines during their design phase. The guidelines do not claim to hold true in every similar context, as each interactive narrative system is unique. Rather, they provide insights and capture my tacit design knowledge so designers do not have to start their thinking from scratch.

Besides the design guidelines, the three works SR, TNFT, and GWO are full narrative experiences, and the systems themselves are design artifacts that contribute to the space of interactive narratives (Zimmerman & Forlizzi, 2014).

3.4.4. Validity

(Sas et al., 2014) describe a couple of evaluating criteria for implications for design. Based on these criteria, my design guidelines have *empirical* validity as they are grounded in user evaluations that provide rationales for the design knowledge. The guidelines have *theoretical* validity as they build on theories in existing literature (lived body, LMA, CE, diegesis). They have *external* validity (abstraction) are abstract enough to provide insights in similar settings. Moreover, the aggregation of guidelines from three different projects, not just one, which makes the external validity stronger. Most importantly they are *actionable* because they are abstract but supported with concrete examples, making them implementable by other designers.

While doing qualitative work it is also important to clarify possible sources of bias (Creswell, 2003). Firstly, in all my three studies, most of the participants were university-level students who had some familiarity with technology and may have been more reflective as they were part

of a learning environment. Secondly, I was the sole researcher in two of the projects (SR, and GWO) and all the insights came only from my analysis. Thirdly, these studies were conducted in controlled environments and were not conducted 'in-the-wild', and so I can not make any claims about how these systems would be experienced in real-life scenarios. Lastly, like with many interactive narrative systems, the designs were novel, and the novelty may have contributed to the participants' positive experiences. While these systems were designed to be one-time experiences, I did observe the novelty starting to wear off in GWO and SR as the stories lasted between 20-45 minutes. I have discussed how novelty may have attributed to a certain finding wherever relevant in each chapter.

Chapter 4. Shiva's Rangoli

Shiva's Rangoli (SR) is a tangible interactive storytelling installation that allows readers to impact the affective tone of the characters and the narrative by sculpting the ambience (lights, ambient sound, music, background video) of the space they are located in through a tangible diegetic interface. The interface engages readers in the art form of Rangoli making and the stories are based on Indian mythology. Rangolis are colorful patterns that are made on the floor with colored powder and flowers, among other things. In the stories, Shiva is a powerful God who creates Rangolis to express his affective state and the weather of the story world transformed to reflect his emotions. Readers take Shiva's role (internal), create Rangolis with the diegetic interface, on his behalf to express his affective state. The Rangolis also help readers set the ambient effects of the space, reflecting Shiva's emotional state, just like in the stories. While the reader's actions with the Rangoli impact the affective tone of the story (ontological), the plot of the story does not change.

I used ambient effects in this installation to help readers express, feel, and impact the affective tone of the narrative. The ambient effects also mimic the sensory environment of the story world, making readers feel a part of that world. Shiva's Rangoli fits into the overall dissertation as I explore how the diegetic tangible interface and ambient effects give readers internal-ontological roles. I also investigate how these diegetic elements can support roleplaying – taking Shiva's role. Lastly, I explore the many complexities that readers had to navigate in SR before they could engage meaningfully with the stories. While this chapter gives a few findings and design recommendations relevant to the research questions of the dissertation, for more details on SR refer to (Gupta et al., 2019; Gupta & Tanenbaum, 2019). The large takeaways from this study are:

- Diegetic ambient effects and diegetic tangible interfaces can work in harmony to help readers engage with different aspects of roleplaying – impacting, expressing, and feeling the character's emotions through ambient effects, and taking actions the character would take through the Rangoli interface.

- Acknowledge the reader's actions with the diegetic interface in the narrative and have noticeable consequences so readers feel they have some responsibility in the narrative and can take the character's role.
- Identify the various complexities of the system that readers may have to navigate and understand. Leave space for readers to move from the phase of understanding how the system works, to the phase of making more intentional decisions. Various diegetic elements working in harmony, multiple acknowledgements of the reader's actions, and having noticeable consequences to actions can help readers understand their role and the agency they have.

I clarify the terms 'affect' and 'emotions' used in SR. In Russel's circumplex model 'affect' is a combination of arousal (high energy vs low energy) and valence (pleasure vs displeasure). (Osdoba, 2015) described emotions as brief, intense, and transpire as a result of action or occurrence. The terms affect and emotions are closely linked and many times used interchangeably (Fagerberg et al., 2004). SR is better understood in terms of 'affect' - in the form of arousal and valence. However, to avoid repetitive language, I too have used the terms affect and emotion interchangeably.

4.1. Background

Shiva's Rangoli positions readers in internal-ontological roles as they take Shiva's role and decide the affective response of the character through the diegetic Rangoli interface and diegetic ambience. It is worth mentioning other works that use ambient settings like light, sound, music, patterns, among others to set an affective tone. Shiva's Rangoli is inspired by an early storytelling system, Scarlet Skellern (T. J. Tanenbaum & Tomizu, 2008). This digital storybook built a rudimentary model of the affective preferences of the reader as they interacted with objects in the space, which then controlled the story's mood by changing the instrumentation of the score, the ambient soundscape, and the color palette of the story. The reader's interaction was decoupled from the plot of the story. A formal user study was not conducted, however, the authors observed that readers were interested in using the system in the debug mode, where readers themselves could change the aesthetics of the story. Shiva's Rangoli takes these ideas further by giving readers agency over the ambience and affective tone

of the story through a tangible diegetic interface. A few other tangible storytelling systems use ambient effects as well. KidsRoom was an interactive physical storytelling space that transformed a child's bedroom into a fantasy story world using visuals and sound (Bobick et al., 1999). In the LIT ROOM, storytellers created expressive ambient environments to add on to the picture books being read to children (Schafer et al., 2018). Shiva's Rangoli is different from these works as rather than using ambient effects to just re-create the environment of the fictional world, it also gives readers the opportunity to impact the emotional tone of the narrative world while taking Shiva's role.

A few works outside of storytelling systems have used ambient effects to set an emotional tone. Ada is an intelligent soundscape space that used color-changing floor tiles, changing graphics on the walls, and music to communicate Ada's emotional state (Wassermann et al., 2003). eMoto allowed users to express their emotional response while texting through pressure and movement, and represented the emotion through different animations, shapes, and colors in the background (Fagerberg et al., 2004). These works show the possibility of using ambient settings to express affective states, as done in Shiva's Rangoli.

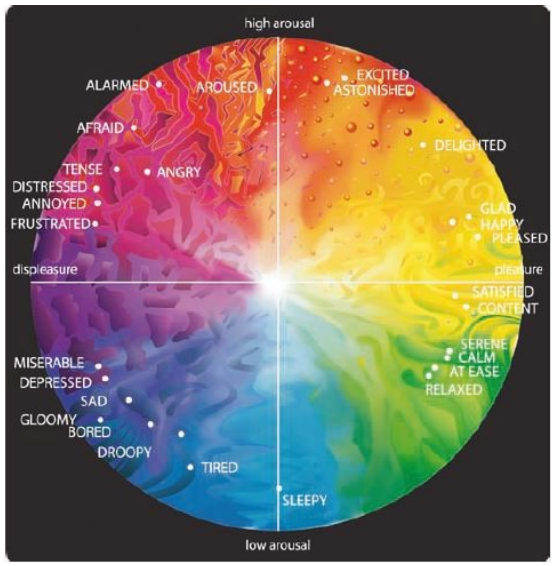


Figure 8: Russel's circumplex model with colors from eMoto (Fagerberg et. al, 2004)

The ambience to affect mapping in Shiva's Rangoli is based on Russel's circumplex model of affect (Russell, 1980). The model categorizes emotions based on valence (negative or positive feelings), and arousal (high or low energy). For example, Happy has high arousal and high valence, calm has low arousal and high valence, sad has low arousal and low valence, angry has

high arousal and low valence. I mapped colors to these affective tones in the Rangoli design using the model represented by (Fagerberg et al., 2004), as shown in Figure 8.

4.2. Design

Shiva's Rangoli enables readers to shape the ambience of their environment through a culturally inspired tangible interface, subsequently setting an emotional context for the two stories they hear. In the stories, Shiva is a God who creates Rangolis to express his emotions, which trickle down into the story world, as the skies transform to reflect how he feels. Readers take Shiva's role and create Rangolis with the diegetic interface on his behalf to express his affective state. The Rangolis set the ambience (light, sound, music, and ambient video) of the space to reflect Shiva's emotions.

4.2.1. The Rangoli Interface

The interface remediates the Indian art form of Rangoli making. Rangolis are elaborate colorful patterns made on the floor during festivals with many materials such as colored sand, flowers, and powdered rice, among others. The readers assemble Rangolis by placing different concentric wooden rings together. The installation space is enclosed by a pavilion and inside the tent lies the interface - a table, 12 artistically patterned rings and two center pieces (Figure 9).

Figure 9: The tent and what lies inside

There are four colored sets of three rings each, where each set/color represents a particular affective tone. The yellow rings represent happy, green is calm, blue represents sad, and red is

angry. This design choice was based on work by eMoto grounded in Russell's circumplex model of affect (Fagerberg et al., 2004; Russell, 1980). Any three of these rings can be placed on the tabletop in a concentric manner to create a Rangoli as shown in figure 10. The tabletop is a foot-tall, encouraging readers to sit down on the floor while assembling the Rangolis, imitating the traditional style of creating Rangolis on the floor. The rings set different ambient effects based on the affective tone that they represent. The outermost ring controls the lighting effects of the space, the middle ring controls sound effects and the innermost ring controls the music. The yellow-happy rings create a warm, upbeat, and chirpy ambience. The green-calm rings create a soothing and soft atmosphere. The blue-sad rings create a low and dull environment. The red-angry rings create a stormy, thundering ambience. Once the reader assembles a Rangoli, an ambient video is displayed, amplifying the affective tone created by the reader. The two center pieces determine which of the two interleaved narratives plays back.

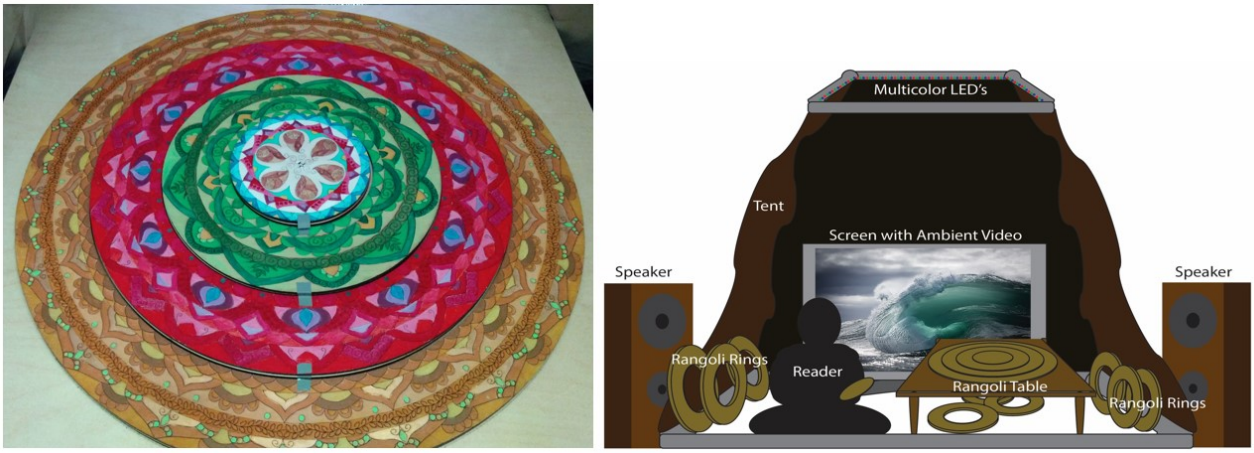


Figure 10: An assembled Rangoli and an illustration of the system

The ambient effects were decided on through a series of iterative user tests and I do not make any claims on the universality of these mappings with affect. Figure 10 is a concept illustration of the installation. Table 3 gives a summary of the ambient effects.

Figure 11 shows the different ambient spaces created when all rings of the same colors are placed. Readers can place any combination of the 12 rings available, setting ambient effects belonging to different affective tones. Once the reader completes assembles an entire Rangoli, the system calculates the overall valence value represented by the Rangoli, and a chapter adapted to the valence value from the story is narrated. After the narration is complete, readers

may change parts of the Rangoli before starting the next chapter. Each story consists of 10 chapters that are played in a linear way.

Table 3: Ambient effects

Affect	Lights (LED strip)	Sound	Music	Video
Happy (yellow)	Yellow lighting with a few LEDs dynamically changing colors	Day time noises near the river side, water flowing, and birds chirping	Upbeat, lively instrumental music	Variations of a river stream flowing near the mountains in broad daylight
Calm (green)	Green lights dimming and brightening, giving a pulsating effect	Stream of constant flowing water	Soothing instrumental music	Relatively calm waters in a lake, by the sea, and near a brook with soothing colors
Blue (Sad)	Blue lights with occasional LEDs blinking white	Water drops dripping slowly	Slow, low, and gloomy instrumental music	Slow flowing water near an icy mountain, at nighttime
Red (Angry)	Red lights that occasionally flash strobes of white giving a lighting effect	Thunderstorm and heavy rain	Fast, tensed instrumental music	Aggressive sea in a thunderstorm at night

Figure 11: Different ambient effects from top-left clockwise: angry, happy, calm, sad

4.2.2. The Narratives

The two stories, called 'the river' and 'the medicine', were authored by me and are inspired by Indian mythology, with a magical river being a central theme between both stories. The ambient effects (sound and visuals) are inspired by water, to give readers a sense of being near the river. In the narratives, the protagonist Shiva is the powerful God of destruction who makes Rangolis to express his emotions and decisions. These emotions trickle down and impact the human world as well, as the skies shape to reflect how Shiva feels. For example, when Shiva is angry, the world's skies become bloody and dark with heavy rains and raging thunderstorms. Readers are invited to take Shiva's role and create these Rangolis as a reflection of Shiva's emotions, shaping the ambience of the fictional world as well as the space in the tent. Both the Rangoli and the dynamic ambiences serve as diegetic bridges. Readers are endowed with Shiva's emotions and how he impacts the story world.

Each chapter has two versions: an emotionally positive version and an emotionally negative version. For simplicity, the system takes only the valence of the affect created by the reader into consideration, grouping happy and calm as positive and sad and angry as negative. The system calculates the overall valence value of the Rangoli rings assembled and triggers one of the two versions. In both versions, the plot remains the same, but Shiva's emotions, how Shiva responds to other characters, the intent behind his actions, the river's waters, the weather in the fictional world, minor consequences, and the narrator's tone of voice changes in each version. Here are the emotionally positive and negative versions from one of the chapters:

> **Positive version:** Brahma and Vishnu approached Shiva and as they looked upon the vibrant Rangoli filled with shades of yellow and green, they were delighted to see that Shiva was in one of his good moods. The skies were light, harmonious, and chirpy reflecting Shiva's pleasure. Brahma and Vishnu never thought twice before approaching him on such days, and so they decided that it was the perfect time to confront him on one of their never-ending arguments, Shiva's destruction.
>
> **Negative version**: Brahma and Vishnu approached Shiva, and as they looked upon the bold Rangoli filled with shades of blue and red, they understood that Shiva was not in the best of his moods. The skies were dark, gloomy, and enraged, reflecting Shiva's displeasure. Brahma and Vishnu always thought twice before approaching him on such days, yet today they mustered the courage to confront him on one of their never-ending arguments, Shiva's destruction.

As described above, Shiva's emotions and the state of the fictional world change but the consequence of Brahma and Vishnu confronting Shiva over his destruction does not change, hence the plot remains intact. Since readers have agency over Shiva's affective state, they still take ontological roles even though the plot does not change. This is because changing Shiva's affective state, the way he responds, and the intent behind his actions leaves a traceable history in the reader's mind about who Shiva is.

As shown in the above lexia, in both stories, Shiva's Rangolis are acknowledged frequently to help readers confirm their understanding of how the colors map to the affect and that they are taking Shiva's role by creating Rangolis on his behalf. Towards the end of each story the stakes are high, and readers are warned that Shiva's emotions are crucial in deciding the fate of the story world, as other characters anxiously await to see the colors of his Rangoli. The endings for each version are similar but how Shiva feels and reacts is different.

Shiva's Rangoli went through two design iterations before reaching the version explained below. In the first iteration, readers took external-exploratory roles, and the pilot tests revealed that people felt the experience was like a puzzle to be solved rather than engaging with the story. In the next version, readers were given Shiva's role and the ability to impact his emotions, but people did not understand what they had agency over and hence could not take Shiva's role. In the final iteration, the story acknowledged the reader's actions with the Rangoli and how they impacted Shiva multiple times, to help readers understand what they had agency over.

4.3. Implementation

The tabletop has different shaped sockets with snap switches fit inside them. A snap switch closes as soon as a tab fits into the socket, completing a circuit connected to the Makey Makey (Silver & Rosenbaum, 2012). The back of each ring has a shape attached to it which acts like a key and fits into a particular socket on the table. Magnets below the table and the rings help the reader snap and lock the ring into the correct position, producing a satisfying tactile experience when placing the rings. Figure 12 shows the tabletop, and details of the switch assembly. The Makey Makey copies a key press on a connected laptop as soon as a circuit is completed. This plays different sounds, music, video tracks, and the narrative dialogue through a Python program on the laptop. The program also controls patterns on a long strip of individually

addressable RGB LEDs, via an Arduino Uno, producing lighting effects in the installation. The story dialogues were pre-recorded and narrated by Melisse Andreana.

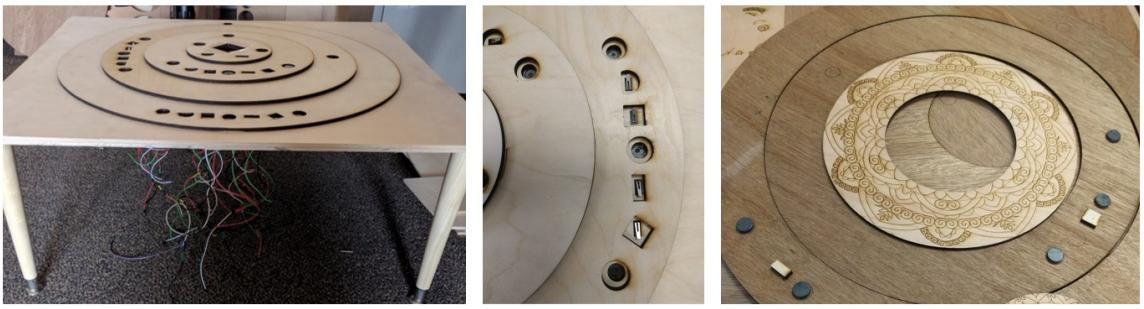


Figure 12: Tabletop, switches, and back of the rings

I tested this entire design using cardboard first, and then smaller wooden prototypes, before laser cutting the final pieces. Figure 13 shows the early prototype iterations. I laser cut the final wooden tabletop, the wooden rings, and the Rangoli patterns. The art on the rings has been inspired by repetitive patterns used in traditional Rangolis and I painted the rings by hand (Figure 14).

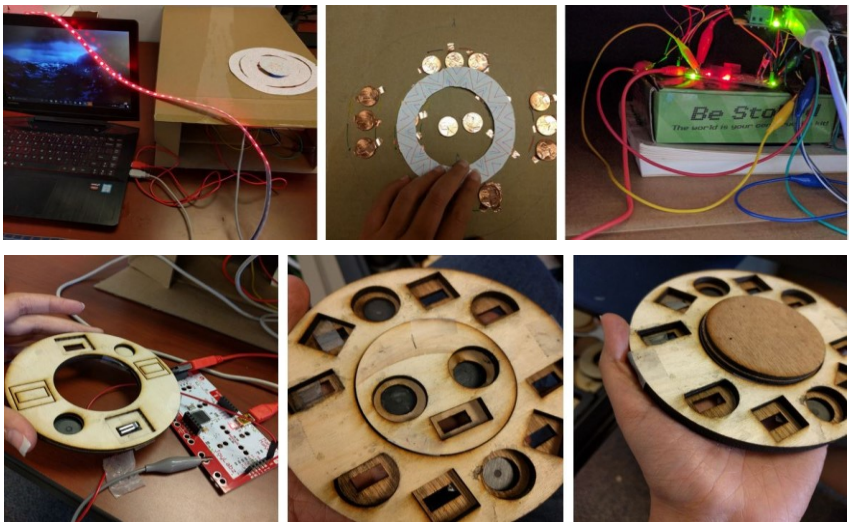


Figure 13: Early prototypes

The enclosed tent was created by suspending a metal frame from the ceiling of our lab and draping it with fabric to produce a tent-like structure (Figure 9). The interior was lit using the RGB LED light strip, which was mounted along the border of the tent frame above the reader.

Figure 14: Hand painted Rangoli rings

4.4. Study

The goal of this study was to understand 1) how the diegetic ambience and Rangoli could help readers impact the affective tone of the story 2) how the diegetic ambience and Rangoli could help readers take Shiva's role and 3) what complexities the readers had to navigate to interact intentionally with the system. This study was conducted from February – March 2018. Participants were recruited through postings on Facebook, flyers on UCI campus, and word of mouth. The criteria for participation were age above 18 and the ability to understand English and the study was unpaid. 25 study sessions and 2 pilot tests were conducted where the majority of participants were graduate and undergraduate students at UC Irvine. The table below represents the demographic data for the 21 participants that were considered for the study. I excluded two participant's data from the analysis due to a complete lack of story coherence.

Table 4: Participant demographic data - SR

PID	Age Range	Gender	Ethnic Background	Occupation
P1	18-24	Female	Indian	Graduate Student
P2	45-54	Female	Caucasian	Graduate Student
P3	25-34	Male	Asian	Software Engineer
P4	25-34	Male	Caucasian	Games Industry
P5	18-24	Male	Indian	Undergraduate Student
P6	18-24	Female	Hispanic	Undergraduate Student
P7	18-24	Female	Caucasian	Graduate Student
P8	25-34	Female	Asian	Graduate Student

P9	18-24	Male	Caucasian	Undergraduate Student
P10	25-34	Male	Indian	Graduate Student
P11	25-34	Female	Indian	Graduate Student
P12	45-54	Male	Indian	Lecturer
P13	18-24	Male	Caucasian	Undergraduate Student
P14	25-34	Male	-	Graduate Student
P15	25-34	Female	Asian	Graduate Student
P16	18-24	Male	Caucasian	Undergraduate Student
P17	35-44	Male	Caucasian	Lecturer
P18	18-24	Female	Asian	Graduate Student
P19	25-34	Male	Indian	Graduate Student
P20	18-24	Male	Indian	Undergraduate Student
P21	25-34	Male	Caucasian	Graduate Student

2 hours long 1-1 sessions were conducted in the Evoke lab at Calit2 at UCI. Participants were first introduced to the concept of Rangolis and were told that the Rangoli they created would be created by the protagonist of the stories as well. After an overview of the basic interactions, participants interacted with the demo version of the system, which allowed them to explore all the ambient effects without hearing the narratives. Once the readers were done exploring the demo, the narratives would begin to play. This experience lasted for 30-40 minutes. Participants were asked to think out loud about what surprised them, confused them, and what colors they chose. I also took notes of what they said, and I took observation notes of expected and unexpected behaviors and states of surprise or confusion.

The experience was followed by a semi-structured interview which lasted between 30-60 minutes. Participants were asked about their understanding of the stories, their mental model of the interaction, thoughts on ambience and affect, their decision-making process of selecting Rangoli rings and crafting ambiences, and their perceived role in the experience. I conducted an open qualitative analysis of the interview transcripts and the think-out loud and observation notes taken during the session (Corbin & Strauss, 2014; Saldana, 2015). After open coding, I continued creating categories until I had 100-200 code categories to work with. I further grouped these categorized codes to identify different themes. I then visualized the themes on a whiteboard with sticky notes and made meaningful connections. I used these themes to think of the design recommendations. These design recommendations provide intermediate-level design knowledge (Höök & Löwgren, 2012). They are not generalizable but are abstracted enough to provide insights to designers making interactive narrative systems with diegetic ambiences and tangibles where readers are given internal-ontological roles.

4.5. Findings

Participants felt agency over the story and took Shiva's role when the Rangolis were acknowledged in the narratives and when the action had an impact on the story world. The ambiences helped people feel what Shiva felt, feel a part of the story world, and personalize the affective tone of the story. I categorized different forms of perceived agency - Story Supporters, Meaning Makers, and Story Controllers. Participants took half the experience to decipher the complexities of the system, and in the other half, they acted with intention. The demo, acknowledgements of the Rangolis, contrasting ambient effects, and occasional mismatches between the plot and ambience helped people understand the mappings between the colors and the affect, their role, and the agency they had.

4.5.1. Diegetic Rangoli and Diegetic Ambience

17 participants felt they could impact the story world through the Rangoli interface. Ten readers felt in control of the character's fate, actions, and at times the story plot itself, specifically when the reader's Rangoli was acknowledged in the narrative and had a noticeable impact on the stories such as other characters being impacted by Shiva's emotions. Participants felt a sense of responsibility towards the story and the characters.

> P13: "My favorite moment was when I decided to give it (Rangoli) a yellow more joyous feeling, even though yellow wasn't my favorite, that added to the story that Shiva was in a good mood today, so Brahma and Vishnu decided this was a better time than otherwise to confront him. I felt alright, how do I think that may turn out. I added more red, blue to give it some negative sense as Shiva's good mood starts to sour. It (the story) responded by Shiva darkening a bit to the annoying conversation."

Five people said they felt they took Shiva's role when their Rangolis were specifically called out as Shiva's Rangolis in the stories. One participant interacted with both the stories twice and talked and acted like Shiva throughout the experience.

> P02: "At one point I felt like I am Shiva. He makes Rangolis and I am sitting here making Rangolis. I thought can he make an all yellow one? So I did it (made a yellow Rangoli), and he did it and said it was beautiful. In that moment I felt embodied."

Towards the end of both stories, readers were warned of the possible repercussions of Shiva's emotions as the other characters anxiously awaited to see Shiva's next Rangoli. This cued the readers into thinking that their next Rangoli would be crucial for the fate of the story. Two participants felt that they took Shiva's role at these points. Furthermore, these high-stakes climax points were impactful in helping participants focus, and deciphering what colors led to what affective responses.

14 participants felt like they were positioned inside the story world because of the ambience they created, especially when the plot of the story and the affective response they created were in sync. 3 people felt they took Shiva's role and could feel what he was feeling because of the affective context the ambience set.

> P19: "The accompanying visuals and the sound of the river gave me the feeling that I was part of the story and was right next to the river. The thunder and sounds with the visual of the waves helped me connect to the situation."

The ambient settings set different affective tones and highlighted certain emotions in the narratives, enabling readers to make multiple interpretations of the story and Shiva's personality. Six people felt that they could enhance or diminish a certain feeling associated with the events of the stories through the ambience control. For example, a happy ambience made during the end of the story 'the river', decreased the harsh feeling accompanying the destruction, and helped readers see the light in the destructive story ending.

> P17: "But if you feared the way things were going, you could offset some of that by making things a little more pleasant. Regardless of what was going on, if the person wanted to calm the story down or if they wanted it to be forceful, aggressive, they could use the Rangoli for that."

Nine people felt the ambience caused incremental and gradual changes in affective settings. For example, they believed that the effect of three red (angry) Rangoli rings on the ambience and the story would be worse than the effect of two red (angry rings) alongside one yellow (happy) or green (calm) ring. They created ambiences to represent a mix of or varying intensities of different affective tones rather than using them for dominantly setting one.

> P02, female: "I could influence how angry someone was, I didn't want to put all red up there, I didn't want to see what would happen. I thought the system might show me if I did."

4.5.2. Perceived Role and Agency

Participants took both internal and external roles. Five claimed they took Shiva's role at various points, especially when their actions with the Rangolis were acknowledged, and during the high-stakes end scenes. Five others felt as if they were a part of Shiva, like a person sitting in his mind. They either placed themselves in his situation and acted accordingly or thought about how Shiva would react. However, 11 others did not take Shiva's role and felt as observers inside the story world, or as puppet masters of Shiva's emotions. These 11 may not have taken Shiva's role because they were not able to decipher the system's complexity – that the Rangolis were diegetic, and the mappings of the colors to the affective states (section 4.5.3). However, three mentioned they did not see themselves as Shiva as they did not connect with his powerful and angry personality and felt detached due to his status as a God, at times even disagreeing with his actions.

Participants felt different forms of perceived agency. I categorized the perceived agency in 3 buckets and call them Interaction Styles: Story Supporters felt they had no agency over the story's plot or Shiva's emotions and created ambiences to support the story's perceivably pre-written plot. Story Controllers felt that they asserted some amount of control over the plot of the story when the Rangoli was acknowledged in the narrative. Meaning Makers felt they had agency over the affective tone of the story but not the plot.

> P13 (Meaning Maker): "I felt I had influenced the mood of the character, even though it didn't influence the progression, I felt like I was able to tell my own story of his emotional ups and downs and that felt powerful to me. It is lot like being the director of the show because the director doesn't write the script. But the director decides what it looks and feels like."

These styles were not mutually exclusive as people often took on different interaction styles as the experience progressed and they understood how the system worked. Here is a summary of these interaction styles. Please refer to (Gupta & Tanenbaum, 2019) for more details.

Table 5: Summary of interaction styles

Interaction Style	Perceived agency	Behavior	Reason
Story Supporters	Did not feel agency over the	Predicted the next story segment and created ambiences that matched	A few mismatches between ambience and plot may have made them feel the story is

	story's plot or Shiva's emotions	the story's perceivably pre-written plot	completely pre-scripted. They may not have picked up on the fact that the Rangolis they created were the same Rangolis that Shiva created
Story Controllers	Felt they controlled the story plot at key points – when the narrative acknowledged their Rangoli, and at the end	Projected own emotions and thoughts to decide how Shiva would react. Felt responsible for story outcome	They noticed that the Rangoli colors they assembled were acknowledged as Shiva's Rangoli. They may have felt their actions were consequential in the story, especially during the high-stakes ending scenes.
Meaning Makers	Felt agency over the affective tone and pace of the story but not the plot	Enhanced or diminished feelings associated with an event, saw different shades of Shiva's personality, and saw the story from different perspectives.	Contrasting ambient effects and changes in the narrator's voice helped them see the story from different perspectives. A few mismatches between the ambience and plot helped them realize they did not have agency over the plot.

4.5.3. Understanding Complexities

Shiva's Rangoli was a complex system to understand. Over the course of the interaction, participants had to understand what Rangoli colors were mapped to what emotions, that their Rangolis were diegetic as what they created was what Shiva created, and that they had agency only over the emotional tone of the stories and not the plot. They had to understand all this while listening to two interleaved stories, in a novel environment. Participants almost took the first half of the experience, that is nearly one story, to understand the system's working. Their decisions in the first half were exploratory and based on trying every color or using the colors and ambient effects they liked, and this could be attributed to the novelty of the system. As they understood the above-mentioned concepts, they made more informed decisions on how they wanted to impact the affective state of Shiva. The contrast in the ambient effects, especially the red (angry) and green (calm) ones, helped people understand how different colors / ambient effects were mapped to different affective states. People who explored the demo version of the interaction longer acknowledged that it helped them relate the colors and ambiences to the affective settings. When the stories acknowledged the colors of the participant's Rangoli and

specified the consequence of those colors on the narrative, the participant would understand how the colors mapped to different affective states, and how their choices impacted the story.

> **P13:** "I think that what clued me in first was the narrative, when she talked about red-blue Rangoli and described the mood it was for Shiva - of turmoil, anger, joy, peace. That was a big clue that helped me understand. Once I had that, I felt like I could piece it together myself."

Although the ambience set the intended affective tone for most people, for a few the ambience did not create the desired emotional effect. For example, two people found icy images (linked to sad) calming, while others found it isolating and sad. These mismatches were mitigated when the narrative called out the colors of the reader's Rangoli and specified its impacts on Shiva. This two-way confirmation through the ambient setting and the Rangoli acknowledgement in the narrative helped people understand the mapping between the colors, ambient effects, and the affective tone.

Although each chapter was written to adapt to the affective tone created by the ambience, a few chapters had essential plot elements that could not be represented in both positive and negative tones. In these cases, a happy ambience created during a sad chapter would result in a mismatch of affective tones, creating incoherence and less perceived agency. Similarly, a sad ambience at times did not match a relatively positive event, yet this case was not as noticeable as the former. However, people reported these mismatches also helped them focus as they questioned their understanding of the system. The mismatches helped them understand that they did not have complete agency over the plot of the narratives, the stories were pre-written to an extent, and there were no branching narratives. Mismatches helped relieve misconceptions and apprehensions about branching narratives, non-linear stories, and combinatorial explosions. A few people also switched interaction styles as they understood what they had agency over, such as moving from Story Controller style to Meaning Maker style.

A few people were overwhelmed by the system as they were not able to listen, act, and understand the system all at the same time. This affected story coherence, they would not notice the diegetic nature of the Rangolis, and/or they would not map the ambient effects to the affective tone. This half-baked understanding of the system may have led to the interaction style of 'Story Supporters' where people felt they had no agency over the story and did not take Shiva's role.

When asked about how they understood the diegetic nature of the Rangoli, participants always referred to the chapters where they perceived their actions to be consequential. However, sometimes the acknowledgement of the colors of the Rangoli was not followed by a noticeable consequence in the story. For example, only Shiva's emotions would change because of the Rangoli, but his emotions would not impact anything in that chapter. The participants may have missed the acknowledgement of the colors of the Rangoli itself because of these unnoticeable consequences, hindering their ability to understand that the Rangoli was diegetic and what colors mapped to what affective tones.

In summary, the following concepts helped people understand the system's working:

Table 6: What helped people understand the system

Concepts	How concept helped understand the system
Demo	• Explored different ambient effects that each ring offered.
Acknowledging the reader's Rangoli in the narrative and having a noticeable consequence in the story.	• Understood that the Rangoli was diegetic, the impacts of the colors on Shiva's emotions, and how different colors mapped to different affective tones. • Gained the most attention during high-stakes endings. Helped confirm understanding.
Contrast in ambient effects	• Helped differentiate between different affective states.
Mismatches in ambience and story plot	• Understood the agency they had over the stories. • Got rid of false assumptions like the story having branching narratives. • Some people shifted between different interaction styles.

Most participants were committed to making ambiences that fit well with the needs of the characters, rather than creating Rangolis based on their favorite colors or other personal preferences. They were further motivated to change the ambient effects after every chapter, to support the next segment of the narrative and create an immersive experience. This shows that readers want to create a meaningful experience for themselves.

4.6. Design Recommendations

In this section, I describe the takeaways and design recommendations from the study findings based on my research questions. In section 4.6.1 I describe how diegetic tangible interfaces and

diegetic ambient effects can work together to give readers internal-ontological roles. In 4.6.2, I describe how these diegetic elements can help readers take the character's role. In 4.6.3 I discuss how complexities of narrative systems (within the context of SR) can be simplified for readers to understand the system and engage meaningfully.

4.6.1. Designing Diegetic Interfaces and Diegetic Ambient Effects

Shiva's Rangoli shows that many aspects of the experience can be diegetic – the Rangoli interface, the ambience and physical space, and the act of making a Rangoli and setting the ambience and affective tone. This design shows that many aspects of the system can be diegetic, not just the interface.

In SR, readers could craft different Rangolis, where different combinations impacted the affective tone of the narrative. However, in many existing works such as *the Reading Glove* and *genieBottles*, diegetic interfaces can not be crafted or manipulated in any way and rely solely on the reader picking up the object. I suggest that diegetic interfaces can be designed to be manipulated or crafted by the reader in different ways where these various manipulations can subsequently lead to varying narrative impacts, giving readers ontological roles. Moreover, these manipulations with the diegetic interface can give readers a stake or responsibility in the narrative – like Shiva's emotions and actions.

The ambient effects were also diegetic in SR, but they were not solely used for sensory mimicking of the story world like in many existing works (Bobick et al., 1999; Schafer et al., 2018), they were also used to express Shiva's emotions as the in the stories, as the world's environment shaped according to Shiva's emotions and Rangolis. However, participants saw Rangolis as tools to set the ambience and Shiva's emotions rather than as an expression of affect. Perhaps the performance of creating a Rangoli could have been more affectively expressive like – heavy and rough rings for communicating anger and soft and light rings for calm. While readers still may not have felt the affective response themselves, the actions could have been more performative and logically convincing ways to impact and express emotions.

Readers used the ambience to make incremental and gradual changes to the affective tone, at times representing a complex mix of many emotions. Certain elements of the ambience could have supported this, such as varying the music tempo and volume to distinguish between

different arousal rates for various affective settings. Actions with the tangible interface such as turning or sliding could have also helped denote ambiences across as a spectrum, allowing readers to represent varying degrees of affect. I recommend that affective states can be represented through ambient effects as continuous rather than discrete variables so readers can represent incremental changes and a mix of emotions. Designers can think about whether the impact of the reader's action is discrete or spread across a spectrum, and how actions with the diegetic interface can support these variables. Readers liked crafting the ambient space, as people found different components (light, sound, music) of the ambience impactful for setting the affective tone. In SR, allowing readers to craft the ambience by combining different components was more beneficial than selecting pre-crafted ambient effects.

Different people related different ambient effects to happy, calm, sad, and angry. For example, two people found icy images calming rather than sad. Personalizing the mappings between the ambient settings and affective tone for each reader could have helped resolve this issue. In the tutorial, people could have been asked to select the rings they found to create a "sad" ambience, and the story could have been personalized accordingly. This personalization may have enabled readers to feel Shiva's emotions through the ambience as well. I recommend asking readers to personalize mappings between actions and affective responses. The table below gives the summary of the recommendations in this section.

Table 7: Designing for diegetic interfaces and diegetic ambient effects - SR

Concept	Design Recommendations
Diegetic tangible interface - Rangoli	• Think of the aspects of the system besides the interface that can be diegetic. Ex: act of creating a Rangoli to set the affective tone. • Allow readers to manipulate or craft the diegetic interface in different ways where various manipulations can lead to varying narrative impacts. Ex: The Rangoli interface allowed readers to create different colored Rangolis that led to changes in the affective tone.
Diegetic ambience to present affective tones	• Use diegetic ambient effects not just for sensorily mimicking the story world, but also for impacting and expressing affective states of the story. • Represent affective states through ambient effects as continuous rather than discrete variables so readers can present incremental changes and a mix of emotions. Design diegetic interfaces to support such variables. Ex: varying music tempo or turning/sliding the tangible interface.

	• Personalize the mappings between the ambient settings and affective tone for each reader. Ex: what ambient effects does the reader find calming?

4.6.2. Roleplaying through Diegetic Interfaces

I discuss how SR helped readers roleplay:

- Feel what the character feels affectively (empathy (Smith, 1995), affective empathy (Levenson & Ruef, 1992), bleed from transformation (T. J. Tanenbaum, 2015))
- Take the character's identity when the reader plays the character's role (transformation, surrender identity and adopt other's (Tal-Or & Cohen, 2010), (T. J. Tanenbaum, 2015), (J. H. Murray, 2016))

Diegetic interfaces can help readers take the character's roles through behavioral mimicking – that is taking actions the character would take (like creating Rangolis to express emotions) (Bizzocchi et al., 2011). I recommend that the reader's actions with the interface should be acknowledged in the narrative and should lead to noticeable consequences in the story. In SR, those who felt the Rangoli was diegetic (their Rangolis were the same as those that Shiva created and impacted the story world) took more internal roles, and a few even took Shiva's role. However, those who did not realize that the Rangoli was diegetic, took external roles and did not feel like they could impact the story world. I recommend that it is important to call out the reader's actions with the diegetic interface multiple times in the story, without being subtle, to help them realize their actions are a part of the narrative.

Just acknowledging the reader's action in the story is not enough, the action should also have a noticeable impact on the story world, so readers take ontological. In SR, sometimes acknowledgement of the reader's actions went unnoticed, especially when actions did not have noticeable consequences such as - Shiva just being happy/sad as expressed in the Rangoli colors, but not impacting the story world and characters because of his emotions. Since people did not always pay attention to the acknowledgement, they may have taken more time to decipher that the Rangoli interface was diegetic, whereas a few participants did not pick up on the fact the interface was diegetic at all. This half-baked understanding hindered readers from taking Shiva's

role. On the contrary, a few people reported feeling like they were Shiva during the end of the stories where the stakes were high, and they were told that their next Rangoli would decide the fate of the story world. This shows that actions that feel consequential can help readers take a role. I recommend that the reader's actions should lead to noticeable or even high-stakes consequences in the story world, to help readers feel like they have some responsibility in the narrative and take a role. This does not mean that the reader's actions need to change the plot of the story. As seen in SR, actions can feel consequential without changing the plot by impacting elements such as –Shiva's affective response, the way he carried out his actions, and how other characters responded.

I recommend that diegetic interfaces can help readers take a character's role by allowing them to impact, express, and feel the character's affective state. The diegetic ambiences helped readers express emotions as Shiva, and at times even feel the affective state of the story and character. Since readers were endowed with how Shiva would feel, they had to put themselves in his shoes and think about what he would act or feel. As mentioned earlier, the act of setting the ambience through the Rangoli could have been more expressive of the affective state too.

Readers took Shiva's role in two ways – by taking actions the character would take through the diegetic Rangoli, and by impacting and feeling his affective state through the diegetic ambiences. I recommend that multiple diegetic elements of the system can work in harmony to help readers take a role, reinforcing different aspects of the role – such as action and emotions in SR.

Lastly, Shiva's personality as an angry God was unrelatable for people to take his role. Perhaps more backstories explaining why he was that way or showing more character growth where Shiva managed his temper could have helped in creating a more relatable character.

Table 8: Roleplaying through diegetic interfaces - SR

Concept	Design Recommendations
Acknowledge the reader's actions and have noticeable impacts on the story	• Allow readers to mimic the character's actions - like creating a Rangoli. Acknowledge their actions in the narrative multiple times in the story. Ex: calling out the colors of the Rangoli that the reader created • Just acknowledging the action is not enough, without a noticeable consequence, the reader may miss the acknowledgement completely. Ex: Shiva just being happy/sad

	as expressed in the Rangoli colors, but not impacting the story world because of his emotions was an unnoticeable consequence. • Ensure the reader's actions have a noticeable impact on the story world so readers take ontological roles, feel responsible, and take the character's role. High-stakes consequences can be even more impactful. Ex: the high-stakes endings of the stories were successful in giving readers ontological roles and feeling like they were Shiva
Take character's role by impacting the character's affective state	• Help readers take a character's role by allowing them to impact, express, and feel the character's affective state. Ex: Diegetic ambient effects helped readers impact and at times even feel Shiva's affective state. However, the act of assembling Rangolis could have been more affectively expressive like using heavy vs light rings.
Reinforce different aspects of the role	• Use multiple diegetic elements in harmony, reinforcing different aspects of the role. Ex: Readers used Rangolis to take actions Shiva would take, and ambient effects to impact and feel Shiva's emotions
Create likable characters	• Create relatable characters. Show character's personality through backstories and show character growth. Ex: Shiva's personality as an angry God was unrelatable for some readers.

4.6.3. Navigating Complexities of the System

As mentioned earlier, SR was a complex system to understand as readers had to figure out what was diegetic, what agency they had, what colors mapped to what affective states, and the fact they were taking Shiva's role, all while listening to two interleaved narratives. Although readers took almost half the time in the experience to understand the system, these complexities also kept readers engaged. However, this kind of engagement can feel more like solving a puzzle, rather than engagement that stems from experiencing a narrative and playing a role. I recommend that designers should think about the kinds of engagement they want readers to experience and simplify or amplify complexities accordingly. It is also important to leave space for readers to move from this phase of understanding how the system works, to the phase of making more intentional decisions, especially if the system has multiple complexities like in SR. SR was long enough, as readers could experience two stories, using one story to understand how things worked, and the other one to act with intention.

While multiple diegetic elements can help readers take a role, they can also be useful for understanding how the system works – what actions map to what consequences. In SR, the narrative gave two confirmations to help readers map colors to affective states – how Shiva expressed his emotions through the different colored Rangolis, and how the ambience of the story world reflected Shiva's emotions. For example, in one of the chapters, when a reader assembled a blue and red Rangoli, the ambience turned gloomy and tensed, and the system narrated the following lexia: *"On such days, the harsh, dark, and stormy lands would fill the sky with a hint of red and blue, as they mimicked Shiva's Rangolis and his unpleasant mood."* This lexia, the Rangoli, and the ambience worked together to tell the reader that their Rangolis were diegetic, Shiva created red and blue Rangolis to express his unpleasant mood, and the ambience of the story world and the reader's physical space reflected how Shiva felt. I recommend that multiple diegetic elements of the system can work in harmony, giving readers the same information in different ways, helping them understand how the system works. Here again, acknowledging the reader's actions and specifying the impact of those actions in the narrative is important to help readers understand what agency they have and the mapping between the actions and consequences. Furthermore, high-stakes scenes such as the ones at the end of the stories, can encourage the readers to focus more, helping them untangle the complexities.

The occasional mismatch between the ambience and the plot (when a happy ambience was created during a sad scene) helped readers understand the agency they had over the story and remove misconceptions and apprehensions about branching narratives. I recommend such occasional mismatches between actions and the expected consequences do not have to be completely eliminated as they may be useful for understanding the boundaries of the system. However, readers could have been backled more by hinting them of what the next chapter might entail, to help them create suitable ambiences for the scene.

Lastly, the demo also helped readers understand parts of the system outside the narrative context – like what ambient effects the different Rangoli rings created. I suggest that demos given before the narrative experience can help readers understand some complexities of the system and give them a space to explore the different actions available to them in a low-stakes environment as they would not impact the narrative at all.

Table 9: Navigating complexities of the system - SR

Concept	Design Recommendations
Identify the various complexities that the system has	• Identify the different complexities in the system that readers will have to understand. Solving too many complexities may feel like readers are solving a puzzle rather than engaging with the narrative. Ex: SR had many complexities - readers had to figure out what was diegetic, what agency they had, what colors mapped to what affective states, and the fact they were taking Shiva's role • Leave space for readers to move from the phase of understanding how the system works, to making more intentional decisions.
Use multiple diegetic elements and acknowledge reader's actions to help them understand the mapping between actions and impacts	• Use multiple diegetic elements of the system in harmony to give readers the same information in different ways. Ex: the narrative gave two confirmations to help readers map colors to affective states – how Shiva expressed his emotions through the different colored Rangolis, and how the ambience of the story world reflected Shiva's emotions • Acknowledge the reader's actions and narrative consequences to help readers understand the agency they have and mappings of actions to consequences.
Mismatches between actions and the story plot may be useful	• Occasional mismatches between the reader's actions and the plot may be useful for readers to understand the agency they have and remove any misconceptions. Ex: mismatch between the ambience and the plot (when a happy ambience was created during a sad scene) helped readers understand there were no branching narratives
Demos before the narrative experience begins	• Use demos before the narrative experience begins to let readers explore different actions available to them and to help them understand some complexities of the system.

4.7. Conclusion

In this section I revisit the main takeaways from this study and how they help answer my research questions.

RQ1: How can different diegetic elements be designed to position readers in internal roles (inside the story world) and ontological (impact story world) roles such that they feel the impact of their actions, and buy into why their actions cause a particular consequence?

SR illustrated that different elements of the system can be diegetic –the ambience, physical space, and the act of making a Rangoli and setting the ambience and affective tone. I

recommend that such diegetic elements can help readers take internal-ontological roles and feel the affective state of the story. One way to give readers ontological roles through the diegetic interface is by allowing them to manipulate and craft the diegetic interface in different ways where various manipulations can lead to varying narrative impacts, giving readers stakes in the story. For example, the Rangoli interface allowed readers to create different colored Rangolis that led to changes in the affective tone.

SR also gave insights on how diegetic ambiences can help readers impact and feel affective states, giving ontological roles, and moving beyond the contemporary use of sensorily mimicking the story world. I recommend that diegetic ambient effects can be designed to support readers in expressing incremental changes and a mix of emotions, like varying music tempo or turning/sliding the interface. This representation of emotions is closer to reality and may increase buy-in. Furthermore, this representation provides a more nuanced way of impacting the narrative and taking an ontological role. Personalizing the mappings between the ambient settings and affective tone for each reader may help readers feel the affective state set by the ambience, and increase buy-in. The Rangolis themselves could have also used tangible metaphors to better represent the affective tones they represented like heavy-rough for displeasure and light-smooth for pleasure.

RQ2: How can diegetic elements support aspects of character engagement (CE) such as - understand and adopt character goals and motives, feel for the character and root for them, feel what the character feels affectively, or/and take the character's identity, when readers interact with another character or take a character's role?

I recommend using multiple diegetic elements to reinforce different aspects of the role. The Rangolis helped readers take Shiva's actions (behavioral mimicking) and the ambient effects helped them impact and feel Shiva's emotions.

I highlight the importance of acknowledging the reader's actions multiple times in the story so realize their actions are a part of the narrative, helping them take an internal role. Moreover, just acknowledging the action is not enough. The reader should feel their actions had a noticeable consequence on the narrative, so they understand the agency they have, and feel responsible. High-stakes consequences can be even more impactful for taking a role.

Diegetic ambient effects can help readers impact, feel, and express the character's emotions. Moreover, being in charge of how the character would feel can encourage readers to think from the character's perspective. However, in SR, the act of assembling Rangolis could have been more affectively expressive like using heavy vs light rings. Lastly, creating a more relatable character rather than a powerful angry God may have helped readers accept Shiva's role.

RQ3: what complexities might readers face while taking internal-ontological roles and engaging with characters in diegetic interactive narratives? How can readers be assisted to navigate these complexities such that they can intentionally impact and engage with the story?

In SR, there were many complexities that readers had to navigate - what was diegetic, what agency they had, what colors mapped to what affective states (what actions led to what consequences), and the fact they were taking Shiva's role, all while listening to two interleaved narratives. Solving these complexities almost felt like a puzzle and many readers were not able to take Shiva's role because of these complexities. I recommend that designers should identify the complexities the readers would have to navigate and give them time to move from the phase of understanding how the system works, to making more intentional decisions.

I also recommend that multiple diegetic elements can work in harmony and give readers the same guidance information like - acknowledging the colors of the Rangoli as a reflection of Shiva's emotions, and the ambient effects mirroring Shiva's mood both gave information about Shiva's affective state. Here again, acknowledging the reader's actions with the interface repetitively without being subtle can help readers understand how their actions impact the story world. SR also showed how occasional mismatches between the reader's actions and the intended consequence can be useful for readers to understand the agency they have, the boundaries of the system, and remove misconceptions. Lastly, demos outside the narrative experience can help readers explore various actions available and understand some complexities before the experience begins.

Chapter 5. The Next Fairy Tale – a VR Experience

The Next Fairylike (TNFT) is a VR interactive narrative pre-show experience for the Broadway play TNFT. This was designed for readers to get a glimpse of the antagonist - Minerva's early life and choices, and perhaps understand and sympathize with her. In the experience, readers take the role of Calliope (internal), the queen of fairy godmothers, who is also Minerva's sister. They help Minerva through one of her pivotal life moments by having a conversation with her. They talk to Minerva by casting spells that can change the affective tone of the dialogues exchanged between them (ontological), bringing out how Minerva feels. The reader's actions do not change the plot, as rather than deciding *what* to say, they decide *how* to say it. TNFT draws on principles of acting theories and theater to help readers take the role of Calliope.

VR can be a useful medium for storytelling because of its multisensory, bodily, and transporting capabilities. At the same time, it can be overwhelming and challenging to design with. This makes VR a worthwhile exploration for diegetic interfaces. TNFT contributes to the overall dissertation by describing how diegetic cues for roleplaying can be embedded in the narrative VR world, and how roleplaying can help develop sympathy for characters. It also elaborates on how to design and scaffold for readers to take and perform a role, all while managing the cognitive overload that VR can produce. Although this work does not involve tangibles like my other two projects, it does include bodily diegetic actions and multi-sensory diegetic roleplaying cues. The contributions from TNFT emphasize RQ2 and RQ3 more than RQ1 because of its focus on roleplaying and creating character sympathy.

The main takeaways from this work are:

- Saturate experience with cues and information about the role across different modalities – audio, visual, and actions with narrativized interfaces (Bizzocchi et al., 2011). Being referred to as the character, being shown one's visual identity as the character, and taking actions the character would take, can all help readers take a role.
- Ease readers into wearing the character's mask through diegetic actions and objects – like picking up and wearing objects that belong to the character.

- Endow readers with other character's well-being to help develop a sense of responsibility and sympathy. Use familiar social scenarios to strengthen CE.
- Manage cognitive overload in VR by repeating and spreading out backleading cues throughout the experience.

5.1. Background

TNFT explores roleplaying with theater strategies in VR. It is worth reviewing existing works in AR/VR theater. Cirque du Soleil (*VR APP*, 2021) and The Circle of Life (Disney On Broadway, 2021) use a commonly emerging approach to VR theater - placing a 360-degree camera on the stage of an existing theatrical experience. These experiences give a new way to experience theater but offer little beyond the immersive video experience. Pillai et al. describe viewers of these experiences as 'active observers' (Pillai et al., 2017). Beyond these immersive cinematic approaches, there are few other designs in VR theater. Wu et al. created a system that allowed actors to animate virtual characters in real-time as they interacted with a user in VR (Wu et al., 2010). Leo et. al investigated the use of physical props in VR to tell the story of an ant's life (Leo et al., 2015). (Plaxen et al., 2018) explored how to position players in a third-person perspective where the narrative branched based on the objects they interacted with. A common trend in these existing theatrical experiences is that the role of the reader/player/viewer is unspecified, often leaving them as invisible observers or as ambiguous entities in the story world. TNFT addresses this gap in the current design space by creating a VR theater experience oriented around the pleasures of playing a role and character engagement (J. Murray, 1997; T. J. Tanenbaum, 2015).

Smith writes about character engagement in two categories - *sympathetic* processes, where a person comes to feel *for* a fictional character, and *empathetic* processes where a person comes to feel *as* the fictional character (Smith, 1995). TNFT was designed such that readers felt as Calliope and sympathized with Minerva. However, accepting and performing a character's role is not a trivial task. Readers must know who the character is, what their goals are, how to perform, and how their character would behave. The field of practice with the most expertise relating to performative enactments is theater. Applying a concept from theater, readers must understand the *script* that they are expected to perform. Tanenbaum's work on transformative play

considers several traditions of theater practice that explicitly engage with strategies for communicating scripts to readers (T. J. Tanenbaum, 2015). Based on Keith Johnstone's work on improvisation for the theater (Johnstone, 1992), and Janet Murray's discussion of masks (J. Murray, 1997), she considers how seeing oneself in a 'mask' can lead to identity transformation. That is, seeing oneself with a particular face, body, fashion sense, and body language, can help them take the character's role. Her work on masks is largely based on in-game avatars, and can be seen as a form of *Narrativized Interface,* where elements of the digital narrative permeate the interface's appearance and operations (Bizzocchi et al., 2011). Tanebaum also describes situated rehearsals – allowing readers to practice their role in low pressure environments. TNFT applies the concept of masks and situated rehearsals to help readers take Calliope's role.

There are certain desired actions that designers want readers to take in order to perform a character's role and advance the overall story. For example, Riedl and Young propose different strategies to guide players towards actions that will advance the plot, or away from actions that might "break" the narrative (Riedl et al., 2003). Sheri Graner Ray argues that while some players prefer to discover how a system works through free exploration, many others wait until the *desired* behavior is *modeled* for them by the system before attempting it themselves (Ray, 2010). TNFT explores how guidance strategies and tutorials can help readers take the desired actions to perform a role by using the theatrical approach of *backleading*. In interactive theater, it is common to invite audience members into the performance and expect them to take on a role within the story. Backleading refers to a series of strategies that actors can use in an interactive theater piece to help put an audience member at ease and encourage them to perform in the moment (Wirth, 1994). Backleading strategies like cueing the audience member with lines to perform or asking them to assume a role that is responsible for something significant within the story, can help audience members offset the anxiety of being invited onto the stage without any preparation.

TNFT combines theatrical strategies of wearing a mask, situated rehearsals, and backleading to help readers play Calliope's role – Minerva's sister, to understand and feel for Minerva.

5.2. Design

My team and I created The Next Fairy Tale over 20 weeks as part of a course on experimental AR/VR Theater in collaboration with a multiple Tony Award-winning Broadway producer -Apples and Oranges Production (*Apples and Oranges Arts | Homepage*, 2021). Eight people comprised our team including graduate and undergraduate students who took the roles of designers, developers, team lead, and artists. I took the roles of design and development. Our design process included three months of design experimentations, paper prototyping, and experiments. We created a 10-minute pre-show VR experience, where audience members would enact as Calliope- the sister of the antagonist – Minerva, to understand and sympathize with Minerva. To preserve the experience of performing a script we designed our system so that the reader was making expressive choices about *how* to perform their role, rather than authorial choices about *what* to say next. We implemented our design in Unity 4.2 for the HTC Vive headset and the art was made in voxel art aesthetic (like games like Minecraft).

We went through many design brainstorming exercises and prototyped a few ideas before landing on the current version. In one of the prototypes, the reader could experience the play from different character perspectives. However, we felt that readers would not have a goal and would not be able to engage with the characters. In another version, the reader would be an audience member of the play and would be called upon backstage to fill in for a missing actor. The reader would then get to dress up and experience a snippet of the life of various characters before choosing the role they would play. While this idea gave readers internal roles and helped them explore a character's psyche, it again did not give them a goal, nor did it allow them to impact the story world. We later landed on the version that is described below giving readers Calliope's role, with the goal of helping Minerva in making a tough decision.

5.2.1. The Story

Working with the playwright and composer of TNFT, we designed a prologue scene that introduced the reader to the motivations and struggles of the central villain of the show: the fairy godmother Minerva. TNFT is a queer fairytale story, where two princes fall in love with each other. The queen of fairy godmothers, Minerva, believes that a prince must only marry a princess and tries to sabotage their love. Our prologue experience shows a glimpse in Minerva's

life from many years ago. The player takes on the role of Minerva's sister, Calliope who is the queen of the fairy godmothers. Minerva has fallen in love with King Arthur, whom she has been assigned as a fairy godmother, but their marriage is forbidden by tradition. As Calliope and a proponent of their love, the reader must help Minerva as she struggles with this pivotal moment in her life. True to the plot of the play, in the end, Minerva decides not to marry Arthur, choosing her duties to her kingdom over love.

5.2.2. Experience Design

TNFT is set in an open area of a magical forest. The reader enters this experience to find a magical Mirror (a character in the play) who is calling out for Calliope (Figure 15). As the reader moves closer to the mirror, they are automatically teleported to stand in front and to the center of it. They see themselves reflected in the mirror as Calliope (Figure 16). The Magic Mirror asks them to talk to their sister, Minerva, who is agonizing over whether to marry King Arthur. Here is an abbreviated selection of the Mirror's dialogue:

> **MIRROR**: Calliope! I know you're near, my queen. You are needed…your sister is quite distressed over this Arthur situation. She needs your guidance!

Figure 15: Entering the experience

This introductory scene uses several techniques from theater. First, the reader is assigned a role, and shown their mask and visual identity reflected in a mirror (Johnstone, 1992). The Mirror backleads (Wirth, 1994) the reader through a combination of direct cueing, goal setting, and responsibility where the reader is given a task to accomplish and another character to care for. Calliope responds to the Mirror, further reinforcing the guidance provided to the reader.

The core of the interaction design is a dialogue interaction where the reader uses Calliope's magic to guide the emotional tone of the conversation by casting spells associated with four different affective states.

Figure 16: Reflection in Mirror as Calliope

We used Russel's model of affect to produce four different emotional states across combinations of positive/negative emotional valence and high/low levels of arousal (Russell, 1980). The spells are in the shape of balls and have facial expressions on them that match their respective affective states – calm, angry, sad, and happy (Figure 17).

Figure 17: Affective spells

We assigned colors to the emotions based on Fagerberg et al.'s mappings- red for angry, yellow for happy, green for calm, and blue for sad (Fagerberg et al., 2004). The actions of casting spells are diegetic as they are a part of the story world and an action that a fairy would perform, contrary to other mechanisms like dialogue wheels that have been used in games for selecting a dialogue (BioWare, 2010).

The Mirror backleads the reader to try out the different spells, by grabbing and tapping them with the wand (Figure 18). As the reader tries out different emotional spell balls, Calliope describes how the spells would impact the conversation. For example, when the reader taps the angry spells, Calliope in an angry tone says "*This spell charges the air with frustration or anger - sometimes, you just need to get something off your chest*!".

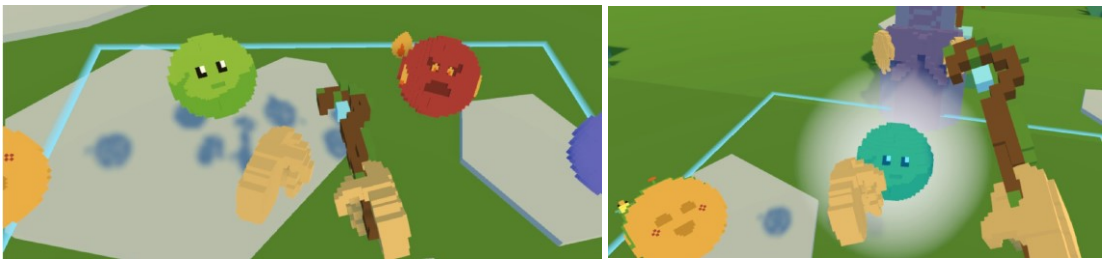


Figure 18: Grabbing and tapping a spell

When the reader taps the green spell, Calliope switches to a soothing voice to say, "*This spell brings calm that can soothe distressed hearts and bring peace*". The happy spell raises positivity, and the sad spell brings out suppressed grief. This interaction with the mirror is a form of situated rehearsal where people learn how to use the spells and their impacts with low stakes (T. J. Tanenbaum, 2015). This conversation with the Mirror also serves as an in-world diegetic tutorial to the readers. During the conversation with the Mirror and practice round with spells, readers are unable to teleport anywhere else and are left standing in front of the mirror. After the reader has tested all the spells, the Mirror moves aside, the teleport feature turns on, and the wall behind the mirror comes down, allowing the player to enter the main big and open space, where Minerva is waiting, mumbling to herself about her troubles (Figure 19). The reader is free to move around in this open space which is full of trees and small animals. They can talk to Minerva at any time by casting a spell. A bug in the system makes Minerva constantly look at Calliope, even when they move around the big open space.

Figure 19: Main space with Minerva

The scene between Minerva and Calliope plays out with the reader moving the conversation forward by casting spells. The reader chooses a spell and hears Calliope's dialogue play out in the affective tone they selected. Minerva's dress changes to reflect the color of the emotion chosen after which her dialogue plays out in the same affective tone (Figure 20), following the same color mappings as the spells. Alongside the dress, Minerva's nonverbal behavior changes based on a simplified version of Laban Movement Analysis (Bishko, 2004). She takes different postures like shaking her fists when she is angry or slouching over when she is sad (Figure 20). All these visual cues are diegetic and help readers understand the consequences of their actions.

Figure 20: Minerva's change in dress and stance with different affective spells (from top right, clockwise: happy, calm, sad, and angry)

5.2.3. Dialogue Navigation

Figure 21 illustrates the interactional logic of our dialogue system. Working with TNFT's playwright we developed a scene that covered a single dramatic arc, but within both a positive and negative emotional valence. Each lexical unit in the dialogue consists of at least one dramatic offer from Calliope and a response from Minerva. Crafting this dialogue was a significant challenge: readers had to be allowed to move between different affective states without the dialogue losing coherence and conveying the same message. To navigate this complication, readers can choose between any of the four affective states at the beginning of a lexia. However, once they have selected an affective space in which to perform (positive – happy/calm, or negative – sad/angry), the two spells from the other space fly out of reach until the lexia is complete, after which they return. Within any given lexia, the readers may continue to cast spells to modulate the arousal level of the conversation (between happy and calm or angry and sad). The semantic of the dialogue delivered within the same affective space is the same and differs only in the voice actor's arousal modulation, which keeps the coherence of the dialogue. In Figure 21 we visualize this and show how a player might navigate the expressive space of TNFT.

Here is an example of a lexia in negative affect where readers can modulate between angry, sad:

> **CALLIOPE**: If you want to marry Arthur, no one will stop you…You will have to leave Avalon, but it will be for the good of the realm.
>
> **MINERVA**: I will never leave Avalon. Do you understand me? I will never stop being a Fairy Godmother, not until the day I die. I swear it.

Here is a lexia from the same moment in the conversation, but in the positive affect, where readers can modulate between calm and happy:

> **CALLIOPE**: Don't you love him?
>
> **MINERVA**: Of course, I do. I've loved him since we began our quest to forge Camelot.
>
> **CALLIOPE**: So? Marry him.
>
> **MINERVA**: Have you lost your beans? I would have to leave Avalon. I would have to give up my wand, give up my place as a Fairy Godmother! I can't do that. Not when the world is at war, and the people need us most.

Both lexia convey Minerva's unwillingness to leave Avalon and her duties. As Calliope, readers are generally supportive of Minerva marrying king Arthur, true to her character in the play. After 8 such lexia, the experience ends with Minerva deciding to leave Arthur, choosing duty over love, true to her character in the play. The credit scenes roll in signifying the end of the experience.

While readers can only modulate the affective tone of the dialogue between the characters, they still take ontological roles even though the semantics of the dialogue does not change. This is because the affective tone of the dialogue leaves a traceable history of how emotionally charged the conversation is, how Minerva truly feels, and how the relationship between Calliope Minerva is.

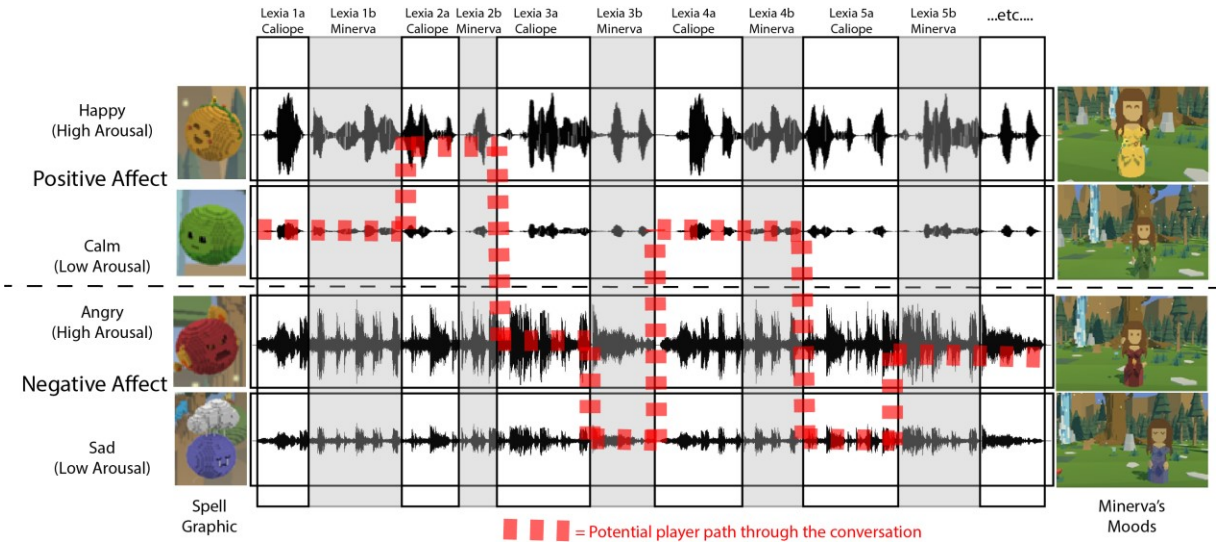


Figure 21: The interactional logic of TNFT's dialogue system, the emotion spells, and Minerva's responses

5.3. Study

The aim of this study was to answer: 1) Did readers report or display roleplaying behaviors in TNFT? What diegetic elements helped and what hindered roleplay? 2) What were the consequences of playing Calliope's role, especially with respect to their feelings towards Minerva? 3) What complexities did readers navigate to play the role? This study focused more on RQ2 and RQ3 of the dissertation.

I conducted the study with three other graduate student researchers from January – March

2019. Another member of this four-person group had also been a part of the eight-member team that helped design this experience. I was the lead researcher on this study and guided the other team members through the research process. We recruited 12 participants through convenience sampling at UCI with no restrictions to participation except for the ability to comprehend English. They all had an interest in VR or theater experiences. The table below gives participant details. All participants had played with VR between 0-3 times and none of them owned a VR headset. Three participants (p03, p05, p07) said this study was their first time in VR. Most participants had a shared interest in theater, but four said they were indifferent (p05, p07, p09, p12).

Table 10: Participant demographic data - TNFT

Participant ID	Age Range	Gender	Occupation	Experience with VR	Interest in Theater
P01	18-24	Male	Graduate Student	1 time	Seen more than 3, likes theater
P02	25-34	Male	Graduate Student	2 times	Seen more than 3, likes theater
P03	18-24	Female	Undergraduate Student	0 times	-
P04	25-34	Female	Graduate Student	2-3 times	Seen more than 3, likes theater
P05	18-24	Female	Graduate Student	0 times	Seen one, indifferent
P06	25-34	Male	Graduate Student	2-3 times	Seen more than 3, likes theater
P07	18-24	Female	Undergraduate Student	0 times	Seen none, indifferent
P08	25-34	Female	Graduate Student	2-3 times	Seen more than 3, loves Broadway
P09	25-34	Male	Graduate Student	1-2 times	Seen one, indifferent
P10	25-34	Male	Software Developer	1-2 times	Seen more than 3, likes theater
P11	18-24	Male	Undergraduate Student	1 time	Seen more than 3, loves musicals
P12	18-24	Female	Graduate Student	1-2 times	Seen one, indifferent

We conducted the sessions in our lab, and they lasted for a duration of one hour each. The participants were first given story context and a verbal overview of the basic interactions, followed by a short practice session/demo in VR that allowed them to practice teleporting (moving from one place to another) and grabbing objects. This was designed to help participants

get used to the VR system. Once the participants signaled that they were ready, they were taken to the main VR experience – TNFT, which lasted around 10 minutes. We asked the participants to think aloud about what confused them and what they liked, and we took observation notes based on what they said, expected and unexpected interactions, and surprised and confused reactions. The experience was followed by a semi-structured interview where we asked them about their understanding of the system, their decision-making process for selecting the spells, the role they played, how they felt about taking the role, their views on Minerva, and their interaction experience with VR. We analyzed the interview transcripts, and the think-aloud notes taken during the session, starting with open coding, and then moving into axial coding (Corbin & Strauss, 2014; Saldana, 2015). All team members coded transcripts independently and reviewed each other's codes collaboratively. We identified and categorized patterns in our interviews and derived broader themes. We then visualized the data on a whiteboard to make connections between the various codes and themes. Based on what we learned in our findings, we conducted redesign exercises to inform our design recommendations which highlighted aspects of the design where roleplaying occurred and where it was more difficult. The design recommendations described provide intermediate-level design knowledge (Höök & Löwgren, 2012). They are not generalizable but are abstracted enough to help designers create roleplaying experiences in VR.

5.4. Findings

The section describes the findings from the study. Section 5.1 discusses what helped and hindered participants' ability to play Calliope. 5.2 describes how people who played Calliope's role connected with Minerva. Section 5.3 elaborates the ways people navigated the complexities of how to interact.

5.4.1. Playing Calliope's Role

We observed that participants took on different roles. Five felt they were inside the story as an observer or puppet master. Four others knew that they were Calliope but did not accept the role. P07, p10, and p11 took Calliope's role and felt like her. Below I describe the reasons for playing and not playing Calliope's role.

Factors the helped play Calliope's role

Many participants identified the magic Mirror as central to their experience of taking Calliope's role. They got the context of who they were and what Minerva's troubles were by conversing with the Mirror. Being referred to as Calliope by the Mirror also helped them know they were Calliope. The Mirror also helped them visually transform into Calliope and leave their own identity behind. Seven participants realized they were Calliope as they saw their reflection in the Mirror. Participants liked the interaction with the Mirror as it gave them a reference of who they were, what they looked like and gave them a sense of being a character and having a body in VR.

> P11: "Instead of being a random person, it (mirror) visually tells you are not you, you are someone else and that helps to put you in the mindset, ok, I am playing someone, I am not playing me."

Two participants reported that the action of selecting a spell and casting it with their wand made them feel like the fairy queen Calliope.

> P11: "I really like having that conversation using the spells with Minerva because I play a lot of video games, just going through a menu and picking up the options…I liked that you had to pick up an object and cast a spell - the mechanic is weaved into the story. You are not just picking a dialogue you are casting a spell."

Factors the hindered playing Calliope's role

However, most participants did not take or accept Calliope's role. Five of our participants found the initial entry into VR disorienting. The combination of the new environment, the unfamiliar interface, and the immediate litany of instructions from the Mirror were overwhelming. They wanted time to ease in.

> P04: "There was a point of getting used to the environment and this overlapping narrative. That wasn't an easy transition for me as I had to pay attention to two things."

Six people said they wanted to spend time exploring the story world rather than just hearing the narrative. They saw the big open space and the artwork as an invitation to explore. P09 started exploring the world as he got bored with the conversation and admitted he had difficulty paying attention as he could not stand in one place for too long. Many participants expected things in the environment such as animals to be interactive. They wanted Minerva to be more animated and would have preferred to move around with her in the space physically. One participant felt

frustrated as they felt all they could do in the big open space was talk to Minerva. There was tension between the desires of participants to explore freely and the designer's intention to deliver a dramatic story arc. In the next section, I will address some possible design strategies that emerged from this observation of TNFT.

> P03: "When I first came into the environment, I am so excited and pay a lot of attention to explore the surroundings and ignore the things I should do."

Five people said that they did not pay attention to the Mirror due to being overwhelmed or wanting to explore. This made it difficult for them to follow the rest of the experience as the Mirror gave crucial context information and set them up for the experience. As the experience went on, they found it hard to stay engaged while conversing with Minerva as they did not feel like they had enough context.

Three participants wanted more interactive elements such as more characters and objects to engage with and understand more about Calliope and Minerva.

> P05: "If I could explore a little bit, there might be some other cues for example a book about her family history or something that I can explore a little bit before having a conversation with her."

Three people felt that they did not have control over Calliope's emotions, which prevented them from taking her role. As per the design, the spells impacted both Calliope and Minerva's emotions. Since Minerva's dress and stance changed to reflect the emotional tone of the spell selected, participants felt their spells influenced Minerva. Since they could not see the same visual effect on Calliope, they felt they had no control over their own character. The performance of the dialogue was not sufficient to communicate the affective variations to the reader, which may have been due to the overwhelming nature of VR.

Two participants could not see themselves as Calliope as their self-image did not match hers. P06 mentioned that it was difficult to play Calliope as he identified as a male in real life. P08 felt that since she did not wear dresses and have long hair in real life, the image in the mirror led her to feel disconnected from Calliope.

> p08: "I feel like an observer inside of Calliope. I don't wear a dress, I don't think that's me in general. It's like I am playing the role, but I am not attached to the person that I am in the play."

People who did not feel they were Calliope could not place themselves in the scene and did not feel as if they were a part of the story. A few realized they were a character in the story due to the reflection in the Mirror, but did not know who they were. Most of their spell selections were exploratory rather than conscious decisions.

5.4.2. Character Engagement with Minerva

Many participants described a sense of coming to better understand Minerva. They termed her as confused, stubborn, and morally inflexible. They were curious about her and wanted to watch the show to know more. Almost all participants followed basic real-life norms such as maintaining personal space and having a mutual gaze with Minerva while talking to her, which is in keeping with studies of nonverbal behavior in virtual environments (Bailenson et al., 2001, 2003; Barab et al., 2010). even though Minerva was a blocky figure with minimal gestures, the participants did not treat her as an inanimate object. We observed that people were attentive to the fact that Minerva turned around to look at the participant if they walked away. Her gaze followed them everywhere. This made them realize that the conversation was the main point of the experience and encouraged them to go talk to her.

Three participants – P07, P10, and P11 who accepted Calliope's role felt responsible for and close to Minerva. P07 mentioned how playing Minerva's sister's role made the experience feel personal. P10 felt responsible for Minerva and wanted to convince her to do the right thing, as he drew from his personal life experience of being an elder sibling.

> P07: "I felt like Calliope! Like I felt like I was actually talking to a sister and trying to persuade them. The red one (spell) looked way too angry. I wanted to use the yellow one more because it looked happier and more positive, because it felt like she was my sister."

They were also sensitive towards Minerva and they chose to have a meaningful conversation with her. P11 and P07 felt their job was not to convince Minerva to marry Arthur, but rather to make her realize how she felt about her decision.

> P11: "It felt like Calliope knew what she wanted to say, and Minerva knew how she wanted to react to it or how she really thought of it. It was how do I get to that point, and how does she really feel in going into that destination."

They chose positive emotions such as happy and calm to show they were understanding and encouraging. They thought using positive emotions might not change the outcome of her decision, but it would elicit an optimistic outlook. They chose negative emotions such as angry and sad to make Minerva reflect on her decisions, bring out what she truly felt, guilt her with sad spells, and at times to be dictatorial and impose their opinion on Minerva. They felt positive spells meant they were on the same page with Minerva, whereas negative spells gave a sense of Minerva being more reluctant to their opinions.

> **P11: "**So I would pick the sad one to know what are her true emotions because that is what I thought would lead me to her actual reaction."
>
> **P07: "**I thought she was taking the cowardly way out so that is when I used the angry, well that is when someone in real life starts doing that, I am like, 'hey come on, snap to your senses' (snaps finger)."

P10 wanted to reach out to comfort Minerva. He expressed his urge to put his hand on her shoulder and give a sense of being there for her. This shows how roleplay helped elicit empathetic actions.

> **P10: "**I was inclined to reach out and touch Minerva, just put a hand on her shoulder, comforting her ...sort of give it more like a sense of being there."

P11 mentioned that playing Calliope felt better than playing Minerva as he might have made different choices for Minerva (for example, marrying Arthur) which would have led to a disconnect between his desires and what Minerva would do. These findings show how roleplaying as Calliope helped people sympathize, understand, and feel responsible for Minerva.

5.4.3. Understanding Complexities of Interaction

Besides understanding their role as Calliope and their goals, participants had to learn how to activate and use the spells to carry out a conversation. The tutorial before the experience, and the conversation with the Mirror taught people how to use these spells. The Mirror also made them try tapping each spell at least once. Despite this 'in-world' tutorial, six participants were confused about how to converse with Minerva. A few participants did not remember to use the spells at all while facing Minerva, a few tried to grab and throw them at Minerva, perhaps because they looked like balls. One tried to put the spells in Minerva's dress pockets.

Existing theories and our interviews point us towards why people may have forgotten how to use the spells. In this experience, after learning the emotional spells with the Mirror, a wall moves down behind them, allowing entry into the main space where Minerva waits. This design might have triggered the 'location-updating effect', which explains that when people pass through doorways or move from one room to another, they forget information (Aylett, 2000). They also may have forgotten how to use the spells, because they were overwhelmed. Perhaps using spells for a conversation was not an intuitive interaction, or maybe the shape of the spells as balls completed people to throw them rather than tapping them. A more narrativized interface that represented spells like drinking and giving potions to Minerva may have mitigated these issues.

> P04: "I didn't know if to activate them I had to tap them or put them somewhere. That wasn't clear throughout the experience. I tried putting them inside the lady, she had this thing (pocket on her dress) so I thought I had to insert them in the holes."

> P07: "I don't know how to make them obviously look like spells though, but I mean balls are fine but I don't know a spell's not a ball.. I don't know how to physically show a spell."

We observed that some participants preferred to use an exploratory approach to understand how the spells worked, while others wanted explicit instructions. This parallels Ray's notion of exploratory vs. model-based learners (Ray, 2010). 6 participants reflected model-based learner approaches as they found that the Mirror set them up well for the conversation with the Minerva.

> P10: "I think the mirror explains things really well, the tutorial was really helpful, and just getting my balance."

However, some people missed the introduction from the Mirror as they were eager to explore. They exhibited exploratory decision-making with the spells in the beginning to learn the impacts of the spells rather than relying on the Mirror. P04 wanted to use the spells on herself first to understand the effects before using them on another person. She wanted to know the risks and consequences before taking the action.

> P04: "It would be interesting to play with the feelings on my own words. So, I could see what they mean."

> P11: "After I used all the 4 balls I realized, oh you are moving the conversation forward, it's not the exact same line of dialogue."

Similarly, after the mirror tutorial, the wall behind the mirror moved down, allowing participants to enter the main space where Minerva was standing in the center, waiting for them. However, after the wall moved down, almost half of the participants were reluctant to move ahead and wanted clear instructions. The other half did not face this issue and moved forward, behaving in a more exploratory way.

> P02 (model-based learner): "In the beginning, the wall drops down, I did not know where to go. No directions on where to go. Blatant silence, nothing was going on."
>
> P09 (exploratory learner): "Time to talk to the lady" (think-out loud while the wall went down)

5.5. Design Recommendations

We brainstormed design recommendations from our findings for 1) helping readers take a role 2) helping readers engage with Minerva and 3) how to help readers navigate complexities as they explore the VR environment and prepare for roleplaying. We describe these design recommendations through examples based on how we could have applied these recommendations to improve the design of TNFT.

5.5.1. Roleplaying by Communicating Expectations and Wearing a Mask

This section explores parts of RQ2 – taking a character's role:

- Understand character's goals, motives, knowledge (Smith, 1995)
- Take the character's identity through roleplay (J. Murray, 1997; T. J. Tanenbaum, 2015)

Endowing the reader with a character's responsibility, like helping Minerva, can help give readers a goal in the experience and take a role. We recommend clearly communicating this information about who the reader is and what they need to do. The in-world-tutorial conversation with the Mirror helped some participants realize they were Calliope, and their goal of helping Minerva.

We recommend that designers should saturate their experience with cues and information about the role across different modalities – visual, auditory, action. In TNFT, the Mirror reflection *visually* gave participants a physical presence through a virtual body, showed them

how they looked in that world, and transformed them into someone else, like wearing a mask (Johnstone, 1992). More backleading cues such as the Mirror asking them to do more bodily movement may have helped some participants realize that the reflection belonged to them. Carrying the Mirror with them throughout the experience could have helped them look at their reflection every now and then, rather than just at the beginning of the experience. We recommend that showing a reader their *visual* identity in the story world can help them take a character's role. At an *auditory* level, the Mirror called out for Calliope in the beginning, and backled people to take her role. The fact that Minerva addressed the player as Calliope also helped. *Actions* with the spells by tapping them with a wand helped some people feel like a fairy. Such narrativized interfaces can help readers behaviorally mimic the character's actions (Bizzocchi et al., 2011). The visual reflection, auditory feedback, and actions with narrativized interfaces can help readers wear a mask, and by mask we mean - any aspect of the reader's embodiment within the digital and physical worlds that confirms them as the character they are meant to be playing.

We recommend *easing* readers into wearing a mask. In TNFT, readers saw their reflection and were referred to as Calliope, however, this transition was very sudden which may have led to a few people rejecting the role. We could have done a better job *easing* people into Calliope's role, so they could leave behind their own identity and be more accepting of Calliope's identity. For example, rather than appearing fully equipped, the reader could be asked to collect their wand (engraved with Calliope's name) and cloak on the way to the Mirror. Perhaps, they could have been given the opportunity to personalize these objects as well. The mirror could have beckoned them when they were closer to it, giving them time to adjust to the new environment and feel less overwhelmed. Other characters could have bowed to them and called them "Queen Calliope". Readers could have explored Calliope and Minerva's backstories by interacting with different trinkets like old photos that would play out video snippets of their past upon a spell being cast. In these ways, readers could be eased into wearing a mask through diegetic actions and objects.

Some participants felt they could not impact Calliope's emotions because they received much less feedback of their own affective state as compared to Minerva's. We recommend readers should have agency over their own character and should be given clear feedback on how their actions impact their character. Just like Minerva's dress and stance change provided clear

feedback of her affective state, Calliope's sleeves or hand tattoos could have changed. Not only the feedback, but the way the action is performed also matters. Designers can use embodied metaphors to communicate who the action is impacting (Bakker et al., 2012). Tapping the spell with a wand was not an effective way to tell people that THEIR affective state was being impacted. Rather than tapping a spell, Calliope could have drunk potions of different colors, which would have communicated that the spell was going 'inside her' and impacting her. Her vision could have been tinged with the color of the affective state that would have told the reader that the spell impacted her. We also observed that people were trying to throw the spell at Minerva or give her the spell, rather than tapping the spell. Perhaps Calliope could have given the potion/spell to Minerva as well, that would have communicated that the spell is being 'given' to Minerva too. We recommend that both the action (giving or drinking a spell) and feedback (dress, stance, vision) can help communicate how one's action impacts the character.

The act of casting a spell by tapping it with a wand did not help readers feel or express emotions as Calliope, as tapping different spells did not *feel* different in any way. Spells could have been activated through more bodily expressions like shaking fists for angry spells or slouching over for the sad spell (like Minerva, using LMA). Readers could also drink potions in reality , where different tastes could have been mapped to different affective states like sweet for happy, and bitter for sad (Obrist et al., 2014). We recommend that readers can perform affectively expressive actions to impact and express emotions as the character.

Table 11: Roleplaying by communicating expectations and wearing a mask - TNFT

Concept	Design Recommendations
Endow with responsibility	• Endow readers with responsibility in the narrative like another character's wellbeing. For ex: taking care of Minerva. • Clearly communicate who the reader is playing and what their goals are. Ex: conversation with the Mirror
Saturate experience with cues and information about the role across different modalities	• Weave narrative cues to provide information about the role across different modalities – audio, visual, action. • Show the reader their visual identity in the story world. Ex: the Mirror showed readers their image as Calliope • Refer to the reader as the character. Ex: the Mirror and Minerva addressed the reader as Calliope • Use narrativized interfaces to help readers behaviorally mimic the actions of the character. Ex: casting spells like a fairy

Ease readers into wearing the character's mask through diegetic actions and objects	• Avoid sudden transitions, ease readers into the role they are playing. Ex: picking up Calliope's wand and cloak before seeing their reflection • Use backstories and side characters to help readers feel like the character. Ex: old trinkets could have shown backstories, other characters could bow to 'Queen Calliope'.
Give readers agency over their own character, use actions and feedback to communicate how the action impacts the character.	• Give readers agency over their own character Ex: impacting Calliope's emotions as Calliope, change in dress or vision tinge signifying the affective state • Use embodied metaphors to communicate who the action is impacting. Ex: drinking potions instead of tapping spells would communicate the spell is going 'inside' Calliope, impacting her as well.
Perform affectively expressive actions to impact and express emotions as the character	• While impacting character emotions, use actions that express the affective state Ex: Spells could have been activated through bodily performances like shaking fists, drinking different tasting potions mapped to different affective states.

5.5.2. Character Engaging with a Second Character

This section explores parts of RQ2 – engaging with another character:

- Adopt character goals, and feel for the character - Minerva (Smith, 1995)

We recommend that endowing readers with the emotional well-being of another character can lead to feelings of responsibility and sympathy. In TNFT the emotional spells helped readers not only care for Minerva, but also understand her personality and engage sympathetically as they used positive spells to show encouragement and negative spells to bring out how she felt. We also recommend that the design should give readers a reason to care for the other character. In TNFT, readers who took Calliope's role felt obliged to help Minerva because they saw her as her sister.

We observed how many participants followed real-life social norms with Minerva like maintaining distance from her and going to talk to her as her gaze followed them. We recommend using subtle social cues to remind readers of their goals and take *desired* actions. Minerva staring at the reader as they explored the space proved to be successful in encouraging them to talk to her. Similarly, Minerva could have expressed anger when the reader walked

away ("Fine Calliope! You obviously don't care about me."). Social norms can also guide how readers might impact the other character. For example, participants who thought they could not change Minerva's decision, but only bring out how she felt about it, bought into the narrative more than those who thought they were puppeteering Minerva's emotions. This is probably because the former scenario is more believable, as one can help another emotionally, rather than having control over their emotions.

One participant mentioned how he wanted to console Minerva by putting his hand on her shoulder. Taking the idea of using social behaviors further, we recommend using diegetic actions and objects that may express different emotions like concern, comfort, encouragement, frustration, among others. For example, the reader as Calliope could give Minerva flowers or a tissue when she was sad, touched her shoulder, hugged her, or showed her old meaningful shared trinkets as a gesture of love.

The other character (Minerva) could show their emotions by responding to the reader's sentimental actions mentioned above. Receiving feedback from the other character may make readers feel good or bad about their actions, making them feel responsible. For example, Minerva's dress could turn from blue to green (sad to calm) after being offered a tissue from the reader. Minerva could express her anger and retaliation (when Calliope cast an angry spell on her) by changing the ambient world (thunderstorms like in SR), by breaking the objects Calliope offered, or by casting spells back on Calliope that the reader could feel through vibrations.

Table 12: Engaging with a second character - TNFT

Concept	Design Recommendations
Endow readers with the responsibility of another character	• Endow readers with the emotional well-being of another character to build feelings of responsibility and sympathy. Ex: using emotional spells on Minerva helped people act sympathetically • Give readers a reason to care for another character. Ex: Playing Minerva's sister's role
Use social norms to encourage character engagement	• Use social cues to remind readers of their goals and take desired actions. Ex: Minerva staring at Calliope made readers feel they should go talk to her • Use diegetic actions modeled from social behaviors to express different emotions like concern, comfort, encouragement, frustration, among others. Ex: giving Minerva a tissue when she is sad

	• Provide feedback by allowing other characters to respond to the reader's expression of sentiments. Ex: Minerva turns from green (calm) to blue (sad) after being offered a tissue.

5.5.3. Navigate complexities of System and Roleplay

In TNFT, readers navigated many complexities – figuring out who they were, their goal of helping Minerva, how to communicate with Minerva through spells, all while orienting themselves in a novel VR environment and following the conversation with Minerva. We draw out recommendations for disseminating important information as diegetic cues in the narrative without leaving the reader overwhelmed.

VR experiences can be novel and overwhelming, and we observed how combined with the reader's need to explore, interaction with spells, and listening to the dialogue became difficult to manage for many participants. There are many things we could have designed differently to manage the cognitive load of the experience. The Mirror's role was to orient and backlead the reader towards Calliope's role. However, because the Mirror began speaking the moment the scene started, readers did not have time to get their bearings and missed critical information. The Mirror could have beckoned them when they were closer to it, giving them time to adjust to the new environment and feel less overwhelmed. Furthermore, the crucial information that the Mirror gave went by quickly and is not repeated. People also found this scene with the Mirror overwhelming and were impatient to explore the story world. We recommend spreading out important information throughout the experience rather than giving it all at once in the beginning. Multiple interactions with the Mirror could have paced out the conversation so that people could assimilate all the information (who they were, the story context, and how to use spells) step-by-step. Furthermore, the Mirror's role could have been extended throughout the experience to support different styles of learning. For example, people could have converted it into a pocket mirror that they could carry around and pull out when needed. This would have given constant guidance to model-based learners and would have avoided long conversations for exploratory learners. We recommend managing cognitive overload by repeating and spreading out backleading cues throughout the experience.

Since VR can be overwhelming and even dazzling to new players because of its novelty, we recommend over-specifying and communicating the expectations of the role the reader will play, that is – who they are, how to perform, and their goals. These expectations can be woven into the story world diegetically through cues and guideposts across different modalities. Repeated interactions with The Mirror could have also constantly reminded the reader who they were (through their reflection in the pocket mirror) and what their mission was ("Calliope, please go talk to Minerva at once, she needs you"). The Mirror taught readers how to use spells, but more low-stakes instances could have helped readers practice the use of spells before encountering Minerva. For example, they could have tried different spells on other characters, animals, or the ambient environment. This kind of low-stakes rehearsal would again be useful for model-based learners to get comfortable and exploratory learners to try out different actions. We recommend providing readers situated rehearsals (T. J. Tanenbaum, 2015) to practice how to perform the action in low-stakes environments where their actions are inconsequential (Nay & Zagal, 2017) to their mission. Designers can create a consistent mask effect by over-communicating and spreading out role expectations.

As observed in TNFT, readers may want to explore the VR world rather than engaging in dialogue. However, these two activities do not have to compete for the reader's attention. We recommend using the 'desire to explore' in VR as a way to prepare readers for the role. For example, the reader could have explored salient objects, photographs, and trinkets to know more about Minerva and Calliope's backstory. Another way for managing the desire to explore while engaging with dialogue, is by clearly demarcating areas of exploration and areas of conversation. For example, a broad open area could be for exploration, whereas the conversations could take place in a narrow area, encouraging people to focus. Logical breaks in the conversation coupled with movement to new locations could have helped make the experience feel less static without too much distraction.

Lastly, a few participants mentioned that the ending was abrupt, and the credits rolled in suddenly. We recommend easing readers out of the role and experience. For example, Minerva could have walked away, the spells could have disappeared, the reader as Calliope could have taken their cloak off and left their wand, and the Mirror could have told the reader they tried their best.

Ultimately, we suggest pacing the experience, maintaining a consistent mask effect, supporting different kinds of learners, and allowing players to recover from inevitable moments of distraction that happen in VR.

Table 13: Navigating complexities of the system - TNFT

Concept	Design recommendations
Manage cognitive overload in VR by repeating and spreading out backleading cues throughout the experience	• Give readers time to adjust to new VR environments. Ex: the Mirror should not have started talking immediately • Spread out crucial information about role, goals, and how to perform throughout the experience rather than giving it all at once. Ex: the Mirror could have become a pocket mirror and could have been pulled out when needed. Interactions with the Mirror could have been paced out.
Over-specify and communicate the role expectations – who they are, their goals, how to perform	• Communicate details of the role by weaving cues into the story world, repeat this information throughout the experience. Ex: the Mirror could have shown the reader's reflection multiple times and reminded them of who they were and their responsibility. • Provide multiple opportunities for situated rehearsals in low-stakes environments so readers can practice how to perform actions. Ex: casting spells on animals or other characters before talking to Minerva.
Desire to explore in VR vs. engaging with dialogue	• Use the reader's desire to explore to prepare them for the role they are playing. Ex: exploring objects and trinkets to hear backstories. • Demarcate areas for exploration and areas for conversation so readers can focus on dialogue exchange when needed. Ex: open spaces for exploration and narrow ones while talking to Minerva. • Have logical breaks in conversation to help readers feel less distracted. Ex: Minerva could have moved around after every conversation arc.
Ease readers out of the role and experience	• Avoid abrupt endings and ease readers out. Ex: the spells could have disappeared, the reader as Calliope could have taken their cloak off and left their wand.

5.6. Conclusion

In this section, I revisit the main takeaways from this study and how they help answer my research questions.

RQ1: How can different diegetic elements be designed to position readers in internal roles (inside the story world) and ontological (impact story world) roles such that they feel the impact of their actions, and buy into why their actions cause a particular consequence?

TNFT illustrates how different diegetic cues can be weaved into the narrative across different modalities (audio, visual, action), to help readers play an internal role. Referring to the reader as the character (calling out for Calliope), showing their visual identity in the narrative (the Mirror), and enabling them to behaviorally mimic the actions of the character through narrative interfaces (casting a spell with a wand), were all diegetic elements through which readers can perform a role. We recommend integrating diegetic cues across different sensory modalities (audio, visual, and action) to help readers take a role.

We also described how to design affectively expressive actions - like using bodily performances such as shaking fists (anger) to cast an angry spell, or drinking potions where different tastes map to different affective states. We recommend using affectively expressive actions to help readers not only impact the affective state of a character, but also buy into why their actions cause a particular consequence. Furthermore, embodied metaphors can be used to communicate who the action is impacting like – drinking potions to indicate the action is impacting the reader, again possibly increasing buy-in.

RQ2: How can diegetic elements support aspects of character engagement (CE) such as - understand and adopt character goals and motives, feel for the character and root for them, feel what the character feels affectively, or/and take the character's identity, when readers interact with another character or take a character's role?

TNFT describes design recommendations for readers to take a role, and act sympathetically towards another character. We recommend readers should be given clear instructions about the role they are playing and what their character's goals are - like the conversation with the Mirror told readers they were Calliope, and their goal was to help Minerva. Their role expectations can be communicated by saturating the experience with backleading cues across different modalities (audio, visual, and action). Readers can be eased into the role through character backstories and objects, sudden transitions should be avoided. For example, they may pick up and wear objects that belong to the character, hear backstories by exploring different objects, and watch other character's behavior towards them (bow to the Queen). Readers should have

agency over their own character and be given clear feedback on how their actions impact the character – like impacting Calliope's emotions and receiving visual feedback of the same.

Readers can be endowed with the emotional well-being of the other character to build feelings of responsibility and sympathy. Giving them a reason to care for the other character can increase CE, like asking Calliope to care for her sister, Minerva. We recommend using subtle social cues to nudge readers into taking the desired actions like – Minerva staring at Calliope to encourage them to talk to her, or Minerva storming away if Calliope walked away from her. Readers can also take actions modeled from social behaviors to express different sentiments like concern, comfort, frustration, among others. The other character may respond to these expressions of sentiments to show their own emotions as well, like Minerva turning from blue to green (sad to calm) when offered a tissue or a hug.

RQ3: what complexities might readers face while taking internal-ontological roles and engaging with characters in diegetic interactive narratives? How can readers be assisted to navigate these complexities such that they can intentionally impact and engage with the story?

VR can be overwhelming, and it is important to manage the cognitive load by repeating and spreading out backleading cues throughout the experience. Crucial information about the reader's role, goals, and how to perform can be explained throughout the experience, multiple times, rather than disseminating all the information at once in the beginning. It can be useful to over-communicate the role expectations to the reader – the Mirror could have shown the reader's reflection multiple times and could have reminded them of who they were and their responsibility. Giving readers multiple opportunities for situated rehearsals in low-stakes environments can help them practice how to perform actions. As described above, social norms can be used to guide readers into taking *desired* actions like talking to Minerva. Lastly, the reader's desire to explore in VR can be used to prepare them for the role - like practicing spells on different things while exploring or hearing different backstories through various trinkets.

Chapter 6. Gummy's Way Out - Design

Gummy's Way Out (GWO) is an interactive narrative experience with food and the diegetic body where a reader eats a gummy bear (called Gummy) and then helps him find his way out of their body by eating various food items and taking different bodily actions. The reader's actions impact their narrative body in ways that either help or hinder Gummy's journey, endowing the reader with the well-being of Gummy and their body.

I used food as a diegetic component in this system because food can evoke sensory, nostalgic, and affective feelings, making food a valuable storytelling component. Moreover, stories with food can help people experience fictional worlds, elicit new ways of appreciating food, focus on their bodies, and experience different cultures around food. GWO uses food to bring focus to the reader's *lived* diegetic body – a living, pulsating body that experiences the world. The diegetic lived body can make readers feel their actions viscerally increasing realism in the story, affords a variety of actions, and can add personal stakes to the narrative.

GWO fits into the overall dissertation as I explore how to position the reader's body in a diegetic role and the consequences of doing so. I also explore how the diegetic body helped build CE with Gummy. Lastly, I investigate the complexities readers had to navigate and understand before they could intentionally interact with the narrative. The broad takeaways from this study are –

- The reader's focus needs to be brought back to their body, so they buy into the idea that THEIR bodies are a part of the story world. This can be done by cueing the reader to perform non-normative bodily actions, followed by a narrative impact.
- Food and bodily actions have sensory, emotional, and functional properties that can be leveraged to cause logical narrative consequences.
- The diegetic body can add personal stakes for the reader in the narrative, which can be aligned with the character's interests to achieve CE. Furthermore, the diegetic body can endow readers with responsibility.
- The mapping between the action and consequence can be easy to understand if the mapping is familiar like – healthy food helping the body.

6.1. Background

I describe existing works in food-based interactive narratives that mostly position readers in observatory roles. However, food-based playful (non-narrative) experiences allow players to interact using different design concepts. I focus on two that I used in GWO – lived body and multi-modality. In GWO, I explore how these concepts can be applied to interactive narratives.

6.1.1. Food-Based Interactive Narratives

Most existing works in food and interactive narratives position readers in external and passive roles, where they observe the story while eating. In *Gustacine*, viewers eat popcorn that changes flavor based on the different emotions expressed in the movie - sweet cinnamon for joy and bitter mustard for grief, among others (Khot & Yi, 2020). A London restaurant used digital projections on food and crockery to tell the story of the chef (Turk, 2017). In an edible cinema experience in London, viewers eat different chocolates while watching Charlie and the Chocolate Factory (*Edible Cinema at the Science Museum: Eat along to Charlie and The Chocolate Factory | London Evening Standard*, 2021). An exception to this norm of passive experiences is the Matter Hatter experience, an early exploration that turns dining into a narrative, challenge-based social experience in a restaurant setting where readers take different roles and dive into the world of Alice in Wonderland (Avdić et al., 2016). They eat meals inspired by the story and solve a mystery. Gingerline, an interactive dining company, has also explored interactive narratives ranging from dinging and story performances to administering food in unique ways (*Homepage | Gingerline Group*, 2021).

While Mad Hatter and Gingerline begin to integrate food and props in interactive narratives, they are highly contextualized to restaurant settings. Moreover, they do not use diegesis, or focus on CE. I saw this as an opportunity to explore food and interactive narratives that position readers in internal-ontological roles using diegesis through GWO. I turned to the concepts of the lived body, Food and play to explore design concepts that could be applied to interactive food-based narratives.

6.1.2. Lived Body, Food, and Play

While there are many design concepts in the field of playful Human-Food Interaction (HFI – the intersection of food, technology, and human interaction) (Altarriba Bertran et al., 2019; Mueller, Kari, et al., 2018), I focused on 'lived' body and multi-modality play. As discussed in chapter 2, Inspired by Merleau-Ponty, Mueller et al. used the German terms 'Korper' (corpse) and 'Leib' (lived body) for bodily play (Mueller, Byrne, et al., 2018). They gave examples of designing for the *lived* body through which people can experience the world, feel sensations, and emotions rather than just treating the body as an interface. They describe localized sensations (touch, pain, proprioception, kinesthetic sensation, and temperature perception) as sensations that cause one to experience the body as *theirs*.

(Svanæs, 2013) also explained concepts of the lived body. They discuss that perception is directed and what one senses depends on the intentions of the task and goals. They differentiate between concrete and abstract movements, where the latter can bring focus to the lived body. Concrete movements are everyday movements like walking and abstract movements are made outside normal context, bringing people out of habitual behavior such as asking a person to move the left foot in front of the right. While few works in interactive narratives position the reader's body in a diegetic role (Bobick et al., 1999; Clifton et al., 2013; Samanci et al., 2007), they do not design for the 'lived' body, nor do they discuss the design and analysis of the diegetic body. In GWO, the 'lived' body, localized sensations, abstract movements, and directed perception are designed to help people feel their bodies are a part of the story world.

Many social playful non-narrative experiences with food design for the lived body, which can be inspirational for interactive narratives. Mad-Mixologist is a VR game where players mixed ingredients to create a potion together, the only problem - their visions were swapped through the headsets (*Mad Mixologist – IndieCade*, 2021). Arm-a-dine is a two-player experience where prosthetic arms were strapped to the player's waists, that fed the other player based on their facial expressions (Mueller, Kari, et al., 2018). TastyBeats is a playful fountain installation where players used their heart rate data from physical activity to create a customized cocktail (Khot et al., 2015). In all these examples, the player's attention is brought to how they experience their bodies. However, none of these examples are narrative experiences. Treating the body as a lived

diegetic body in narratives can allow readers to engage with all the different actions and sensory information the body offers and feel those actions viscerally, a topic I explore through GWO.

Figure 22 (L to R): Mad Mixologist, Arm-a-dine, and TastyBeats

Multi-modal sensory experiences involve more than one sensory modality layered together. While food-based playful and educational experiences have layered and modified multiple sensory experiences (Narumi, 2016; *TeamLab / チームラボ*, 2021), I focus on sound here as GWO is an audio experience. Chewing Jockey is a technical investigation where users heard different sounds as they chewed and perceived a changed flavor profile (Koizumi et al., 2011). One example stood out to me - the authors mentioned that users were amused when they chewed on jellybeans that made screaming noises. I used this concept in GWO and took the idea further through a narrative. Educatableware consisted of a fork and cup that emitted sounds to teach children better eating habits such as chewing enough (Kadomura et al., 2013). The Drink Up Fountain by 'Yes Yes No' told quirky facts about water to people who drank from the fountain (*Drink Up Fountain*, 2021). In Lickestra, users made different instrumental sounds by licking ice creams (*LICKESTRA – Emilie Baltz*, 2021). Similarly, in Iscream, the user licked an ice cream and heard sounds like crunching, roaring, burping giggling (Wang et al., 2019). The authors confirmed roaring sounds transitioned people into a fantasy world, a promising finding for interactive narratives. All these examples show the potential of interactive food experiences, but none of them involve storytelling. GWO leverages this potential and enables readers to interact with a food-based story as they hear the story through audio.

6.2. Design

Gummy's Way Out is a light-hearted humorous story of a sentient and sassy gummy bear (called Gummy) who gets stuck in the reader's body and tries to find his way out with the reader's help. This is a seated experience where readers hear Gummy's dialogues through audio and help or

hinder Gummy by consuming various food items (Figure 233Figure 23: A reader interacting with GWO).

Figure 23: A reader interacting with GWO

Gummy travels in the reader's body from organ to organ, describing rich visceral descriptions of what he sees, the hurdles he faces, and how the reader could help him by eating. As the reader consumes different items to help or hinder Gummy, he describes how the item is impacting the reader's body (narratively), and subsequently Gummy. Gummy's health depends on the body's health, which endows the reader with not only Gummy's well-being, but also their own body's, positioning their body in a lived diegetic role (Figure 24).

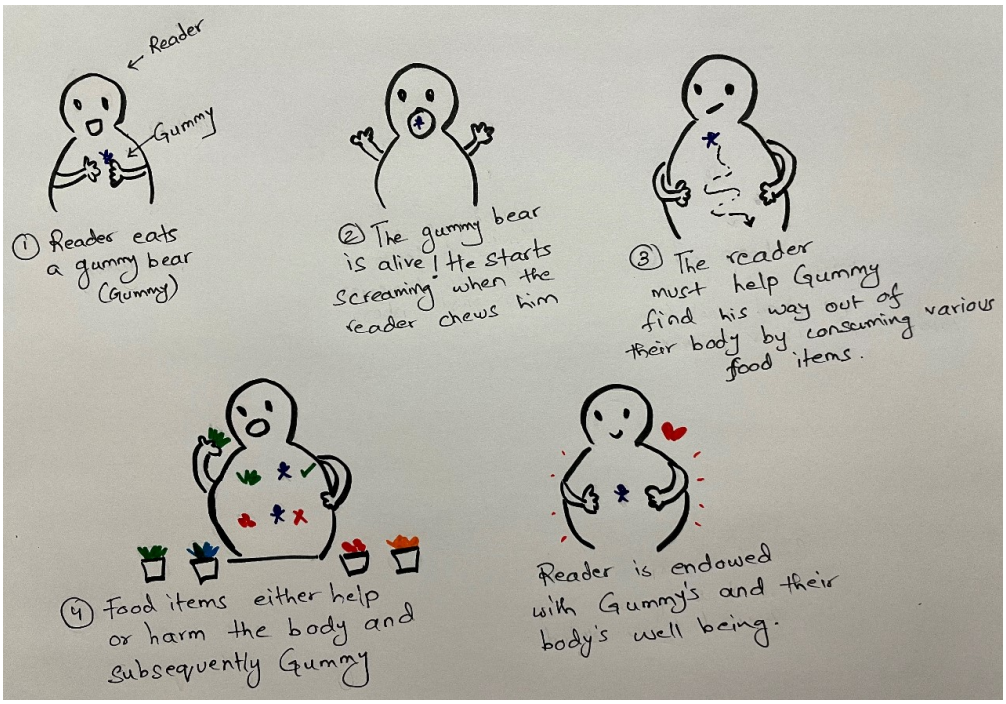


Figure 24: Illustration for GWO interaction

This design also puts readers in an internal-ontological role as their bodies are a part of the story and they can impact Gummy's journey. Readers are responsible for helpless Gummy, which opens possibilities for CE. While readers are encouraged to think about food's nutritional components, this experience is not meant to be educational, and is more about focusing on the body and building a relationship with Gummy.

The food spread consists of - two different servings of healthy foods like fruits and vegetables, an unhealthy oily food, an unhealthy sugary food, a drink that one finds relaxing and would have before bed, a drink that one finds energizing and would have in the morning, water, and a few gummy bears (Figure 25). Within these broad categories, readers are free to choose and personalize food items they want to consume for the story experience (see study section for more details). Next, I describe the design through a walkthrough of the story experience.

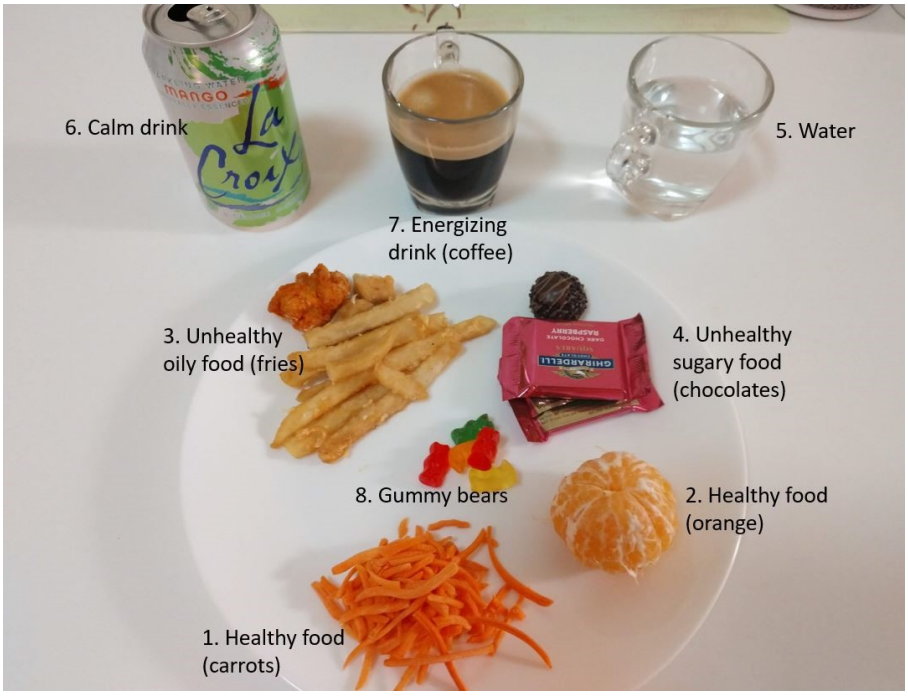


Figure 25: A sample of the food spread

6.2.1. Experience Walkthrough

The story starts when the reader eats a gummy bear. As the reader chews the gummy bear, they hear him (Gummy) cry out for help, begging the reader to stop. Gummy is soon swallowed and expresses he is in a dark pit – the stomach. From here on, Gummy asks the reader to help him

find his way out of the reader's body. This scene hooks the reader to feel guilty and obliged to help Gummy, whose goal is made clear from the very beginning – help him find his way out and be reunited with his family.

In the stomach, Gummy describes what he sees to help readers visualize the story. He tells the reader he is in a dark pit which is accompanied by a reverb in his voice making it sound like he is in a big chamber. He describes the '*fleshy stomach walls churning food into pieces*', accompanied by sounds of gurgling and churning. He sees a '*river of acid*' that he must cross to get to the other side and asks the reader to start eating so he can make a boat out of the food. This is the first open-ended cue and readers are encouraged to explore how different food items impact the narrative. Healthy food helps Gummy build a boat and keep the acid in check and unhealthy food does not. In this scene, Gummy encourages readers to add variety and explore what is on their plate, where unhealthy food leads to bad effects. For example, when the reader eats oil unhealthy food, Gummy says:

> "Ouch! I am slipping on all the oil you just ate. Your fleshy stomach walls seem to be working too hard, it's scary!"

Throughout the story, Gummy calls attention to the reader's action by acknowledging how the action feels, and how it impacts the reader's body and Gummy. Soon after the reader eats more unhealthy food in the stomach, the acid rises, leading into the first scene where the stakes are high. Gummy expresses that he is burning, and the reader needs to curb the acid.

> "Uh oh, what did you just eat? All that oil! it is making this acidic river rise! (swirling acid sounds). Too much acid…this river is spinning out of control, (screams) Hurry! drink something to tame this acidic river, your belly walls are on fire! (acid swirls, stomach gurgles) aaaah it hurts!"

If the reader continues to eat unhealthy food, the situation worsens and Gummy complains about his limbs burning and the stomach walls getting bruised because of the acid. These actions not only hurt Gummy, but also the reader's narrative body. Gummy also refers to his burnt, lost limbs later in the narrative, reminding readers about their actions. In this way, the reader is nudged to consume something to curb the acidity. When the reader does so, Gummy describes how he narrowly escaped and that he can see the stomach walls cleansing. He urges the reader to drink something calming, so they can both relax after the fiasco, slowing down

after the high-stress point. Gummy and the reader enjoy a slower, calmer moment, encouraging the reader to keep sipping the relaxing drink (something they drink before going to bed):

> "Ahhh (long sigh), that feels nice, very nice. Every corner of your stomach is softening. I'm 'finally' going to take a few moments to relax by this tranquil river, you should do the same! Keep sipping (3 deep breaths, and sighs)".

Readers can also choose to drink caffeine instead, where a grumpy Gummy would curse the reader and move ahead.

Next, Gummy sees the way out of the stomach and asks the reader for a belly rub to help push him along. This is the first *body action* that readers perform which is different from food consumption. As the reader rubs their belly, Gummy says he feels the warmth and the massage (acknowledging the reader's touch). He expresses gratitude and trusts the reader to help him (to build CE). Readers could have chosen not to help Gummy, where he would have expressed distrust and waddled his way out. Either way, Gummy lands in the small intestine where he gets stuck in the villi. He asks the reader to 'do something to help'. This again is an *open choice* where readers are free to explore. After two unsuccessful attempts, Gummy asks the reader to send in one of his friends to help. Readers must eat another gummy bear called Ana, who finds Gummy and helps him out. They both cross a few more hurdles with the reader's help and end up getting absorbed from the intestine into the bloodstream (like most food). Gummy loses Ana during this scene and his mission from there on is to find her and get out.

Gummy catches a ride on a red blood cell (RBC) whose speed increases only if there is more oxygen. Gummy gives readers the first cue for taking 2-3 deep breaths, another bodily action, so that he can catch up and find Ana. He lands up in the spleen to find Ana, where he encounters white blood cells (WBCs). The white blood cells see him as an outsider and start attacking him, another high-stakes scene. There are alarm sounds ringing '*intruder alert*' and laser shooting sounds, as Gummy runs and shouts:

> "oh no, oh no, time to run (shooting)!...aaahhh, A little help, here! Your body's immune system is going to kill me! Eat or drink something to slow down these white blood cells! buy me some time!".

This is the only scene where the reader's actions hurt their body but help Gummy. If the reader chooses to help their white blood cells by eating healthy food, the situation for Gummy worsens, WBCs get stronger, Gummy gets shot, questions the reader's loyalty, and after three

attempts, he dies. If the reader eats unhealthy food, their WBCs slow down giving Gummy a narrow escape.

Next Gummy enters the bowels thinking he might find Ana there. But meets a massive pile of 'hard brown rocks'. Readers must eat food with fiber to help Gummy, if not, the pile of rocks gets bigger, risking the creation of an avalanche. Gummy asks for another belly rub to proceed from the bowels, and then claims to see a light – the way out of the reader's body. However, he goes back into the bloodstream as he decides not to leave without Ana.

A dejected and helpless Gummy lets the bloodstream take him, as he thinks about Ana. There is a thumping heartbeat sound in the background and Gummy says he is drifting into the reader's heart! He asks the reader to slow down their heart rate as it beats too fast for him to waddle in. As readers take deep breaths or drink their calming drink, they hear the heartbeat sound slowdown in the background. Readers can choose not to help Gummy, where he would get a bumpy ride and guilt the reader. Gummy enters the heart and asks the reader to consume food that will keep the heart rate steady. Readers can eat healthy food to help Gummy and strengthen their heart or do the opposite. If readers eat healthy food, Gummy expresses his gratitude to the reader by massaging the heart. Either way, he still cannot find Ana and starts to imagine the worst-case scenarios, thinking his way into a panic attack. He gasps and urges the reader to take deep breaths and send in oxygen. Readers also hear the heartbeat thumping increase in pace again. If readers take deep breaths, they hear the heart rate slow down, and Gummy expresses his recovery as he feels less claustrophobic. Soon after, Ana pops into the heart from her own quest of searching for Gummy. They reunite and exchange stories, as Gummy describes (reminds the reader!) how he lost his limbs. They both express their gratitude to the reader and the story ends with them traveling to the bowel to find their way out. At this crucial end scene, if the reader decides not to take deep breaths during the panic attack, Ana still finds Gummy, but only to find him dying. This is where the experience ends.

6.2.2. Linearity, Backleading, and Complexity

In most scenes, Gummy backleads the reader to take a specific action like drink something calm or eat something with fiber. However, there are a few places where Gummy does not backlead the reader and just asks them to explore – such as the stomach, and when the intestine. I term

these choice points as *open choices*, where readers have the agency to explore different food items, and not feel like they just have to follow Gummy's instructions.

The story is largely linear, except for the two points where Gummy can die after the reader takes actions to harm Gummy thrice in a row – spleen, and heart. I added these two points where Gummy could die as the stakes are very high.

At every choice point, readers have 2-3 chances to either support or hinder Gummy, based on how Gummy backleads them. The linear story structure is maintained as readers can only proceed to the next segment of the story after making a particular set of choices. For example, in the stomach acid scene, readers could eat different things that would either increase or decrease the acid, helping or hurting Gummy, but they would only proceed to the next segment of the story after they had successfully curbed the acid by eating 3 healthy food items consecutively. While readers can go against Gummy, they are nudged into taking the desired action through worsening consequences like Gummy losing his limbs in the acid attack and spleen, or questioning the reader's loyalty. Gummy's physical and emotional condition, the condition of the body itself, Gummy's trust in the reader, all depend on the reader's actions.

At some points (like the stomach acid) if the reader does not take the desired action even after 2-3 chances, they hit a repeated dialogue where Gummy urges them to take a specific action to proceed (boundary of the system). At other points, Gummy can proceed even without the reader's help (red blood cell, belly rubs, bowels). At these points, if the reader continues hindering Gummy, then he just guilts the reader and expresses mistrust, proceeds with his journey despite the reader's actions, and the story continues. In this way, readers have the agency to help or hinder Gummy, build a relationship with him or disappoint him, and help or hurt their own bodies along the way. The reader's choices impact Gummy's attitude and their relationship with him, but not the story's plot, maintaining a linear story while still giving readers ontological choices.

This experience was designed to have low complexity through the clear and frequent backleading, easy predictability of the impact of a food item on the body, and the fact that readers do not take a role but are a part of the story as themselves.

6.2.3. Previous Iterations

GWO went through one design iteration. In the previous iteration, I used vibration motors and a heat pad on a belt as described in the next section. The motors would vibrate when Gummy felt agitated. However, people did not understand why the belt was vibrating. I then changed the logic, and the motors vibrated when Gummy moved down the reader's digestive system while verbalizing 'feel me go!'. I was unable to test this as in the final version I did not use the belt at all since the study was conducted remotely.

In the previous version of GWO, each food interaction was a standalone interaction and readers could consume any other food items to progress the story. In one of the cases, Gummy prompted them to drink something to curb the acidity, and participants liked this interaction as it gave them a sense of continuity and logic to their choices. I changed the story and interactions to provide more cues and continuity to the experience.

In the previous version, readers also felt the stakes were low as Gummy always tackled what came his way. In the final version, I provided setbacks to progress and higher stakes such as Gummy losing his limbs and blaming the reader. I also noticed that calling attention to the visceral and sensorial properties of the food made people really 'feel' the food, and so I introduced more such dialogues like 'slipping on oil'.

6.3. Implementation

Although the study was conducted online due to the Covid-19 pandemic (more details in study), I did implement a version before. The food and drink items were connected to the computer through a Makey Makey (Silver & Rosenbaum, 2012). The Makey Makey board was clipped to different spoons and forks made of steel, that were mapped to different food items. A small copper tape was placed on the rims of the glasses. Readers sat with a glove on their dominant hand, so the circuit was not completed by their hands. As soon as their lips touched the conductive spoon, fork, or copper taped glass, the Makey-Makey circuit would complete, and they would hear the audio clip (Gummy's dialogue and ambient body soundscape) associated with that item based on the story segment (Figure 26).

Readers also wore a belt that contained mini vibration motors and Adafruit's Flora (Industries, 2021). Long Velcro straps were used for adjusting the belt around the waist (Figure 27). The motors were connected to the Flora, and the Flora was plugged into the laptop using a long USB cable, which was convenient as this was a seated experience (Figure 26). In this design, the vibrations signified Gummy's movement inside the stomach and intestines. The Python script handled interactions with the Makey Makey, decided which audio clip to play, and sent commands to the Flora for the vibration motors.

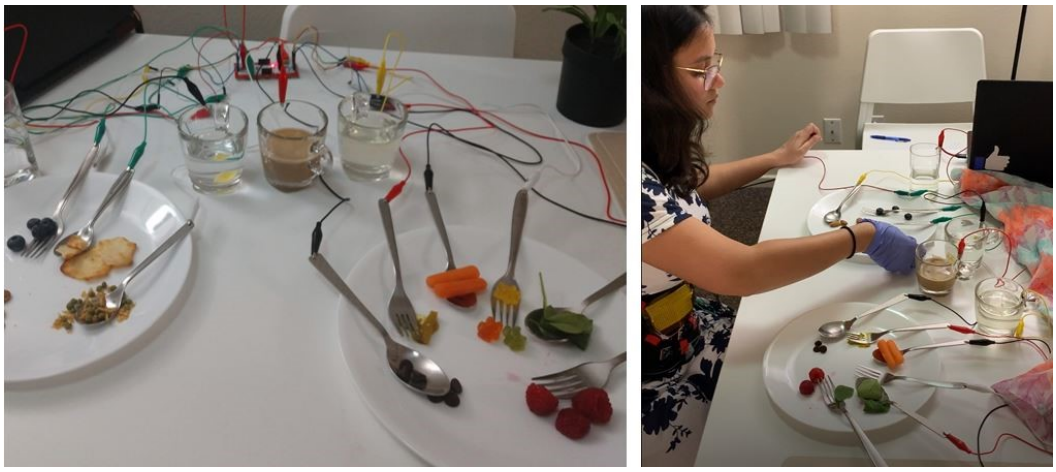


Figure 26: Utensils connected to Makey Makey and a reader interacting

As detailed in the next section, I ran this study virtually in a wizard-of-oz style due to the Covid-19 pandemic and did not end up using the belt. I included deep breaths and belly rubs in the design to bring more focus to the body, in the absence of the vibration motors.

The mechanism for belly rubs can be implemented through an alligator clip on the belt around the waist connected to the Makey Makey. Once touched by the non-gloved non-dominant hand, the circuit will be completed, and audio will be triggered. Similarly, for a low-tech solution, the reader can be asked to touch their chest or stomach while taking deep breaths. While this gives a faster and cheaper way to technically input deep breathing, it also adds to the design of the lived body. Touching one's belly or chest is more performative as it allows one to feel the movement of the body while taking deep breaths, which can bring focus to the body.

Figure 27: The belt with the vibration motors and Flora

6.4. Study

Based on my three RQs, the goal of the study was to understand 1) what helped readers feel their body was diegetic, and how that impacted their experience 2) how readers felt towards Gummy and why, especially in relation to the diegetic body and 3) how easy or difficult it was to understand how to interact with the system and why. I conducted this study in December 2020 where participants experienced the system and then went through a semi-structured interview.

Table 14: Participant demographic data - GWO

Participant ID	Age	Gender	Occupation	Field of Study
P01	35-44	Female	UX Designer	Human Computer Interaction - HCI
P02	35-44	Male	Graduate Student	Games, HCI
P03	25-34	Male	Graduate Student	HCI
P04	25-34	Female	Graduate Student	Informatics
P05	25-34	Male	Graduate Student	Informatics
P06	25-34	Female	UX Designer	Design
P07	18-24	Female	Graduate Student	Informatics
P08	25-34	Female	Graduate Student	HCI
P09	25-34	Female	UX Researcher	HCI
P10	25-34	Male	Graduate Student	Informatics
P11	18-24	Female	Undergraduate Student	Business

P12	25-34	Female	Graduate Student	HCI
P13	25-34	Male	Graduate Student	Computer Science
P14	35-44	Female	Graduate Student	Informatics
P15	25-34	Female	Graduate Student	Education
P16	25-34	Male	Graduate Student	Games, HCI
P17	25-34	Female	Graduate Student	Informatics
P18	35-44	Male	Graduate Student	Informatics
P19	25-34	Female	Graduate Student	Informatics

I conducted an unpaid study with 19 participants (13 female, 6 male), recruited through convenience sampling, ages between 21-40, all based in the US, and worked as researchers, designers, and graduate students (Table 14). All participants had engaged with some form of interactive narratives through museums, theme parks, choose your own adventure story books, video games, and RPGs like dungeons and dragons, and animal crossing, among others. Since the study was done during the Covid-19 pandemic, all sessions were held virtually on Zoom.

A week before the session, I instructed participants to plate items from the food categories - two different servings of healthy foods like fruits and vegetables, an unhealthy oily food, an unhealthy sugary food, a drink that one finds relaxing and would have before bed, a drink that one finds energizing and would have in the morning, water, and a few gummy bears (Figure 25). I intentionally made this list of foods generic enough for people to procure these items easily. Following these instructions, all food and drink items were based on the participant's preferences, and adjustments were made based on dietary needs. Figure 28 shows a few of the participant's plates.

I conducted the study sessions in a 'wizard-of-oz' style study where I kept track of what the participant ate during the narrative and shared my computer's audio through Zoom. Participants did not have access to the belt and hence the vibrations were not included. Each session lasted two hours. I briefed participants that they would be interacting with a light-hearted story by consuming what they had plated and instructed them to think aloud – any thoughts about their bodies, Gummy, surprises, and points of confusion. The experience lasted between 30-40 minutes, and I took observation and think-aloud notes, noticing expected and unexpected interactions, and surprised and confused states. After the experience, I conducted a semi-structured interview, 1 - 1.5 hours long, asking them about their experience – an overview of what they found engaging or confusing, what they chose to eat and why, how they felt towards Gummy and why, how they experienced their bodies and what brought focus to their bodies,

how they experienced eating various food items, their 'calming' drink, belly rubs, and deep breaths, and what these different design elements did for their relationship with Gummy, if anything at all.

Figure 28: Plate setups of different participants

I transcribed the interview data and then conducted an open coding analysis of the transcripts and observation data based on the goals mentioned at the beginning of this section. I then categorized the open codes looking for phenomena, attributes, conditions, and consequences, and after repeated categorizations, I eventually created themes (Corbin & Strauss, 2014; Saldana, 2015). I visualized these themes on a whiteboard to find connections between them. I used this whiteboard and my notes to write the findings section. I went through each theme carefully and brainstormed design recommendations. I visualized the recommendations on a whiteboard as well to find connections. These design recommendations give intermediate-level design knowledge (Höök & Löwgren, 2012) that are not generalizable, but abstract enough to provide insights to designers creating interactive narratives with diegetic food items and the diegetic body, as the reader interacts with another character who they are responsible for.

In the next chapter, I describe the findings from this study.

Chapter 7. Gummy's Way Out - Findings

I describe the findings from the 19 study sessions I ran. In section 7.1, I describe what helped participants feel their bodies were diegetic, the consequence of positioning the body in a diegetic role, and what hindered this process. In section 7.2 I describe what helped readers engage with Gummy (CE) – how they aligned with his goals, navigated conflicts, felt responsible for him since he was in their body, affective sync with Gummy, high-stakes scenes, and why Gummy was a sympathetic character. In section 7.3, I describe how readers perceived their agency and role in GWO, how backleading helped, how readers understood the interface, what kept them engaged, and overall participant reflections.

7.1. Positioning the Reader's Body in a Diegetic Role – What Helped, What Hindered, and Consequences

Participants felt their bodies were a part of the story world due to the bodily actions of deep breaths and belly rubs, visceral feelings in their bodies, and by focusing on what was happening inside the body especially when Gummy did something strange inside. This made participants buy into the narrative consequences, added personal stakes in the story, and made them feel more responsible for Gummy as he was in THEIR body. However, a few things in the design hindered readers from buying into the narrative, specifically when they could not recognize Gummy's form or location in their bodies, and when there were anatomical inconsistencies like food impacting Gummy at a very fast speed. This break in diegesis made them feel distracted and less connected to Gummy. The sub-sections describe these findings in detail.

7.1.1. Bodily Actions, Visceral Food, Impact on Narrative Body, and Visceral Descriptions Helped Readers Feel their Body was Diegetic

Almost all participants reported that some parts of the story were playing out in their heads whereas other parts felt like the story was happening inside their bodies. Participants stated that the unexpected bodily actions of belly rubs and deep breaths reminded them that the story was happening inside their bodies. 8 mentioned that belly rubs were particularly useful for making them feel like they were physically interacting with Gummy. 4 out of the 8 people reported that they felt this way because Gummy acknowledged their touch when they rubbed

their belly, Gummy felt comforted, and responded with gratitude. This helped them feel like Gummy was inside THEIR body and that they helped Gummy on his journey. Moreover, since Gummy acknowledged how the touch felt by commenting on the warmth of the belly rubs, participants felt the acknowledgement added more buy-in as Gummy described how they felt. These people also reported feeling that their body was 'living', brought focus to the gurgling / churning happening inside, and encouraged them to take care of their stomach. For example, P18 mentioned how he thought of jabbing his stomach but decided not to as he felt that was not a good way to treat his body.

> P16: "It feels like I'm physically moving and rotating (my belly) to help him bounce through. It's hard to describe that feeling. I'm not sure if he's here or not, but for a moment feels like he is there"
>
> P9: "I think the audio feedback was that the gummy bear was comforted. And that just kept me going and I felt like it was actually translating through my body skin flesh to my stomach. So I felt very aware of my body at that time."

Almost all participants mentioned that the action of taking deep breaths helped them feel their body was a part of the story world as the action made sense logically in the narrative – whether deep breaths were taken to give red blood cells oxygen, for alleviating the panic attack, or for feeling calm. Since deep breaths served the same purposes in the story as in real life, participants were able to buy into the fact that the story was happening inside their bodies. This sentiment was not shared with belly rubs as many reported that they did not associate belly rubs with anything in real life. 4 said that deep breaths helped them focus on their bodies due to the 'immediate' impact it had on Gummy and their own bodies, especially when they heard their heartbeat decrease because of the action. I suppose they were comparing the 'immediate' impact of deep breaths to food consumption, where one can feel deep breaths through chest expansion much faster compared to food consumption. 4 people reported that they were able to focus on their bodies through the deep breaths because they had a daily practice of taking deep breaths.

> P11: "the deep breaths -I liked a lot - deep breathing is like a technique I actually use most of the time for calming myself down, it's something I learned in yoga, using your breathing to connect with your body. I think it just kind of made the whole experience come to life for me a little bit more because like, I'm putting stuff into my body, not just through my stomach but also through my lungs. It was like, reinforcing my body likes oxygen so does Gummy."

> P6: "Whenever it asked me to breathe for whatever reason, it felt justified. When it said it wanted oxygen, then it connected to the fact that hemoglobin needs oxygen, when you are stressed you need to deep breathe to calm down."

Participants reported that the frequent consumption of various food items throughout the experience helped them feel their actions viscerally. 3 mentioned that every act of consumption felt different because every food item varied in texture and flavor, especially the oily and acidic ones as they caused the stomach acid to rise in the story. 4 commented that they could feel the actions more when the story was taking place in their mouth and stomach as compared to other body parts as one can feel what is happening in those organs. 4 elaborated that since the action and consequence (on Gummy and the narrative body) both were happening inside their body; they felt their actions viscerally and did not have to cognitively map the action to the impact.

> P13: "I was eating different things, I experienced differences at each point in the story, not just based on the name of the food, but like the action of the food that I was eating"

> P7: "Usually when you have some sort of ache it's always your stomach when it's food-related. You never feel pain in your intestines or your bowels. This is gonna sound weird, but you're more in tune with your stomach. I feel like if you take something to soothe your stomach, there is an immediate response to it in a couple of minutes. So I feel like you get feedback from your stomach."

> P17: "In the beginning, I was way more connected (with gummy) from my mouth to my throat to my stomach because the gummy bear is following the same exact (path) in real-time. … he was describing going down my esophagus the stomach lining…. I feel that actual physical interaction the same way."

The impact on the participant's body in the narrative (referred to as narrative body) helped them feel their body was a part of the story world. 5 people elaborated how any good or bad impacts on the narrative body brought focus to their bodies. For example, P11 mentioned how the cookie causing the stomach acid to rise was memorable for her. P13 described that he could visually imagine oranges adding fiber. P8 reported that she could imagine her stomach walls cleanse after the acid attack which was evocative. P17 felt her stomach tighten because of Gummy being inside her, especially when she ate something acidic as she felt the acidity in her mouth and heard Gummy complain about the rising acid in her stomach. Similarly, P16 felt grossed out by the oil in his mouth when Gummy slipped on oil. 7 mentioned that the heartbeat thumping felt like it was their own because they could impact it through deep breaths.

> P11: "when I ate like the cookie, the walls of my stomach were like, freaking out and the acid. Felt I should help the gummy and, oh, shoot, I shouldn't have messed with my stomach like that."
>
> P17: "I felt a tightness in my stomach. it's because my body was part of the story, my stomach was getting upset, I could feel the acidity (in my mouth), I could feel the heartbeat, it brought realism. The gummy bear was talking about being in there, and I think my body physically reacted and started feeling a little bit of that… oh, there's a gummy bear, that feels discomforting. And then the addition of more sugar and eating food I think it made it tight."
>
> P13: "The oranges made a visual difference when it was reducing the poop. That was funny. But I could, like, imagine the poop softening."

5 people reported that Gummy brought their attention to their bodies because of what he was doing inside their bodies, especially in areas that could be felt more like the mouth and stomach. They also mentioned Gummy's immediate feedback to their actions helped them feel like he was inside their body. Gummy coming towards the heart specifically stood out as people were apprehensive of Gummy coming close to a gentle and vital organ, where the heartbeat sound added realism. One describes Gummy as 'something slithering in my heart' while another commented on the bizarreness of a foreign object 'massaging his heart' and feeling his food after eating it. 2 felt similarly during the WBC scene, where one felt queasy because Gummy let germs escape from the WBC and the other felt that Gummy's lack of concern towards her body made her more aware of her body. 3 people commented they felt uncomfortable when Gummy was trying to exit their body because Gummy wanted to get out while they were in their living room, and they thought of going to the bathroom to let Gummy out.

> P5: "She says I'm gonna massage the inside of your heart for you! That sounds bizarre, like the fact that I have to pretend that a piece of food has arrived in my heart in the first place is terrifying. But then, but then she says let me massage your heart for you. I don't want to even imagine the sensation of something inside my body, like rubbing up. I don't want to think about a foreign object in my body having so much agency. She almost became like a tapeworm."
>
> P1: "There was something very real about eating the gummy bear and then hearing it talk to you. I did have these moments of these brief twitches where I had this weird feeling of trying to imagine an actual sentient creature running around inside my body and yelling at me. And that was that did have like a certain visceral impact."
>
> P3: "When the gummy bear was near or inside my heart, I could feel the heartbeat from these microphones also but same time I can also feel my heartbeat. It was making me anxious like what is this person

> (Gummy) doing inside my heart? I might get a heart attack or heart stroke, like why are you there?"

Lastly, Gummy's visceral descriptions and sound effects also helped people focus on their bodies, especially the gurgling acid and echoes in the stomach (5) and heartbeat (10) sounds. 5 people reported that visceral descriptions like 'oily fries', 'brown rocks', 'tacos churning', 'acid river', and 'cleansing walls' made them feel like Gummy was inside their bodies.

While some of the above-mentioned findings can be attributed to the novelty of interactions, each interaction (belly rubs, deep breaths, food consumption) was repeated multiple times throughout the story so participant's experience was not just limited to a one-time interaction.

7.1.2. Consequences of the Diegetic Body – More Buy in, Higher Stakes, Sympathy for Gummy

4 participants discussed how their body being a part of the narrative experience helped them buy into the story more as the body gave a sense of realism. They reported that the taste, consequences inside their bodies, the story world inside all felt real.

> P17: "I felt a tightness in my stomach. it's because my body was part of the story, my stomach was getting upset, I could feel the acidity, I could feel the heartbeat, it brought realism."

6 participants said that their personal stakes in the story were higher as their bodies were a part of the narrative, increasing the gravity of their choices in the story. They felt since their choice affected their bodies inside and outside the narrative, their choices carried more weight. This also led to an urgency to act for their body especially in the heart and bowels scene. 3 out of the 6 mentioned their actions of eating were more intentional as they were irreversible.

> P13:" Usually in a game when you take an action, it doesn't impact you in (reality) anyway. But here you know when you ingest something, it's really being ingested. It's not just gummy being affected, it's me too, because gummy will get pooped out. But the fries and carrots exist in my body. So, in screwing over gummy, I am physically screwing over myself."

> P02: "This didn't just allow me to control the outcome of the story, it allowed me to control the outcome of my actual body, like, how am I going to feel in an hour after I've digested all this stuff. Everything that you do here, actually affects your body in roughly the way that the gummy bear is telling you."

People also acted in ways to help their bodies, since they had personal stakes. 7 said they took actions in the story such that they would help and not hurt their bodies in the narrative. Two mentioned how they felt bad for their stomach after the acid scene and wanted to eat healthy after. One wanted to keep drinking the calming drink to slow down his heart rate.

> P5: "I felt bad eating sugary food and then experiencing how that was affecting these characters in the context of my body. And then of course, thinking beyond just this moment - like, Oh, my God, sugar consumption, in general, must be creating this atmosphere and, and it's weakening the white blood cells."

8 people mentioned they felt more responsible for Gummy as he was in their body, and hence was their responsibility. They felt whatever happened to him was because of their actions and their body's response. They also felt guilty of chewing him as well.

> P5: "The thing that sort of set it all into motion was the second that I like swallowed her. I was like, well, she's my problem now. This is my body, so I have to make sure that she gets out."

> P7: "I was kind of tempted to eat another gummy bear. But I didn't because I didn't want to care for a third gummy bear. I already felt responsible for two of them… because, it's like your actual body. You're kind of like putting in a potential third, like a victim I guess. It's your responsibility."

While the diegetic body added realism and sympathy for Gummy, 4 people reported that some scenes reminded them of their medical issues in reality, which was not uncomfortable for them, but added to their immersion. 2 said that the panic attack felt serious, and 2 felt more conscientious in the heart scene due to her high blood pressure and heart problem. However, for 6 other people, their medical issues made them feel uncomfortable. One said she wanted the acid scene over with quickly due to her acidity problems, one felt dizzy in the blood scene, 2 felt overwhelmed with the heartbeat sound, and 2 said that belly rubs made them feel conscious of body fat.

7.1.3. Break in Diegesis

A few design concepts led to participants questioning the diegetic nature of their bodies and Gummy. I term this as a 'break in diegesis'. 6 people questioned how Gummy was alive even after they chewed, shredded, and mangled him. 2 mentioned they could not figure out Gummy's location especially in the blood and spleen. 2 also questioned Gummy's form as they

could not imagine how he was traveling through their bodies in one piece. This led them to connect less with Gummy as they could not picture him. 3 pointed out how anatomical inconsistencies caused distractions – Gummy going from bowels to blood, how food was impacting Gummy and the body so quickly, and how food (Gummy) was in their heart. 5 also pointed out they did not feel what was happening to their narrative body in a few scenes – Gummy trying to exit, and their heart rate increasing when Gummy was getting a panic attack. These breaks in diegesis caused distractions and less buy-in as people jolted out of the story.

> P18: "I destroyed the gummy immediately by chewing him…But then I was like, no, that's not what actually happened. He got mangled around like he was in the laundry machine. And so he was never actually torn apart…. I had to make that decision because that (Gummy being destroyed) doesn't work for how I want this story to unfold."
>
> P1: "I had this moment of like, do I need to go to the bathroom? Like, my body's sort of like, oh, something's coming out like and it was this weird sort of quasi- realistic feeling."

7.1.4. Summary

Table 15: Findings for positioning the body in a diegetic role – GWO

Concept	Finding
Elements that helped Position the body in a diegetic role	• Belly rubs made it feel like the story was happening inside their bodies, especially when Gummy responded to being touched. • Deep breaths brought focus to the body as they made sense logically in the narrative – giving O2 and feeling calm. They had an immediate impact on the body (heart rate decreased). • Different food items made actions feel visceral due to the varying textures and flavors. Could feel actions more when the story was taking place in the mouth and stomach. • Impact on narrative body brought focus to the body – heartbeat felt like their own as they could impact it, good/bad effects on the narrative body like acid rising, walls cleansing brought focus to the body. • Gummy brought focus to the body when he went towards their vulnerable heart, massaging the heart, letting germs escape in the WBC scene. • Visceral sounds and descriptions – 'brown rocks', 'oily' fries, 'cleansing', gurgling, bubbling, heartbeat
Consequences of positioning body in the diegetic role	• More buy-in and a sense of realism as their body was a part of the story. • Personal stakes were higher as their bodies were impacted. This increased the gravity of choice in the story. Took actions to help their body. • Felt more responsible for gummy as he was in their body and they felt guilty for chewing him and putting them there.

	• Reminded of medical issues which were uncomfortable for a few and immersive for a few.
Breaks in diegesis	• Confusion about Gummy's form and how he was alive after being chewed. • Could not figure out Gummy's location in the blood and spleen. • Anatomical inconsistencies caused distractions like when Gummy moved from bowels to blood. • Could not feel a few events in the body like the heart rate increasing during the panic attack and Gummy trying to exit. • Caused distractions, less buy-in, and less connected to Gummy as they could not picture him.

7.2. Connecting with Gummy – What Helped and Hindered CE

In this section I describe how participants connected with Gummy based on CE – understanding and adopting character goals, feeling for the character, and feeling what the character feels. The participant's and Gummy's goals of helping the body, largely aligned. However, some felt that Gummy was trying to escape their body, which made them dislike Gummy. A few short-term conflicts like Gummy going towards the participant's vulnerable heart may have stirred some negative feelings towards him as well. Almost all participants felt guilty for chewing Gummy and putting him in their bodies, which made them feel responsible for him throughout. Moreover, high-stakes scenes gave them an urgency to act where they felt more sympathy and concern for him. Participants also reported enjoying moments of calmness with Gummy especially with the deep breaths and the calm drink. They sympathized with him when he got hurt due to their actions and felt validated when he expressed gratitude. Participants also sympathized with Gummy because they were able to facilitate rather than directly impact his journey, and because Gummy had a cute and funny personality.

7.2.1. Aligned and Misaligned Goals

5 participants talked about how their overall goals of helping Gummy and helping their bodies aligned with Gummy's goals of getting out of their bodies. They felt they would have to go against their own bodies to harm Gummy and mentioned they liked that Gummy cared for their body's well-being too and trusted him. Gummy clearly communicated his goals early on, which also helped people align with his goals. This made them feel happy when he was successful.

> P02: "Our priorities primarily align. To play negative, you also have to explicitly destroy your own body, you're also being antagonistic to yourself. So to me narratively that doesn't make sense."

One said that he cared more about Gummy's success and failures more than traditional games, as this experience involved them as well, making them feel like Gummy and they were on a mission together.

> P18: "On some level, I felt like it was Tinkerbell assisting, it felt that we were working together. I don't think I would have (felt this way if the body was not involved)... which is weird, because when I play games like that, I don't feel that way"

5 people mentioned how their feelings and goals with Gummy aligned in certain scenes – urgency, relief, liking / disliking a situation. They stated how they both wanted to get out of the intense heart scene, wanted to keep drinking the calm drink as it felt good, and both wanted to escape the bowels as it was a bad place to be. 4 discussed they appreciated when Gummy expressed gratitude, complimented, and tried to help their body like with the heart massage.

> P5: "I was most immersed during the heart stuff. But that was scary, I felt the greatest sense of urgency. I wanted to get out of the situation. And I felt that Gummy and I - our mutual goals aligned, I was like – You (Gummy) don't like this, I don't like this, we're gonna get out of here."

However, 5 people felt that Gummy was fighting against their bodies trying to escape them, positioning their bodies in a bad light. They felt Gummy was weak and annoying as he was getting hurt by their normal bodily functions over which they had no control over. One mentioned she wished Gummy would help her body as she was helping him, since she saw him as a 'nutrient'. They found Gummy judgmental when he commented on the consumption of junk food, called their bowels 'stinky', and talked back at them rather than saying 'please'. Other words used to describe him were – sassy, pushy, needy, complaining, and helpless. This misalignment led to people being detached from Gummy's suffering, having mixed feelings for Gummy as he was mean yet helpless, and wanting to punish Gummy after he judged them on eating junk food.

> P17: "Oh, I felt he is sassy. Like, get out of here already, like you're so demanding and complaining about my body. I don't want that thing around, he was critiquing my body and what I put in it."

> P06: "Everything was an obstacle for it. It was trying to get out, didn't want to be in my body... so even if it was a nutrient it didn't feel like it wanted to stay in."

> P04: "I was kind of detached from gummy's suffering and plight. Especially after the spleen was very clear that we were separate entities, and our interests might not always collide."

While the above-mentioned people felt their goals misaligned with Gummy throughout the experience, a few mentioned short-term points of conflict with Gummy. 6 people described feeling apprehensive about Gummy entering and massaging their heart. They were more invested in what he was doing there and were glad when he said he would be gentle. They did not want him inside a vulnerable organ and one person clenched his chest in this scene. 8 people felt conflicted during the white blood cell scene as they had to go against their bodies to help Gummy. One mentioned she chose to eat junk food in that scene as Gummy would have died without her help, while another mentioned that scene was impactful in bringing her focus to her body. Beyond this scene, one said that he acted with urgency in the stomach acid scene as he did not want Gummy to accidentally cause more harm to his body. These short-term conflicts made people more aware of their bodies, helped them feel things viscerally in the heart, and may have stirred some negative feelings towards Gummy as they felt protective of their bodies ('Get your Gummy fingers out of my heart!'). On the flip side, the WBC scene was a high-stakes scene and despite the conflict of interest, most people were rooting for him.

> P16: "I don't care you (gummy) are going to my stomach, WBCs, intestine... but, you're at my heart! You are the danger, You become the threat. How dare you enter my heart! He's escaping me, but I really want to escape from this situation too."

> P11: "Definitely the heart the moment when I was picturing Gummy bear walking around the chambers of my heart. It felt like something was like slithering through my heart."

7.2.2. Feeling Responsible for Gummy

The most successful design element that helped readers feel responsible for Gummy was chewing him in the beginning. 12 people felt like they were hurting Gummy as he was screaming. They felt guilty of eating something that was alive especially when he begged them to stop, and they still kept chewing him. One mentioned that hearing herself chew and chomp created a dramatic effect with all the screaming made her feel like a monster.

> P01: "That was the hardest part - when she's in your mouth, complaining about being chewed on. I did have this moment of like, okay, let's not do this… I'll just spit this out. No, I have to keep eating even though it's begging me not to eat it."
>
> P09: "It's almost like when you're chewing it, you are chomping, plus that audio experience gives a very dramatic effect. feel like a monster eating a tiny human."
>
> P16: "I can feel like when I when I'm doing this (chews a gummy bear), I'm eating, I'm tearing I'm teasing it, I'm separating its body and torturing it."

The chewing scene made people feel sympathy and guilt, which set them up for pledging their allegiance to Gummy throughout the experience, as they did not want to defy him. One person described how she caused him harm, while he wasn't doing anything, so she saw it as her responsibility to help him through. 7 people mentioned they thought about swallowing the second gummy bear (Ana) whole without chewing her.

> P05: "I am emotionally invested in her as a character, she was really sympathetic early on, and so as a result, I was reluctant to defy her. When the first gummy bear revealed themselves to have consciousness and the ability to talk to me, I felt immediately guilty about the fact that I was hurting them by chewing."
>
> P7: "I feel like he was minding his own business and then I decided to pick him up and eat him. And he was just like, 'why would you do that to me? I have a family to return to' and I'm like, Oh, my God."
>
> P15: "I don't think it ever crossed my mind to mess with gummy's journey…. I think I was just kind of invested in gummies journey beginning …if the beginning had not been quite as empathetic, I may have felt like why should I care?"
>
> P10: "There was the point where I swallowed the second gummy whole, to help them out. I felt bad about chewing the first one, I didn't know they would talk to me until I was picking them out of my molars."

Besides chewing Gummy, 5 people reported feeling responsible for Gummy during scenes where the stakes were high, that is, when Gummy was in danger- like the rising acid, WBC attack, and the panic attack scene. This was especially true when the scene came as a consequence of their actions like the rising acid. These scenes made people believe Gummy would not survive without their help, making them feel responsible. Participants also felt guilty when their actions had lasting impacts like Gummy losing his limbs and referring to them later.

> P11: "I felt the most responsibility towards Gummy when my choice caused my body to do something that made gummy to be in distress- So in those situations, I felt more responsible and more like stuff was at stake.- The acid and the spleen"

As mentioned in the previous section, 8 people felt responsible for Gummy because he was in THEIR body and was impacted by their body functions (my body, my responsibility). However, 6 people felt less responsible for Gummy because he was the one giving them instructions and calling the shots. One hit a repeated dialogue after she kept repeating the same action, and thereafter felt she had to follow what Gummy said to proceed. Another mentioned that because she had chewed Gummy, he was already dead. 3 people felt very guilty of chewing Gummy and hence detached themselves from the situation, deciding it was not 'real', removing themselves from Gummy's suffering.

7.2.3. Sharing a Calming Moment with Gummy

The belly rubs, deep breaths, and calming drink were designed to help readers share a calming moment with Gummy and feel what he was feeling. 4 people found belly rubs comforting, and Gummy's reaffirmation further enhanced the feeling. They wanted to keep performing the action as it felt good, aligning with how Gummy felt.

> P7: "I think the times where I really felt like a connection when he asked me to rub my tummy. There was an immediate response afterward, where he said thank you, I appreciate your support and, I felt like a part of the experience. Sense of physical touch adds like an additional layer between you and Gummy. Like you pat your stomach and then you sense that he's there because he responds and says thank you."

However, 8 others did not share this sentiment as they found belly rubs to be an unusual action, something they did not do in real life for digestion or for feeling calm. One reported that she felt calm during belly rubs, but Gummy was calm due to different reasons, and even though they were feeling the same thing, she did not connect with him. One mentioned how even though Gummy found belly rubs calming, he wasn't in peril, so it did not feel like her action helped him drastically. 2 questioned why Gummy acknowledged the warmth from the belly rubs as it did not help him in any way.

Deep breaths were successful in making people feel calm but for different reasons. 10 people felt calm because of their body's physiological response out of which 4 mentioned it was

because of their daily practice of deep breaths that did calm them down in reality. 4 reported that they were able to focus on their bodies so much, that they cared more about themselves and the heart rate sound decreasing than they cared about Gummy.

4 others reported that the link between deep breaths and calmness made sense logically, as that is what deep breaths are supposed to do, but they may not have felt calm themselves. 8 people felt relief with deep breaths because it gave Gummy instant relief and they felt connected to him as they helped him through the panic attack. One mentioned feeling like a guardian angel. However, their relief was narrative, and not because of the act of deep breaths.

> P13: "My calmness level didn't go up or down...It seemed to do the thing that deep breaths are supposed to do, which is calming people down. When I'm upset, deep breaths are always the go-to. And it helped."

5 reported they felt calm both physically and because of how Gummy reacted immediately to the deep breaths. I call this *affective sync* where people felt what the character felt narratively and physiologically. This made them feel they were helping and working together with Gummy. One mentioned how deep breaths gave Gummy O2 and appreciated how they were weaved into the narrative. Another said Gummy validated what he felt by confirming that deep breaths were calming to Gummy too. 2 mentioned how Gummy mirrored their feelings which helped them trust him as there was no dissonance between what they felt and what Gummy felt.

> P15: " It was very calming. I found myself closing my eyes when I need to take deep breaths and focusing on my breath and trying to center myself with my body. And I feel like that was really engaging for how my body was feeling throughout the story…. I think it was calming because of the deep breaths initially, but then, it was like a validation that Gummy also found it comforting. But I think if Gummy had not found that comforting, I would have been like, Oh, well, that's strange. There may have been some sort of dissonance… it helped center my body in the story as well, because I saw or heard the immediate ways that like, doing something with my body had an effect in the storyline and emotions of the character that I was following."

> P18: "I felt that his description of what was happening in my body was the same as I felt that was happening in my body. There was no disconnect. And so because of that, I was like, Oh, he's there. I can trust this guy because he's describing things as I interpret them."

4 people said that they reacted during the panic attack scene and took deep breaths instinctively without thinking about them and before even being prompted. They seemed

intuitive and natural. The sense of urgency to react was created because of their heart rate increasing in the narrative (personal stake) and because Gummy was in danger.

The calm drink followed a similar pattern where people found it calming physically, because of gummy, both, and just cognitively. 13 people found their calm drink physically calming and described it as 'creamy, cold, soothing'. The feeling was enhanced when it helped curb the acid and slow down the heart rate. 3 participants found the drink calming only because of Gummy's relief and how it helped him in the story. 9 people reported they linked the drink to calmness only because they knew that is what it was supposed to do, they did not feel calm themselves. They said that the context of when the drink made them feel calm was different in real life such as – watching TV at night and relaxing, sipping it slowly. In the experience, the same rituals were not followed and the motivations were different – to relax Gummy.

> P13: "So the reason of calmness that comes from the drink is because I sip it in a relaxed mode. But when you're doing an activity, like this experience, it's intense… it's (calm drink) not a sedative, like it doesn't take over the system. it's not a calming drink, it's more of...ah I enjoy this as well."

5 people felt calm physically and because of Gummy, another case of *affective sync*. 3 mentioned that the calmness was augmented by Gummy's voice, encouragement, and reaffirmation that it was calming. One said that the drink always had a calming effect on the story which made her view it as an elixir. One felt the action of sipping tea repeatedly (Gummy backled them to keep sipping) was comforting and another felt Gummy was a part of her as both were comforted together. Interestingly, 3 out of the 5 people saw Gummy in a negative light because he was trying to 'escape' their bodies, the calm drink being one of the rare positive experiences with Gummy for them. One mentioned that even though she and Gummy both felt calm, she felt more as a facilitator of the calmness through her body, and the scene did not add to connection with Gummy even though they both felt similarly.

> P6: "Because it (Gummy) was so in sync with the feeling of relaxation when I had tea, I almost felt like it was a part of me"

> P9: "So I felt like it (calm drink) soothes me down and because I got that affirmation from the gummy bear that it's helping the gummy bear as well…. Yes, it was definitely soothing. And even the voices become calmer, and he said to keep going. And I was like, well, yeah, I want to keep going. There were certain things - I like them and they're comforting to me, but it augmented, I like eating chocolate even more,

> enjoy drinking even more... I would love to listen to an audio book that soothes me while drinking tea."
>
> P16: "There's like the first moment I drink the calming drink and she said, Oh, I feel relaxed. I feel relaxed too. Maybe that's the most comforting moment during the entire experience…. the calming down really syncs with my body…Like If this is how my body feels at that moment, if the Gummy in the story feels the same way as my body feels, then yeah, I feel it too."

A few observations showed how important it was to ask participants to personalize their calm drink. One reader had two calming food items – their calm drink and Nutella. In the story, he ate Nutella to lower his heart rate but since the program did not see Nutella as the calming food, Gummy reacted by saying Nutella wasn't calming, and prompted him to drink the calm drink. This made him feel that Gummy was acting like he knew more about his body, and he felt less agency. Another mentioned how he felt Gummy, and he were friends as Gummy enjoyed his choice of calm drink. Another person said if the food items were not personalized to his taste, he would have made great efforts to avoid certain foods in the story.

> P3: "I felt like I did not have the power to select what to eat. Because somebody else (Gummy) was telling me this is the calmer option, this calms your body so eat this and not the other thing."

7.2.4. High-stakes Scenes

12 people felt sympathy, concern, and responsible for Gummy in scenes where Gummy's life was in danger and the stakes were high. They could feel Gummy's stress in scenes like the rising acid, WBC, and panic attack, and felt relief after they helped Gummy out of the situation. 3 felt more responsible when they made a choice that had negative consequences and made the situation more urgent like Gummy burning his arm in the acid or getting shot in the spleen.

> P14: "when I burnt his arm off, I felt very responsible, I was like xx. I would not have felt this way if I did not hurt him."
>
> P7: "I definitely sympathized with him especially during times of heightened stress. Certain segments like the stomach and the small intestine where the walls were closing in and him and Ana were being sucked out into the bloodstream and I was like, No!"

10 people reported they felt an urgency to act in high-stakes scenes so Gummy would not die. One reported how his emotions were in sync with Gummy in the WBC scene and he did not waste time thinking, but rather *reacted*. Another talked about drinking water when the acid rose

without being prompted as it sounded urgent, and she knew that water helped her body when she had acidity in real life. Similarly, 3 people took deep breaths during the panic attack scene without Gummy's cue.

> P2: "Rising acid is scary. It's like a deeply ingrained trope of all media, especially boiling acid, which is kind of what's going on in your tummy… I felt the immediacy of the choice mattered more."

What scenes felt like high-stakes scenes? 14 people felt the acid scene was high stakes as Gummy was burning, he sounded panicked, it was the first time something bad happened to him, and he continued to talk about his lost limbs later. 8 talked about the panic attack being intense because of the heartbeat sound, their own medical histories, and because it felt like the climax. 12 thought the spleen and WBC shooting were intense, Gummy sounded like he was in danger, and he was losing his limbs. 4 mentioned that being sucked from the intestine felt like a high-stakes scene as they lost Ana there. 5 said they felt the stakes were high when Gummy was stuck in the intestine as it took them time to figure out that they had to eat another gummy bear to help him. This made them feel the situation got direr (even though it did not).

7.2.5. Hurting and Helping Gummy

Participants reported feeling sympathy, guilt, and responsible for Gummy when their actions hurt him. 2 felt bad when Gummy lost his limbs in the WBC scene due to their 'mistake' of eating healthy and making their WBCs stronger. 4 people discussed they felt guilty and chastised for eating something unhealthy and 3 talked about Gummy feeling betrayed and questioning their loyalty which made them feel they were disappointing him. One person acknowledged he took all the 'right' choices and nothing bad happened to Gummy due to his actions, and he may have felt more connected to Gummy if his actions had hurt Gummy.

> P01: "I think sometimes when I did something bad, she would say something like, 'I thought you were on my side', you know, like, very betrayed about the choices I was making. It was not just like, oh, you made the wrong choice, but it was like, you were failing me."

2 mentioned that it was funny to see the negative consequences carry over when their actions of hurting Gummy were intentional. These 2 made choices to explore and go against Gummy when the stakes were low like giving Gummy a bumpy ride in the heart or letting him slip on oil. However, they cooperated with him during high-stakes scenes, and they too felt guilty and

responsible when they hurt Gummy unintentionally in high-stakes scenes like accidentally eating healthy in the WBC scene.

> P13: "I remember the spleen, I remember very well because I really messed up. I felt bad for gummy. For some reason, I thought I need to eat something healthy. I forgot that gummy is fighting my own body and I'm making my body stronger. Gummy had to lose a hand for me to realize that so that was a complete mistake on my part….When I consciously took a bad decision of eating the wrong thing, I only felt a little like sympathy, like gummy is wading in oil, sorry but deal with it."

Negative consequences changed people's experience of eating the food item. 5 people reported feeling guilty when junk food had a bad effect on Gummy, especially if it was something they enjoyed like chocolates or cookies. 6 felt bad for their own bodies as they heard how the oil in the junk food caused an acid attack.

> P16: "Junk food felt worse (than real life) when it didn't work in the story. Like when I hear the oil. It's just junk. So gross"

Actions that led to positive consequences made people feel validated, but CE was not as high as it was when their actions hurt Gummy. 9 people felt the actions that helped Gummy got less rewarding as they had to eat healthy food multiple times to progress, and Gummy seemed less grateful. They described these scenes as something that was supposed to happen, like a tick mark, necessary for story progression. 3 people liked that Gummy expressed gratitude, complimented their bodies (strong army fighting scum), and did good for their bodies, one thanked him for the heart massage.

> P5: "You had one bad piece of food, now stop doing that forever. And it was like you just had one good piece of food, we're gonna ask you to do that five more times now. So whenever I was told to send down more food, it got less rewarding each time."

However, good effects on Gummy helped people enjoy their food more. 5 said they enjoyed eating junk food when it helped Gummy (WBC). 3 enjoyed eating healthy food more than in real life as it had a good effect on their bodies and served as a good reminder. For example, one mentioned that drinking water helped her hydrate which had good consequences outside the story as well, and another felt his choice of eating spinach the day before was validated.

> P13:" I did not enjoy the chocolate which made me sad, as I ate my favorite chocolate. But I genuinely enjoyed eating the carrot, which I don't like."

> P18: "the spinach I really enjoyed a lot more than I was expecting. There were different points where I was like, Oh, the specific qualities of spinach are going to improve the story more so than other things."

7.2.6. Story-based Sympathy

Lastly, participants also felt sympathetic because of Gummy's personality and other points in the story's plot. 7 reported Gummy's high-pitched kid-like voice, voice inflection/acting, and expression of urgency vs relaxation, helped them sympathize with Gummy. They thought Gummy was cute, humorous, and generous as he tried to help their body. One found the visual shape of the Gummy bear cute as well.

> P11: "I was like, looking at the pile of gummy bears on my plate, and I'm like, aww this little teddy bear dude walking through my body. I don't want him to die. I want to help him out. I think part of it was the voice as well. When you think of the higher-pitched voice you think of a kid. I think the natural inclination is like, Oh, I want to help them."

9 people felt sympathy for Gummy because of Ana. They felt concerned when Gummy lost her and felt they could connect with the thought of losing a friend. They also connected to Gummy's relief when he found her. A few said that they were concerned about Gummy when he chose not to exit the body but understood why he turned back to find Ana. 3 other people reported feeling Gummy's happiness and gratitude at the end when he was ready to leave. One felt as helpless as Gummy in the blood scene as he too did not know how to find Ana. Similarly, another felt as hopeless as Gummy when he was stuck in the intestine as he did not know how to solve the problem.

Besides the story plot, 2 people said they felt more sympathetic towards Gummy because they could only facilitate Gummy's journey by impacting what they put in their body but had no direct impact on their bodily functions nor Gummy.

7.2.7. Summary

Table 16: Findings for connecting with Gummy - GWO

Concept	Findings
Aligned and Misaligned Goals	• Overall goals of helping body and gummy aligned, rooted for his success • Feelings and goals aligned in certain scenes – calming drink, intense heart scenes. Both Gummy and participant liked/disliked these situations • Appreciated when Gummy expressed gratitude, complimented, and tried to help their body. • Short-term conflicts created when Gummy was entering and massaging their heart, and when people had to weaken their WBCs. Felt more invested, focused on body, felt conflicted to help Gummy or body. • A few felt body was painted in a bad light as Gummy was escaping it. Found Gummy judgmental, sassy, needy. Felt detached from his suffering, wanted to punish him.
Feeling responsible for gummy	• Felt guilty of chewing and hurting Gummy. Pledged allegiance to Gummy through the whole story. • Felt responsible during high-stakes scenes when Gummy was in danger, especially if their actions led to the high-stakes scene. • My body, my responsibility. • A few felt less responsible when they felt less agency as they had to follow Gummy.
Sharing a calming moment with Gummy	• Belly rubs helped feel a physical connection with Gummy. Found belly rubs comforting and gummy's reaffirmation enhanced the feeling. However, many did not feel this way as they did not connect belly rubs to anything in real life, and did not understand how warmth helped him • Deep breaths felt calming for different reasons - only physically, only due to Gummy's reaction, both, or just cognitively as people knew they were calming. There was *affective sync* when people felt calm because of their physiology and Gummy's reaction. This made people feel like they helped Gummy, and that they were working together. • Calm drink felt calming for the same reasons listed in deep breaths. For a few, the motivations and rituals that made the drink calming were not replicated here. *Affective sync* made people feel Gummy's relief. • Personalization of calming drink was important
High-stakes Scenes	• felt sympathy, concern, and responsible for Gummy in scenes where Gummy's life was in danger – acid attack, WBC, panic attack • felt Gummy's stress and relief, felt urgency to act and save Gummy. • A few 'reacted' as they knew what to do during acidity, panic attacks
Hurting / helping gummy	• Felt guilty, sympathetic, responsible when their actions hurt Gummy unintentionally like in the WBC scene. • Felt chastised as Gummy felt betrayed and questioned their loyalty. • Felt bad about eating that hurt Gummy and their bodies.

	• Good impacts felt validating, helped the story progress, but got less rewarding. Liked when Gummy expressed gratitude, complimented. • Felt good eating food that helped Gummy and their bodies.
Story-based Sympathy	• Gummy's personality: cute, funny, childlike, voice acting. • Plot: finding and losing Ana, stress/panic at high satkes points • Felt sympathy as they could only facilitate Gummy's journey but not directly impact him

7.3. Understanding Complexities and Engagement

In this section, I describe how people described their perceived agency and roles, how backleading helped, how they understood the interface, what kept them engaged, and overall reflections. Most participants followed Gummy's instructions as they felt guilty about eating him. A few felt limited agency as they did not feel in control of their involuntary body responses, whereas a few felt the same when they hit a repeated dialogue. Many participants thought it was easy to predict the impact of their actions as the consequence was based on basic science. They mapped the nutritional, emotional, visual properties of food to positive and negative effects in the story. People described their bodies as a stage, a playground for Gummy where their role was to facilitate his journey and protect him. They stayed engaged with the fast pace of the story but found the ending abrupt. This experience made people think of their own eating behavior, how food affects the body, and served as a reminder for owning responsibility for their bodies' well-being.

7.3.1. Perceived Agency, Backleading, and Roles

While people had the option of following or going against Gummy, all of them chose to follow his instructions because they felt guilty of chewing him in the beginning and their goals mostly aligned (more in section 7.2). 7 people even followed Gummy's cue to keep repeating an action – keep sipping, rubbing, breathing. One mentioned that she chose to follow Gummy because she had no backstory about him, and hence could not decide if she wanted to go against him. Early on people followed Gummy to understand the story and the system. A few mentioned they feared going against him as they thought that would kill him, whereas 3 people felt they had no option but to follow Gummy because of the constant backleading. 2 reported they wanted to explore the boundaries of the system by going against him and see how far they could take the story without killing him. One did so when the stakes were low saying that he

always felt in control of stopping things from getting too bad for Gummy. Another thought that hurting Gummy led to funny consequences and found that rewarding.

8 said they followed Gummy but also included their personal preferences by eating what they wanted to eat within the category Gummy asked for, like having a blueberry over cantaloupe for healthy food, or balancing their taste palette with sweet and salty food. One participant said she wanted to drink her calm drink to console Gummy and tell him everything would be okay, indicating she wanted more ways to communicate with Gummy than the system allowed for.

A few people mentioned different ways in which they perceived limited agency. 2 people felt limited agency as they felt they could not control their body's involuntary responses feeling helpless to help Gummy. However, they felt more in control while performing deep breaths, belly rubs, and chewing.

> P3: "when I rub my belly, I could feel that okay, the gummy bear was here, and I rubbed it, and it helped the gummy bear. So I felt more in control….if the gummy bear was, let's say in my lungs, then I could like breathe more and it would have given more space to the gummy bear. But now the gummy bear is in my stomach or in my intestine and I don't know how to control those spots."

3 people felt less agency when Gummy presumed to know more about their bodies than them. One mentioned how he knew better than Gummy on how to get Gummy out of his body, and another felt another food was more calming for him than his calm drink. 6 participants tried to test the boundary of the system but hit repeated dialogues at some point. This made them feel the story would progress only if they followed Gummy, feeling 'enslaved' by him.

People also talked about *open choices* – where there was less backleading from Gummy. They reported getting more space to explore, feeling confused about what to do, feeling like they were being tested on their science skills, feeling as if they hit a decision point, and feeling even more chastised if they performed an action with a negative consequence during an open choice.

> P5:" When the decisions were left ambiguous, that's when the chastisement felt the greatest. It was like, Oh, really -So you decided to go for the chip? Huh? Five raspberries left, I see."

People were also asked about the role they and their bodies played in the experience. They described their bodies as a stage/setting through which Gummy went through as they ate,

rubbed their bellies, and took deep breaths. Other words used were – playground, an environment where organs were different levels, living vessel, and battleground.

> P10: "I'm the environment, I'm the world, I'm Gaya. It was interesting to view subsections of myself as kind of these environmental hazards....where they are of me, but I can't like control it. I couldn't like, drain the acid lake. A tornado can't be like, Oh, let me put your house back together."

> P15:"Different parts of my body were either vehicles or obstacles for Gummy. Like he took a ride on the RBCs but was being attacked by the WBCs. That was amusing."

12 people reported feeling like their role was of a protector or guardian to Gummy, helping him survive by ensuring their body's environment was more suitable for Gummy, taking on a 'facilitator' role rather than directly impacting him. They felt they had to nurture 'weak and defenseless' Gummy. 2 felt like they were Gummy's instruments taking orders from him, 2 saw themselves as side characters to Gummy's story, and 2 felt like they took a God-like role, controlling Gummy's fate.

> P11: "I felt responsible to follow the gummy bear's instructions. Like the gummy bear was calling the shots. But I felt like I had a stake in it. Because if I didn't do my part, then the gummy bear would like die inside me."

> P15: "I think I was a facilitator both in terms of taking the right foods and helping facilitate gummy's journey, also, making sure that my body was in tune with what the story required. So if gummy prompted me, don't make any sudden movements, I was trying to be really careful to not make it."

> P09: "I Felt like a guardian. I was kind of trying to help the gummy bear throughout its journey towards the destination."

7.3.2. Understanding the Interface

Most people reported that it was easy for them to anticipate the consequences of what they ate in the story. 5 said this was easy as consequences were based on basic nutrition and body science, and 3 felt that Gummy's guidance and feedback helped. One tried to combine different foods together, and one questioned why healthy food gave Gummy a boat in the acidic river.

> P8: "It was easy – I do same things for my digestion – hot tea, and Gummy was very vocal about the feedback. What was gummy saying and what I know what works for my body."

3 people said they felt confused because of the different properties of food they had to think of – nutritional and emotional. One questioned if she should eat oil or fiber in the bowels, another tried to calm down her WBCs with her calm drink rather than eating unhealthy food, and one felt confused when the wine had an emotionally calming effect but a nutritionally bad effect in different parts of the story. However, these different properties of food also kept them engaged as they had to think of properties that would be best suited for the situation.

> P4: "In the stomach, I took wine the first time and the walls were burning down. And then the second time I did that (wine) mostly for the trolls he was like, Oh, hey, everything is like good and he felt calm"

2 people mentioned they carried over their learnings of how a particular food item impacts Gummy through the rest of the story. One did not want to use water again as it did not help Gummy with the boat, and another wanted to keep eating carrots as it helped Gummy in the bowels. 2 also thought about the visual properties of the food although that was not a part of the design. They thought of using almond's 'wood like' visuals for the boat, and an orange slice shaped like a boat. 3 people compared the fiber value in their fruits and decided to eat the one with more fiber – like raspberries over blueberries. However, the design of the system did not differentiate between the amount of nutrition and clubbed them all under the healthy category.

7.3.3. Engagement and Reflections

While some of GWO's enjoyment could be attributed to the novelty of the interaction with food, the aspects mentioned below also added to people's engagement levels. Participants commented on how they enjoyed the story's pace - the change in scenes from organ to organ and Gummy's immediate feedback to their actions. However, one mentioned the pace was too fast for him as the dialogue was completed before he had finished chewing.

7 reported they felt engaged because their bodies were a part of the story, Gummy was alive, described what he saw inside them, and he kept talking to them as they ate.

> P14: "the little gummy bear, the anthropomorphic sounds, he is alive and communicating to you. So cute. I wanted to keep engaging as he was responding to my actions."

One mentioned that he liked that different actions were involved, and he was not just eating, making the experience non-monotonous. 8 talked about how Gummy's hilarious and cute

personality and the voice acting kept them engaged. 4 felt the sound design was intriguing. 4 felt that solving the challenge of what to eat kept them engaged. One felt overwhelmed as she had to focus on the story, feel the food, and think of what to eat next all at once.

When asked about larger takeaways, 3 people said the experience of taking care of Gummy reinforced that they should take better care of their bodies. One said it was simpler to take care of the Gummy who he was obliged to than caring for himself. Another said the experience highlighted the agency she had over her own health.

> P10: "It was much simpler to take care of the gummies than me. It was mainly getting away from the prescriptive, like, you should eat this, or you should eat that. Eating here provides for a third party (Gummy) to whom you are either obliged or feel responsible. Taking care of myself - a bunch of xxxx, taking care of other people - sure, I'll do that."

7 people reported they felt more aware of how food affected their bodies. One mentioned that sugar weakening the WBCs made him reflect on what sugar might be doing to his body. Another said that the fact that fruits helped WBCs get stronger stuck with him. Another reflected on how food intake is not just about calories but impacts the smallest things like RBCs.

> P5: "When we eat food there is an effect at the smallest possible level, like at the level of our red and white blood cells. And that, when we put food into our body, it isn't just a number, and that number is called calories. But that nutrition matters"

4 talked about wholesome well-being of the body as what one eats impacts emotions, and how one feels impacts digestion. They reflected on relaxing techniques like deep breathing and consuming a calming drink. 2 said that food on their plate did not have meaning before, but now every time they would look at a gummy bear they would think of Gummy.

> P8:" It (the experience) felt wholesome, it is not just about what you eat. If you have anxiety, it will affect digestion. Taking deep breaths may help, loving your stomach (belly rubs) or going for walk can help you feel better."

The experience made people reflect on their eating habits but not necessarily change behavior, 2 people said they already felt responsible for their bodies and while the experience served as a good reminder, they would not do anything differently. One said he would not eat oily food for a while, one felt she wanted to drink her calm drink more frequently, and one realized she should not drink coffee excessively. Another talked about changing eating habits if she went

through more such experiences. One felt embarrassed for eating cookies frequently and thought if her body were a person, they would be angry at her for the choices she made. Another questioned if she wanted such feedback (from Gummy) daily, and how much she wanted to know. One talked about how food can't just be classified as healthy vs. unhealthy as food can also be soul-nourishing.

7.3.4. Summary

Table 17: Findings for understanding complexities and engagement - GWO

Concept	Findings
Agency	• Followed Gummy's instructions as they felt guilty of chewing him, feared going against him would kill him, a few felt they had to follow him due to constant backleading • Followed gummy and balanced choice with personal preferences for eating by sticking to the genre of food prompted for. • A few went against Gummy and tested the system when stakes were low but followed him when stakes were high. • Felt less control over the body's involuntary responses but more control over chewing, deep breaths, and belly rubs. • Felt less agency when Gummy presumed to know more about their bodies. • Felt less agency when they hit a repeated dialogue.
Backleading	• Followed Gummy's cue when he asked to 'keep going'. • Open prompts (less backleading) – explored, felt helpless like Gummy, felt more chastised, felt like a decision point.
Perceived Roles	• Body as a stage, setting, playground, environment where organs were different levels, living vessel, and battleground. • Reader: facilitator, protector, guardian, side character, God-like, Gummy's instrument.
Understanding the interface	• East to predict consequences of actions as they were based on basic science and Gummy backled them. • Felt engaged but sometimes confused while thinking of different properties of food – nutritional, emotional, visual, sensory. • Carried over learnings and wanted to take actions that previously helped Gummy and keep away from ones that did not. • Compared nutritional values of fiber within the healthy food items - like raspberries over blueberries.
Engagement and Reflections	• Liked the story pace and moving going from organ to organ, Gummy's immediate feedback to action. • Felt engaged because their bodies were a part of the story, Gummy described what he saw inside them, and kept talking to them. • Different actions were involved, not just eating. • Gummy was funny and cute, sound design was engaging.

	• Taking care of Gummy reinforced that they should take better care of their bodies. • Felt more aware of how food affected their bodies - WBCs get strong by fruit, weak by sugar. • Reinforced wholesome well-being of the body – food and emotions. • Reflected on eating habits but will not necessarily change behavior.

Chapter 8. Gummy's Way Out - Design Recommendations

In this section, I describe the design recommendations and overall takeaways from this study. In section 8.1 I discuss how this study gave insights on how to position the body in a diegetic role. In section 8.2 I describe how the diegetic body can help create CE. In section 8.3 I discuss how to help readers navigate complexities while designing for the diegetic body. All design recommendations are within the context of GWO and are not meant to be generalized, but rather produce intermediate-level design knowledge (Höök & Löwgren, 2012).

8.1. Designing for the Diegetic Body

GWO showed how the diegetic body can add personal stakes, increase the gravity of choice, help readers feel actions viscerally so there is more realism, endow readers with responsibility, produce affective responses, and feel connected with the character. However, to make readers feel the above, they must buy into the fact that it is THEIR body that is a part of the narrative, giving them internal roles. I describe 3 design recommendations for the same – *body tethers*, breaks in diegesis, and weaving actions and consequences into the narrative. *Body tethers* are design hooks that remind readers THEIR body is in the story world and is diegetic. I discuss how the diegetic body can lead to breaks in diegesis as the body is very close to the real world. Lastly, I describe how actions and consequences can be woven into the narrative, so readers have an ontological role – performing an action, acknowledging the action, impacting the narrative body, impacting the story, and providing feedback.

8.1.1. Body Tethers

In tangible interactive storytelling, the diegetic interface is often in front of the reader, giving them a tangible tether to the story world. For example, in SR, the Rangoli interface was a gateway to the story world, reminding readers how their real-world was connected to the narrative. However, when the diegetic body is a gateway to the story world, readers may forget that the narrative is referring to THEIR body, as they are not always aware of their bodies like they are aware of a tangible object in front of them (Rangoli). For example, in GWO, participants

mentioned that they imagined parts of the story in their head, rather than in their bodies. Moreover, the gummy bear, which was the other diegetic interface tethering them to the narrative also disappeared. I describe *body tethers* as hooks that remind readers that *their* body is a part of the narrative world.

Body tethers can be created by asking readers to perform unfamiliar and out-of-the-ordinary actions that bring focus to one's body such as – taking deep breaths or belly rubs. (Svanæs, 2013) describe concrete movements as everyday movements like walking and abstract movements as movements made outside normal context, bringing people out of habitual behavior such as asking a person to move the left foot in front of the right. Similarly, I recommend that performing abstract movements outside normal context can act as *tethers* for the diegetic body. However, some abstract actions may bring the reader's focus to their body so much that it pulls them out of the narrative experience. For example, in GWO some participants mentioned that deep breaths helped them feel calm, but in that moment, they did not care about Gummy. It is important to find abstract actions that are not ordinary/concrete, but also do not pull people out of the story. Figure 29 shows the sweet spot for *body tethers*.

Just performing an abstract action in the narrative is not a complete body tether. After performing an abstract action, the story or character should acknowledge how the action feels and how the action impacts the narrative. For example, Gummy responded to belly rubs by saying they felt warm (how the action feels) and helped him move further (impact of the action).

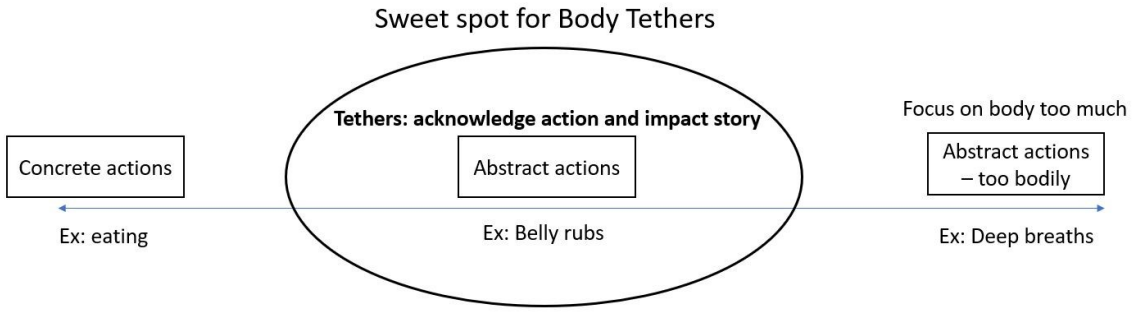


Figure 29: Body tethers

Acknowledging how the action feels brings attention to localized sensations that help people experience their body as theirs (Mueller, Byrne, et al., 2018). However, if the action does not have a narrative impact, people may not notice the acknowledgement at all. For example, not

many people noticed the warmth of the belly rubs as the warmth had no narrative consequences. Furthermore, the narrative impact of the action can help people feel their body is a part of the story world.

Tethers can also be augmented by bringing attention to the physiological response of an action such as a change in heartbeat after taking deep breaths. In GWO particularly, the actions were felt more viscerally when the story took place in the mouth and stomach, as compared to other parts of the body like the bloodstream and intestines. This is because localized sensations are felt more in the mouth and stomach, and the story brought attention to these organs. Tethers are better felt in parts of the body where one has lived experiences of feeling sensations.

Body tethers can also be facilitated by a character or any other external entity that shows agency over the reader's body. In GWO, participants mentioned they had a visceral reaction to Gummy moving towards their heart. These tethers can be augmented if the character / external entity acts against the reader's body. Participants felt more aware of their bodies when Gummy asked them to eat junk food for him to escape the WBCs, creating a moment of conflict for the readers. Body tethers could also be designed through external vibrations/pressure /heat but would need to be designed such that they are not distracting, nor uncomfortable.

8.1.2. Breaks in Diegesis

Designing with the diegetic body can be tricky as the body is an interface that is very close to the real world, making suspension of disbelief more difficult. In GWO, participants expected Gummy to follow the rules of their body as he was coming into their world, unlike SR and TNFT where readers stepped into the narrative world. Since the story was grounded in the reader's reality, they got distracted when Gummy mentioned anything that went against the body's rules of functioning like - anatomical inconsistencies such as Gummy traveling from the bowels to the heart. While designing with the diegetic body, it is important to keep in mind the fragility of suspension of disbelief, especially while grounding the story in the reader's reality.

Another source of broken diegesis was Gummy's changing form throughout the story. Some participants felt like chewing Gummy broke his form, which meant he was dead. Some felt they could not picture him in the bloodstream as he was too big to be in the blood in his original form. This broke the reader's recognition of Gummy as a character, hindering not only buy-in

but also CE. I recommend that designers can consider how a diegetic action may change the form of the diegetic interface and what readers might conclude from that.

Lastly, the diegetic body can create immersive but also uncomfortable experiences as they may bring attention to a reader's health problems. While it is important to design empathetically and avoid negative experiences, designers can also provide a note of caution beforehand.

8.1.3. Weave Actions and Consequences in the Narrative

In this section I describe how actions with the body and their consequences can be woven into the narrative through 5 steps 1) perform an action 2) Acknowledge how the action feels 3) Impact the narrative body 4) Impact the character/story world 5) Provide feedback and encourage the reader to keep going or stop.

Why is weaving actions and consequences in the narrative world important? The body and food can make us feel sensorily (food that is hot, juicy), affectively (food that is nostalgic or calming), and physiologically (decreased heart rate on taking deep breaths). If these actions and the way they make us feel are weaved into the story world, readers may buy into why their action led to a particular impact and feel the action viscerally, giving them internal-ontological roles. I describe this further through an example. Let us assume that Gummy progressed in his journey when the reader drank cold milk. Here milk gives a tangible and ontological interface but does not tap into any of the properties and experiences that milk can provide like being soothing, or nostalgic. How is milk then much different from pressing a button? Building on this example further, what if drinking cold creamy milk made a soft and cool corner in the stomach for Gummy, where he could relax and go to sleep. This example takes the sensory (soft, cool) and emotional (relaxing, sleepy) qualities of milk and weaves them into the story such that it has a meaningful impact on the body and Gummy. This example brings attention to the visceral properties of milk, enabling readers to feel the action viscerally. It also increases buy-in for why milk helps Gummy compared to the first example.

Another example of a questionable consequence was healthy food giving Gummy a boat in the acid river. Readers had a tough time buying into why healthy food gave Gummy a boat. Perhaps if the physical properties of food were used such as foods that float gave gummy a boat, the consequence would be more believable.

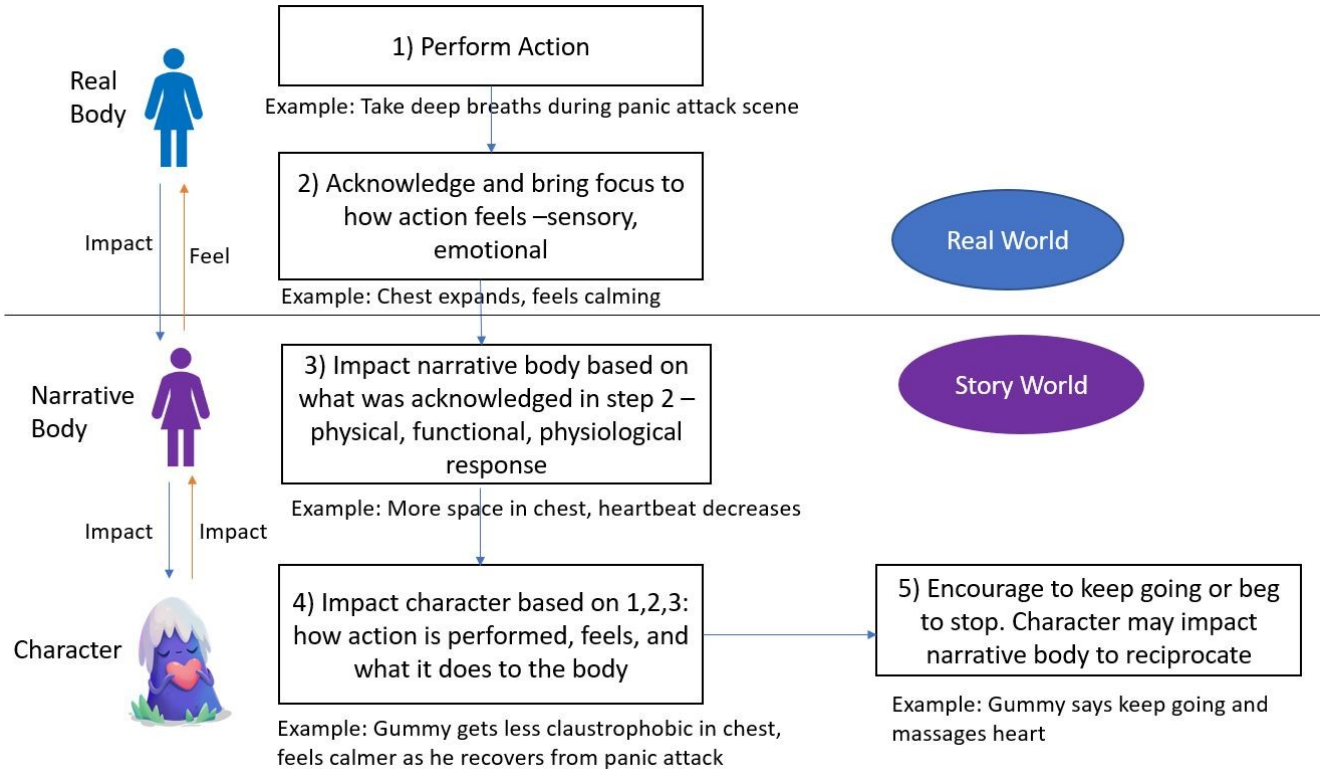


Figure 30: Summary of 5 steps to weave actions and consequences in narrative

I describe how actions and consequences with food and the body can be weaved into the story using sensory, affective, and physiological properties of food and the body through the 5 steps mentioned above, so readers buy into why their action caused a particular consequence. In chapter 9, I extend these properties to other diegetic interfaces beyond food and the body, and term these properties as *affordances*. Figure 30 shows a summary of the 5 steps with an example – taking deep breaths during the panic attack scene.

1) Perform an action:

While designing for the diegetic body, it is useful to think about how different actions may serve different functions – some may act as *body tethers* like belly rubs, some may elicit an emotional response from the reader like deep breaths, and some may carry different sentiments like touching vs. jabbing one's belly. I also recommend thinking of what the action may physically do to the diegetic interface and integrating that consequence into the narrative. For example, chewing Gummy broke him into pieces that felt like he was getting hurt, eating food and breathing gave Gummy food and O_2, and touching one's belly led to Gummy being touched.

2) Acknowledge how the action feels:

The performed action and how it feels can be narratively acknowledged in the story by the character, so the reader feels the action viscerally, and feels that THEIR body is a part of the narrative. This is important because perception is directed (Svanæs, 2013), and readers may not focus on the sensation at all, if it is not explicitly called out. Furthermore, this acknowledgement is how designers can bring the sensorial and emotional properties of the food and body into the narrative.

In GWO, the action and how it felt were acknowledged by Gummy. Different foods felt juicy, sticky, hot/cold, oily, sugary, etc. Actions with the body like belly rubs felt warm. Sound effects like the sloshing of oil in the stomach or whirling winds in the lungs could have accompanied the verbal acknowledgement as well.

Actions were felt more viscerally when the story was playing out in parts of the body where readers could feel localized sensations like the mouth and stomach. For example, chewing Gummy and feeling the impact of Gummy breaking down was visceral as the action and consequence both took place in the mouth where readers could feel the localized sensation. However, drinking water to speed up the RBCs was not felt viscerally, because people cannot feel their blood. In such cases, readers may have to cognitively map the action to the consequence rather than feeling them viscerally. I recommend that actions are best felt when the reader's focus is on body parts where they experience localized sensations.

Food and bodily actions can also have an affective response like consuming a *calming* drink or *energizing* coffee. I recommend that this affective response can also be acknowledged in the narrative to help readers feel a particular way or validate how they may be feeling. It is useful to leverage familiar actions commonly associated with the affective response (like taking deep breaths to feel calm) because even if readers do not feel the affect, they can at the very least associate the action to the affective state.

However, unfamiliar actions may not elicit the same response as readers may not associate the action to anything in real life – like many readers did not find the belly rubs calming. Another useful strategy is to *personalize* the interface component and affective response rather than trying to find universal or familiar mappings. In GWO, participants were asked to bring any drink

that they found calming, and hence, they already associated their drink to a calm state, increasing the chance of feeling calm while drinking it in the story.

Lastly, some actions may be associated with rituals like consuming a calming drink, while others may not need a ritual to feel the affective state like taking deep breaths. I recommend either making these rituals a part of the story experience or using actions that do not require rituals.

3) Impact the narrative body:

I define impacting the narrative body as having an impact on the body in the narrative world, as the impact on the body in reality may be different. While this concept may be specific to GWO, it can be applied to designs where the body is a part of the story world, and in designs where the reader can not directly impact the character/story world but can only impact an intermediary entity (in this case, the body). As observed in GWO, including the body in the story can give readers personal stakes and goals in the narrative, giving opportunities to align with or create conflicts with the character (CE). Moreover, to effectively design for the diegetic body, just acknowledging how the action feels (step 2) is not enough. A narrative consequence, in the case of GWO – the impact on the narrative body, is important so readers feel like their actions matter and have a consequence in the story world.

I recommend impacting the narrative body based on the functional and sensorial properties of actions acknowledged in step 2. For example, breathing in O2 made the RBCs go faster, cold milk reduced acid, and oil made the stomach walks slippery. Similarly, anything juicy could have bathed the stomach walls and deep breaths could have created more space in the lungs. These consequences can be well defined by painting rich and visceral descriptions of both good and bad impacts. In GWO, since Gummy came into the reader's reality, it was useful that the narrative body was impacted in ways similar to real-life (like milk reducing acid), increasing the reader's buy-in. However, using unfamiliar actions like belly rubs created a problem, as readers did not associate these actions having any impacts on their bodies in reality. I recommend using actions that readers are familiar with to impact the narrative body.

The affective component acknowledged in step 2 can be represented in the narrative body through a narrative physiological response. For example, deep breaths make people feel calm and lower their heart rate. This was represented in GWO through the heartbeat sound slowing

down. Including a narrative physiological response can increase realism as the character is not just stating that an action is calming, but the actions and physiological response work together to reinforce the affective state. It is important that readers own and impact these narrative physiological states by performing an action and not just passively observe it change. For example, the increase and decrease in heart rate in GWO happened because of the reader's actions (deep breaths). On the contrary, when the heart rate increased when Gummy was having a panic attack, a few readers questioned why their heart rate was increasing when Gummy was the one stressing out.

The reader's perceived agency can also change based on the action performed and the impact on their narrative body. Participants reported feeling more in control in scenes where they rubbed their bellies, chewed Gummy, or took deep breaths during the panic attack, as compared to the scenes where they were consuming food. This is because they felt more in control over body actions like deep breaths and belly rubs as compared to changes in the internal body (like reducing acid) because they did not associate having agency over their internal body in reality. Moreover, they described impacting their bodies more 'immediately' as they did not have to cognitively map the impact of chewing Gummy, belly rubs, or deep breaths, but they did have to think about how a particular food item impacted their WBCs or intestines. Even though the *narrative* agency of belly rubs and eating something were similar as they both helped Gummy progress, the *perceived* agency by the reader was different. This shows how different actions can give different perceived agency, irrespective of the consequence. Actions that give more perceived agency can make people feel they are in control while actions where one feels less agency can lead to a feeling of helplessness (Pratte et al., 2021).

4) Impact on character or story world

I recommend that the reader's actions should have an impact on the story world or characters based on 1,2, and 3. This will give readers an ontological role and endow them with responsibility. Just performing and acknowledging how an action feels is not enough (steps 1,2). Without a meaningful consequence, the reader may ignore the acknowledgement or get distracted by it. For example, readers questioned how the heat of the belly rubs helped Gummy. Even though the heat acknowledgement served as a body tether, there was no obvious connection for how belly rubs and the warmth helped Gummy, which became distracting for a

few. I further recommend that the consequence in the story can be based on the properties of the action that were acknowledged in steps 1 and 2. This will help readers buy into why their action led to a particular consequence. For example, people questioned how healthy food gave Gummy a boat in the acid river, because the consequence of building a boat had nothing to do with the nutritional property of food.

In GWO most times, the action's consequence on Gummy and the story depended on how the narrative body reacted (step 3), and how the action felt sensorily and affectively (steps 1 and 2). I recommend that food's visual, sensorial, affective, and functional properties can be used to impact the story. For example, oil in the food made the stomach slippery (step 3), which made Gummy slip, building on the sensory quality of oily food. Deep breaths gave Gummy oxygen that helped him ride the RBCs faster (functional). Similarly, deep breaths could have given Gummy more space in the lungs making him feel less claustrophobic (sensorial). Ginger tea could have given Gummy warmth (sensorial), something juicy could have bathed the stomach walls and given Gummy a shower (sensorial), things that float could have given Gummy a boat in the acid river (functional), and Gummy could have felt comforted by soft belly rubs but retaliated if the belly was jabbed (sensorial).

I recommend that actions that create an affective response can be used to express or feel an affective state in the story. This can be useful when the character and reader share an emotional moment together (panic, relief) or when the reader themselves play the character (TNFT, SR). GWO focused on the former where such moments of *affective sync* (deep breaths during the panic attack, drinking calm drink) made participants feel they assisted Gummy and that they and Gummy were in the situation together.

In GWO, Gummy acknowledged the affective property of the food/action (deep breaths and calm drink are calming), and felt the same way because of how the reader's body responded. However, I observed that this design led to situations where the reader felt the same affective state as Gummy but for a different reason. I recommend these states of affective sync between the reader and character could occur during specific plot points in the story like when the action brings the character from peril to calm (deep breaths during panic attack), when the reader and character enjoy a moment of calmness after peril, or when the reader is consoling the character. Affective sync at such plot points can help readers feel for the character, building CE.

5) Provide feedback and encourage the reader to keep going or stop.

Lastly, readers should be given clear feedback on whether their actions led to positive or negative consequences, and if they should continue to take the same action or not. To provide positive reinforcement, characters may express gratitude, comfort, and encourage the reader to keep going. Encouraging the reader to repeat the action can also help them slow down and feel the sensory and affective impact of the action. For example, in GWO participants were encouraged to keep sipping the calm drink multiple times to feel its effect. Repetitive actions can help readers taste the food more as well. This positive reinforcement not only provides readers validation for their actions, but may also encourage them to slow down and join the character for a relaxing moment.

On the contrary, if actions lead to undesired or negative consequences the character can respond by screaming / crying, blaming the reader, showing urgency, begging the reader to stop, and possibly leading to scenes where the stakes get higher. Such scenes can make readers feel responsible and concerned for the character. In GWO, actions leading to negative consequences felt worse because readers were not just hurting Gummy but also their own bodies.

The character may also express their reaction to the reader's actions by impacting the reader. In GWO, Gummy could have helped the reader's body when the reader took a *desired* action, and he could have accidentally hurt the reader if they took undesired actions – like panicking during the acid attack and accidentally scratching the stomach walls. These effects could be amplified by external vibrations and heat on the body to signify what Gummy was doing and feeling. I recommend that acts of reciprocation by the character to the reader can amplify the character's feedback.

8.1.4. Examples of Weaving Actions and Consequences in the Narrative

In this section I describe examples from GWO to illustrate how they succeeded or failed to apply the 5 steps above. I also explain a few 'what-if' scenarios to show the importance of each step.

The first example is eating oily food and feeling the impact of the oil. The reader ate oily unhealthy food (step 1). Gummy acknowledged the action and how oily it was (step 2). The

stomach floor got slippery (step 3), which made Gummy slip as well (step 4), and he encouraged the reader to eat something else (step 5). Participants reported having a visceral reaction to the oil and feeling bad for their bodies as well as for Gummy (CE). Had Gummy not acknowledged the oil in the food (step 2), readers may have not noticed the oil or associated it with Gummy slipping. If Gummy had not slipped (steps 3 and 4) but just acknowledged the oil, readers may have not felt the intensity of how bad oily food was for Gummy and their bodies, possibly decreasing feelings of sympathy as well.

The next example is chewing Gummy. Readers chewed Gummy at the beginning of the experience (step 1). Gummy shouted and acknowledged the reader was chewing and breaking him (step 2). He said he was getting hurt because of the reader (step 4) and he begged the reader to stop (step 5). In this example, readers felt they were hurting Gummy because they were breaking his physical form and because Gummy shouted and expressed the same. This scene made them feel guilty and endowed them with responsibility. However, the scene broke down to some extent at step 4 as the continuous action of breaking Gummy made readers feel that Gummy was dead, but that was not how the story went. This conflict made them question their buy-in to the narrative. This could have been resolved through another action like Gummy asking readers to eat honey and gluing himself back together with honey's stickiness.

The next example is taking deep breaths during the panic attack scene. Readers took deep breaths (step 1). Gummy acknowledged that the deep breaths were calming (step 2). The heart rate sound slowed down (step 3). Gummy felt relieved and recovered from his panic attack (step 4) and encouraged the reader to keep going (step 5). This scene worked well as it enabled readers to feel the affective response of the deep breaths, not just because of how Gummy felt but also because of the decreasing heartbeat (added personal stakes) and the act of taking deep breaths. They felt their emotions synced with Gummy and helped him move from a state of peril to calmness, feeling Gummy and they were in the story together. This scene could have been less effective if there was no heartbeat sound in the background, decreasing the personal stakes (step 3). It may not have created a calming effect if the calmness was not acknowledged and used to impact Gummy in a similar way (steps 2 and 5). This was observed when readers took deep breaths for making the RBCs go faster, where they focused more on the functional quality of deep breaths – providing oxygen, rather than the affective quality. This comparison shows that step 2 is important as readers are more likely to focus on what is acknowledged.

Lastly, I describe two examples that I designed after this analysis, using the 5 steps mentioned above. One example is about exploring Gummy's backstory as a few participants mentioned they wished to know more about him. This scene could have been facilitated by drinking alcohol (step 1), where Gummy would have acknowledged the warmth and expressed feeling relaxed and uninhibited (step 2). The stomach would get warm creating a cozy campfire corner for Gummy (step 3), and Gummy would have relaxed into this warm corner and shared his backstory (step 4). The more the reader would drink, the more Gummy would get tipsy and share (step 5). This scene builds on the nostalgic, warm, relaxing, and social qualities of alcohol. In another example, I imagined if Gummy was stuck in the reader's nasal cavity. Readers would eat something spicy like wasabi (step 1). Gummy would acknowledge the spice (step 2), and the consequential runny nose (step 3). He would feel less trapped in the mucus (step 4) and encourage the reader to keep eating so they might have actually felt the impact of spice in their nasal cavity (step 5). This example uses spicy properties and their effect on the body.

In summary, these 5 steps can help create an experience where readers buy into why their actions cause certain consequences and feel their actions viscerally. Weaving actions and consequences in the narrative can help them feel like their bodies and actions are a part of the story world, giving them internal and ontological roles.

8.1.5. Summary

Table 18: Designing for the diegetic body - GWO

Concept	Design Recommendations
Body tethers: Hooks that remind readers that *their* bodies are a part of the narrative experience by bringing focus to the body.	● Ask readers to perform abstract, out-of-the-ordinary actions with their bodies in the narrative. ● Acknowledge how the action feels sensorily or emotionally. Impact the narrative because of the action. ● Body tethers are felt better in body parts where people experience localized sensations like the mouth. ● Augment body tethers through external modalities and entities that show agency over the reader's body. ● Avoid using tethers that may be too strong and zap readers out of the story world.

Breaks in diegesis while designing for the diegetic body: When readers do not buy into the story world because of what is happening to their bodies in the story world.	● Since one's body is very close to reality, suspension of disbelief may be harder. ● Follow real-life rules of how the body works, especially if the story is grounded in the reader's reality rather than a fictional world. Avoid anatomical inconsistencies. ● Design with empathy and caution to avoid uncomfortable experiences with the body
Weave actions and consequences in the narrative: Integrate body and food-related actions and consequences in the narrative using their sensory, affective, and physiological properties. See Figure 30 for a diagrammatic summary.	● Step 1: Perform an action. Ex: Readers eats oily food ● Step 2: In the story, acknowledge how the action feels sensorily and affectively. Ex: Gummy says food is oily ● Step 3: Impact the narrative body based on what was acknowledged in step 2. Ex: Stomach becomes slippery because of the oil. Represent affective responses through augmented physiological responses of the narrative body like a change in sound of heart rate to show panic/calm. ● Step 4: Impact the character/story world based on the acknowledgement in step 2 (sensory, affective, functional properties) and how it impacted the narrative body in step 3. Ex: Gummy slips on the slippery stomach floor ● Step 5: Provide positive or negative reinforcement to the reader for their action. The character may reciprocate to the reader's actions by showing pleasure or displeasure. Ex: Gummy begs the reader to eat healthier food

8.2. Character Engagement through the Diegetic Body

In the section I describe how the diegetic body may facilitate aspects of character engagement while the reader interacts with another character (second-person perspective), specifically:

- Align and adopt character goals, root for them, feel for their success/failures, feel for the character (allegiance – both cognitive and empathetic components (Smith, 1995))
- Feel what the character feels affectively (empathy (Smith, 1995), affective empathy (Levenson & Ruef, 1992))

As seen in the previous section the diegetic body can increase personal stakes for the reader in the narrative as *their* bodies are a part of the story and are impacted by their actions. In GWO the reader's personal stakes and goals were largely aligned with Gummy's, building CE, with some conflicts along the way. Furthermore, the diegetic body endowed readers with Gummy's well-being as he was dependent on an entity (reader's body) that readers were responsible for. Actions with the diegetic body created opportunities for affective sync with the character, which

helped readers feel how Gummy felt, enjoy calming moments with him, making them feel like they both were working together.

8.2.1. Align Reader's Personal Stakes with Character Goals

I recommend aligning the reader's personal stakes and goals with the character's goals in the narrative, which can help in achieving allegiance. In GWO, helping or hurting the body helped or hurt Gummy, largely aligning the goals of the readers and character. This goal alignment can help readers root for the character and feel for the character's success or failure. For example, participants mentioned feeling bad when the acid attack hurt Gummy and their stomach. They cared for Gummy, felt positive when they helped him, and were careful in high-stakes scenes.

However, a few participants saw Gummy negatively as they felt he was trying to escape their bodies, painting their bodies as the enemy. Here, while Gummy and the readers both had the same goals – to help Gummy escape, the sentiment for doing so was different. They wanted Gummy to escape because they found him annoying and selfish, and the motivations for their actions mostly served their personal goals. They harbored negative feelings towards Gummy, wanted to punish him, and detached themselves from his suffering, decreasing CE. These negative feelings may have been more enhanced in GWO because the reader's body was involved, and perhaps Gummy could have been less sassy. I recommend that readers should be encouraged to act in the character's interest and not just their own interests. This requires creating likable characters, building trust, showing the character cares for them, and creating high-stakes scenes. In GWO specifically, the goal alignment could have been better perhaps if Gummy and the reader fought a virus together or if Gummy were a vitamin whose main purpose was to help the body.

While aligning the overall goals (like helping the body) is important, I also recommend creating short scenes where both the character and the reader like or dislike a situation, to help with goal alignment and allegiance. Participants enjoyed drinking the calm drink, taking deep breaths, and rubbing their bellies and wanted to continue doing those actions as they felt good. Since these actions also helped Gummy, this led to goal alignment. Similarly, participants desired to lower the heartbeat pace because it created a stressful moment for them and Gummy. The

diegetic body's ability to involve personal stakes and produce *affective sync* can be used to create these short scenes that both the reader and character enjoy or dislike.

While having the overall goals of the reader and character in conflict can be detrimental to CE, creating smaller conflicts may be useful. The diegetic body was a *shared entity* between the reader and Gummy, which made conflicts possible as Gummy did things in the body that people found uncomfortable. He moved towards vulnerable organs like the heart making people feel protective about their bodies. He escaped the WBCs asking readers to choose between him and their bodies. While these conflicts may have harbored some negative feelings towards Gummy in the moment, they had many benefits - they acted as body tethers, added variety as goals were no longer aligned, and they raised the reader's investment as their bodies were impacted negatively. Conflicts can also give space to build the reader's trust in the character. Gummy could have diffused the situation, showed that he cared for the reader, or helped the body if it were harmed in the conflict – like encouraging the reader to eat healthy to rebuild their WBC strength after he had escaped them. These reciprocating actions by Gummy may have increased the reader's trust and liking towards Gummy, building allegiance.

8.2.2. Endow Readers with Responsibility through the Diegetic Body

Endowing readers with some responsibility can give them a goal in the narrative. In GWO they were endowed with Gummy's well-being who was dependent on their bodies' well-being. They felt responsible for Gummy since he was in their body – an entity they owned, cared for, and controlled. Furthermore, they could not directly impact Gummy but only help him on his journey. This put them more in a facilitator role and less in a God-like role, which may have fueled sympathy for Gummy. For example, they could not control his actions and felt sympathetic when he did not leave the body without Ana. I recommend that readers can be endowed with the character's well-being by making the character dependent on an entity that readers have ownership, control, and responsibility for, in this case – the diegetic body. I also recommend positioning readers in a facilitator role, so they do not directly impact the character, but act as supporters.

Participants also felt responsible for Gummy because they chewed and hurt him in the beginning, which made them feel guilty for putting him in the situation he was. This act made

readers pledge their allegiance to Gummy from the very beginning. I recommend creating hooks where readers may take actions that accidentally put the character in a difficult situation. These hooks can help readers feel responsible for helping the character. However, there is a caveat here. Readers may feel it is out of character for them to hurt someone else, distancing themselves from the situation. This was observed in GWO where a few participants felt very guilty about chewing Gummy and decided to absolve themselves. In such strong hooks, perhaps diffusing the intensity of the situation may work, Gummy could have consoled the reader by saying he was alright and would not die so easily.

Contrasting positive and negative consequences to actions can help readers feel responsible. In GWO, negative consequences (anything that hurt Gummy) started with being funny, but if readers kept taking those actions, Gummy would later blame the reader, question their loyalty, and express lasting and worsening consequences. On the other hand, with positive consequences (anything that helped Gummy), he showed gratitude, encouraged the reader to keep going, complimented the reader's body, and after points of high stress, he asked readers to slow down and share a relaxing moment with him. Negative consequences on the character may be more useful for CE as compared to positive ones, because they can facilitate sympathy responsibility. However, positive consequences can help create moments of affective sync, which are also useful for allegiance.

I clarify that consequences to the actions need not be plot-centric - the story need not have branching pathways. As described in section 6.2, GWO's plot was linear, but readers had agency over making Gummy's life easier or more difficult as they went through the story. After the reader took 2-3 undesired actions, Gummy would keep repeating the same dialogue until readers took the needed action to proceed. While most participants took the desired actions before hitting a repeated dialogue because of the worsening consequences, a few participants did hear Gummy repeat himself, effectively hitting the system's boundary. This made readers feel they had to follow Gummy for the story to progress, not only decreasing perceived agency but also their feelings of responsibility towards him. I recommend backleading readers away from the boundaries of the system by making the situation very dire. In GWO, Gummy could have made it seem like he was going to die if readers went towards a boundary, effectively increasing the stakes. Another way to avoid repeated dialogues is to make story progression independent of the reader's actions after a certain point (like in belly rubs Gummy moved ahead

with gratitude or mistrust depending on the reader's action). In the above example, Gummy could have just proceeded despite the reader's 3 undesired actions, all the while expressing betrayal, distrust, and stress ('I'll burn myself while I waddle through the acid thanks to you!').

8.2.3. Navigate High-stakes Scenes and give Open Choices

I term *high-stakes scenes* as scenes with dire circumstances where the character's life may be in danger. In GWO, the stakes were higher because the reader's body was in danger as well, adding personal stakes. High-stakes scenes can be created through the reader's actions that cause unintended negative consequences and character suffering. For example, participants reported feeling especially bad for Gummy when he got shot by the WBCs because of their 'mistake' of accidentally eating healthy food. Worsening and lasting consequences from high-stakes scenes can make readers feel responsible and sympathetic for the character as well. For example, if the reader continued eating healthy food in the WBC scene, the consequences would worsen as Gummy would start losing his limbs. Furthermore, Gummy referred to his lost limbs even later in the story (lasting consequences) which made readers feel guilty and sorry for Gummy. High-stakes scenes can encourage readers to build allegiance with the character as they help the character through stressful moments.

I recommend providing *open choices* – where readers are not backled but given open-ended instructions instead. For example, open choices were given in GWO when Gummy asked readers to 'do something' instead of 'eating something healthy'. Open choices can give readers room to explore and take actions that may cause unintentional negative consequences, subsequently leading to high-stakes scenes and CE. In GWO, readers were encouraged to try different food items in the stomach scene (early in the experience), where they could explore what each food item did. As they explored each item, the oily and sugary food led to the acid attack – an unintended negative consequence that created a high-stakes scene. Open choices can also help readers play out their curiosity, perceive more agency, and feel less like they need to always follow instructions. They may also make readers feel helpless as they may not always know what to do. For example, participants mentioned feeling helpless when Gummy was in the intestines and he asked readers to 'do something'. Open choices can also make the situation feel direr than it really is. For example, participants reported that the scene where Gummy was stuck in the intestine felt intense, as it took them a long time to figure out that they had to send

Ana to help him, even though narratively this was not a high-stakes scene. I recommend giving open choices with less backleading as they can help readers explore, cause unintentional negative consequences, perceive more agency, feel helpless or feel the situation is dire.

Lastly, high-stakes scenes create urgency and encourage readers to *react* – act without thinking critically. For readers to react, they should know what consequence their action would cause. This is simple with the diegetic body as readers already have lived experiences of actions and consequences, and their actions can be instinctive. For example, participants reported taking deep breaths instinctively during the panic attack scene as they already associated deep breaths with resolving panic attacks in real life.

8.2.4. Create Likable Characters

Readers must like a character to achieve allegiance (Lankoski, 2011). Firstly, the character should be personified. Gummy's visual appearance (gummy bear) and the range of emotions he expressed helped readers see him as a living being. Furthermore, his child-like, funny, and helpless personality made readers want to care for him. He always pushed readers to keep moving ahead and showed gratitude. Such personality traits can be used to create likable characters. However, some readers felt Gummy was judgmental about their eating habits. Gummy could have been gentler with how he breached these delicate topics. Relatable hardships can also help create likable characters. Participants felt sympathetic when Gummy was alone and when he went back to find Ana. Lastly, seeing the character suffer and helping them through moments of stress, panic, despair towards moments of joy can help build allegiance as well.

8.2.5. Summary

Table 19: Character engagement through the diegetic body - GWO

Concept	Design Recommendations
Align reader's personal stakes with character goals: Readers may have personal stakes in the narrative due to the diegetic body. Align them with the character's goals.	● Create actions that have similar positive or negative consequences for the reader and the character. Ex: healthy food helped both the body and Gummy ● Align overall goals, build trust, and show that the character cares for the reader, so the reader likes the character and acts in the character's interest and not just their own. ● Create short scenes where both the character and the reader like or dislike a situation. Ex: sharing a calming drink together ● Create conflicts between the reader and character by negotiating the body between them to bring focus and raise investment levels. Ex: Gummy going to the vulnerable heart ● Let the character help the reader after creating conflicts so readers can trust the character
Endow readers with responsibility through the diegetic body: endow readers with responsibility so they have a goal. The diegetic body can be a facilitator of responsibility.	● Make the character dependent on the body – something the reader can control, own, and feels responsible for. ● Position readers in a facilitator role rather than a God-like role so they can only help the character but not directly impact them. In GWO, readers could only help Gummy by impacting their bodies. ● Create hooks where readers take irreversible and unintentional actions that put the character in a difficult situation, like chewing Gummy ● Give readers agency by having contrasting negative and positive consequences to actions. Consequences to actions need not be plot-centric. Negative consequences may be more effective for CE. ● Avoid repeated dialogues through worsening consequences or by making story progression independent of the reader's actions after a certain point.
Navigate high-stakes scenes and give open choices: High-stakes scenes are scenes with dire circumstances where the character's life may be in danger. Open choices are points where readers are not backled but are given open-ended instructions.	● Create high-stakes scenes through actions that cause unintended negative consequences (mistakes). Have worsening and lasting consequences to fuel sympathy. ● Give open choices for readers to take actions that cause unintended negative consequences, play out their curiosity, perceive more agency, and maybe feel helpless. ● Create opportunities for readers to react in high-stakes scenes. Chances of reacting through the diegetic body are high as actions can be instinctive because of the reader's lived experiences.
Create likable characters: Create likable characters to achieve allegiance	● Personify the character through physical appearance and expression of emotions.

	• Make character personality funny and helpless. Character should be sensitive and less judgmental about the reader. • Allow readers to see the character go through Relatable hardships, suffering, and resolution.

8.3. Navigate Complexities and Keep Up Engagement Levels

This section describes how to help readers navigate the complexities they face while understanding how to interact with the interface, the mapping between actions and consequences, their role, and how to perform, all while keeping up engagement levels, so readers are not bored nor overwhelmed. GWO had very low complexity as readers were not playing a role and entered as themselves, the consequence of an action was easy to predict as it was based on basic science, and Gummy backled them all the way by giving visceral descriptions of where he was, describing the obstacles he faced, and what actions the reader could take to help him. The fast pace of the story, shifting from organ to organ, and different kinds of actions kept them engaged.

8.3.1. Predicting Consequences of Actions

Readers must map, understand, and remember what actions lead to what consequences in order to interact intentionally with the narrative and connect with the character. These mappings are easier to understand if they follow patterns that readers are already familiar with from their lived experiences. In GWO, the consequences of actions were easy to predict as they relied on basic science – healthy food has positive consequences on the body and unhealthy food does not. This logic was much simpler than the mappings in SR and TNFT, allowing readers to engage with Gummy rather than deciphering a complex puzzle (SR). Personalizing the interface can also help readers map actions to consequences. For example, readers already associated their calm drink with a calming effect as they were asked to personalize the item.

However, very simple mappings between actions and consequences may make the experience monotonous or underwhelming. Mappings can be made more complex to add variety and allow readers space to take actions that may lead to unintended negative consequences. In GWO, even with the simple interface, readers had to estimate which property of the food item – emotional, visual, or nutritional was best suited for a given choice point. This added layer of

complexity challenged readers and did not leave them bored as they did not just have to think about healthy vs unhealthy food, but other properties of food as well. These complexities challenged their mental model and allowed them to make 'mistakes'. A few participants increased the complexity by comparing nutritional values between healthy foods like which food has more fiber. This shows that actions do not have to be binary (good or bad) but can be spread across a spectrum.

8.3.2. Keeping up Engagement Levels

Participants mentioned they felt engaged due to Gummy's funny character, the story's pace, and the shift in scenes moving from organ to organ. I recommend changing scenes in the story to keep readers engaged. Readers also stayed engaged because they had to think of different food properties (nutritional and emotional) while interacting. They could also take different actions like belly rubs and deep breaths, and they were not just eating. I recommend creating experiences that allow readers to take different actions, enough to keep them involved but not overwhelmed.

Chewing Gummy in the beginning was captivating and kept readers involved. However, the ending of GWO was quite abrupt. Perhaps Gummy could have gone through a few more high-stakes scenes to reunite with Ana, and the story could have ended in the bowels rather than the heart. I recommend creating captivating scenes in the beginning and easing readers out of the experience in the end. Lastly, people mentioned they felt engrossed because their bodies were in the story and Gummy talked to them, a demonstration of the power of diegetic interfaces and internal roles in creating engaging experiences.

8.3.3. Summary

Table 20: Navigating complexities and keeping up engagement levels - GWO

Concept	Design Recommendations
Predicting consequences of actions: Readers need to map, understand, and remember what actions lead to what narrative consequence	● Make mappings between actions and consequences simple by following patterns that readers are familiar with from lived experiences. Ex: healthy food and good consequences on the body, unhealthy food does not. ● Allow readers to personalize the interface, that is mappings between actions and consequences.

	● Add complexity to the mapping so the experience is not boring and so that readers can take actions that cause unintended negative consequences. ● Use different properties (emotional, sensorial, functional) of actions to add complexity. ● Spread action across a spectrum rather than having binary choices to add complexity
Keep up Engagement Levels: Readers should be engaged and not overwhelmed or bored	● Keep up engagement levels through the shift in scenes. ● Create captivating beginnings and ease readers out of the experience in the ending. ● Allow readers to take different actions and think about various consequences, enough to keep readers engaged but not overwhelmed. ● Make the character engage with the reader through diegetic interfaces like the body

8.4. Conclusion

In this section, I revisit the main takeaways from this study and how they help answer my research questions.

RQ1: How can different diegetic elements be designed to position readers in internal roles (inside the story world) and ontological (impact story world) roles such that they feel the impact of their actions, and buy into why their actions cause a particular consequence?

The diegetic body can help readers feel actions viscerally increasing realism, endow readers with responsibility, produce affective responses, and add personal stakes increasing the gravity of choice. However, for the above benefits, the reader should be reminded that *their* body is a part of the narrative experience through *body tethers*. Body tethers are abstract actions that when performed, are acknowledged by the character and have a narrative impact, bringing the reader's focus to their body and giving them an internal role. Since the body is close to the real world, suspension of disbelief can be more difficult, which can lead to breaks in diegesis. To avoid such breaks, rules of the real world could be followed in the story and anything that makes the reader feel like '*that's not possible in my body*' could be avoided.

Food and bodily actions have sensory, affective, and functional properties that can be used to impact the narrative, so readers feel the actions viscerally and buy into the consequences of the actions, giving them ontological roles. The 5 steps to integrate these properties are – 1) perform

an action 2) Acknowledge how the action feels 3) Impact the narrative body 4) Impact the character/story world 5) Provide feedback and encourage the reader to keep going or stop.

RQ2: How can diegetic elements support aspects of character engagement (CE) such as - understand and adopt character goals and motives, feel for the character and root for them, feel what the character feels affectively, or/and take the character's identity, when readers interact with another character or take a character's role?

GWO focuses on how readers can engage with characters from a second-person perspective. The diegetic body can give readers personal stakes and goals that when aligned with the character's goals (like taking care of one's body) can lead to CE. While long-term conflicts between the reader and character should be avoided, small ones can be created to add investment and variety. These conflicts can be a result of the character impacting the reader's body in strange or uncomfortable ways. The diegetic body can be used to endow readers with the character's responsibility by placing readers in 'facilitator' roles where they can only help the character but not directly impact them. Another way to endow readers with responsibility is by guilting them of taking actions that may cause unintentional harm to the character (chewing Gummy), or by navigating high-stakes scenes that have lasting and worsening consequences. Lastly, it is important to create likable characters to achieve CE.

RQ3: what complexities might readers face while taking internal-ontological roles and engaging with characters in diegetic interactive narratives? How can readers be assisted to navigate these complexities such that they can intentionally impact and engage with the story?

GWO provides insight into mappings between actions and consequences. These mappings can be easy to understand and remember if they are based on familiar real-life patterns like - healthy food helping the body and unhealthy food hurting the body. Furthermore, readers can be asked to personalize components of the interface (like bringing their own calming drink) so they can anticipate the consequence of an action with that component. However, the complexity of the system should be maintained to an extent, so the experience is not monotonous and there is variety. Different properties of the actions (sensory, emotional), non-binary choices spread across a spectrum, a mix of actions, and a fast-paced narrative with shifts in scenes can help keep up engagement levels.

Chapter 9. Design Guidelines - Affordances and Attributes

In this chapter I give design guidelines that come from the insights of my three pieces and the literature review to answer my first research question RQ1: How can different diegetic elements be designed to position readers in internal roles (inside the story world) and ontological (impact story world) roles such that they feel the impact of their actions, and buy into why their actions cause a particular consequence?

In my three studies, I explored how various diegetic elements such as diegetic ambiences, actions, and the body could provide readers internal-ontological roles. During the synthesis of all these works together, I kept returning to the importance of taking diegetic actions that have a *logically convincing* consequence in the narrative. Readers may feel like they have stakes in the story, feel the impact of their actions, and buy into the consequences of their actions more if the answer to the question '*why does this action lead to this consequence in the story world*?' has a believable and reasonable answer. This chapter focuses on how designers can provide logically convincing mappings between diegetic actions and narrative consequences.

While designing for ontological roles using tangible and bodily interactions, it can be tempting to connect interactions with different diegetic objects to different consequences in the story world – assembling various Rangolis (SR) or casting various spells (TNFT) to impact the affective states of characters, eating healthy food to give Gummy a boat, interacting with a tactile cube to save the forest (Harley et al., 2017) or pulling a braid on a wig to pull up a shield (Jung et al., 2021). However, connecting a diegetic action to a consequence in the story is not simple as there needs to be a logical explanation between the action and the consequence, unlike the examples above. Actions that do not have logically convincing consequences like the ones mentioned above may leave readers questioning why their actions led to the particular impact in the narrative ('why does healthy food give Gummy a boat? – chapter 7), possibly breaking them out of the experience. On the other hand, logical explanations between the action and the consequence may lower the chances of readers breaking out of the experience and questioning the logic, and adding buy-in.

Comparing logically convincing and not so convincing consequences can help illustrate the importance of this point further. In (Harley et al., 2017), stroking a squirrel to calm it down sounds more logically convincing than tapping a cube to save the forest, as the act of stroking relates to calmness. Similarly in (Jung et al., 2021)'s work on gaming wearables, taking deep breaths to focus, feel calm, and activate an invisibility cloak is more reasonable than pulling a braid on a wig to pull up a shield. In GWO, deep breaths to help Gummy through the panic attack led to more buy-in than rubbing one's belly to help Gummy move farther. A few participants questioned how belly rubs helped Gummy move along their digestive tracks as they could not relate the action to anything they would do in real life. On the other hand, participants felt they really helped Gummy through the panic attack by taking deep breaths and some even reported feeling calmer themselves. These examples begin to illustrate how logically convincing consequences to actions may help people buy into the story world and even feel the impact of their actions emotionally and sensorily.

As I synthesized my findings (details in chapter 3) looking for logically convincing mappings between actions and consequences, I started recognizing patterns that I can best describe as different *affordances* that bodily actions and tangible objects offer. Gibson described affordance as 'all actionable possibilities with an object based on the user's physical capabilities' (*What Are Affordances?*, 2021). Norman described affordances as 'what users can do to an object' (Experience, 2021). In the dissertation, I focus on how *affordances* of actions with the body and objects can help readers feel, perform, express sentiments, and lead to logically convincing consequences in the narrative. During the synthesis, I found patterns in the kinds of *affordances* I was seeing in my three projects and works from the literature review. I categorized the *affordances* into three groups - *affective, semantic,* and *sensorily perceived and performed affordances* described in table 22. *Affective affordances* refer to how actions may make one feel affectively, *semantic affordances* refer to the meanings and sentiments that actions carry, and s*ensorily perceived and performed affordances* refer to how actions are physically performed and what they may make one feel sensorily. It should be noted that while more *affordances* may exist, these are the ones I recognized from the synthesis of my three works and the insights from the literature review.

The cold milk example in GWO (Chapter 8) explains the concept of *affordances* as used in the dissertation further. Drinking cold milk to help Gummy move through one's stomach is not very

logically convincing. This example uses milk as a tangible diegetic interface but does not use any of milk's affordances, positioning milk almost like a tool to help Gummy, which is not very far from pressing a button. However, the example - drinking cold milk to soothe and soften one's stomach to create a soft calming corner for Gummy, leverages milk's *sensory affordances* (soothe, soft) and *affective affordances* (calming) to reasonably impact the narrative body and subsequently Gummy. Here, the reader is more likely to think of milk as a soothing, calming agent and buy into how drinking milk helps Gummy.

The cold milk example also illustrates that *affordances* can not only provide logically convincing consequences to actions but can also help readers feel the impact of their actions sensorily and emotionally. This shows how affordances can leverage the unique capabilities of the TEI field - making the experience more sensory and lived. Furthermore, acknowledging the *affordance* in the story and directing the reader's attention to how the action and consequence feel can also help readers think that their actions are a part of the story world, helping them take internal roles.

Alongside affordances, I also found that certain characteristics that describe how the action is performed and represented can also increase the reader's buy-in. I call these characteristics *attributes*, which are essentially levers that shape how an action is experienced and provides more ways to think about the action – adding risks, length of action, intensity and crafting, familiarity, coupling between action and consequence, and perceived agency.

In summary, leveraging *affordances* and *attributes* of actions and objects while designing for internal-ontological roles can help design diegetic actions that lead to logically convincing consequences, reduce the possibility of readers questioning the logic between the action-consequence and breaking out of the experiences, and help readers buy into why their actions led to a particular consequence in the story. *Affordances* and *attributes* can also help readers feel the impact of the action sensorily and emotionally as a part of the story world giving them internal roles and providing lived experiences.

In this chapter, I provide **design guidelines** that can be used to leverage the above-mentioned *affordances* and *attributes*. The design guidelines on *affordances* and *attributes* come from my synthesis process of categorization, abstraction, and providing supporting examples based on insights from my three projects and the literature review (more details in chapter 3). Each

section consists of a definition of the affordances, sub-sections describing design guidelines for leveraging the affordance, guiding questions for designers, and a summary table of the design guidelines presented in the section.

The above-mentioned affordances (*affective, semantic, and sensorily perceived and performed*) have been used in existing works in different areas of psychology, interaction design, and machine learning. However, I have used these terms differently in my dissertation. To avoid confusion the table below describes these affordances as used in this dissertation, and how they have been used in existing works.

Table 21: Definitions of different affordances in this dissertation vs. in existing works

Affordance	**Definition as used in this Dissertation**	**Definition as used in existing works, NOT to be confused with while reading this work**
Affective	Aspects of body actions and objects that can help readers feel, impact, and express /enact affective (valence and arousal (Russell, 1980)) states in the story.	● Attributes of Information technology artifacts that can trigger or stimulate user's emotional reactions (Zhao et al., 2013). ● Actions that afford engagement and affective bonding between player and character (van Vugt et al., 2006). ● In virtual learning environments affective affordances are described by immersion and presence (Shin, 2017)
Semantic	Semantic (meanings, histories) values attached to body actions and objects that can help readers express their sentiments in the story.	● Mining semantic affordances – given an object, determine whether an action can be performed on it (Chao et al., 2015)
Sensorily Perceived	Different sensory feelings (outside or on the body) that body actions and objects can elicit, that can help readers feel the impact of their action in the story.	● Sensory affordance - design feature that helps users in sensing (e.g., seeing, hearing, feeling) something. Only includes the physical act of sensing and not the cognitive act of perception(Hartson, 2003) ● Perceived affordance – characteristics in the appearance of a device that give clues for its proper operation (Hartson, 2003 - describes Norman)
Performed	Performance of an action with objects can have physical and spatial impacts on the object, that can help readers feel the physical impact of their actions in the story	● Physical affordance – affordances of artifacts that can be acted upon or physically manipulated. Design feature that helps in physically doing something(Hartson, 2003).

9.1. Affective Affordances

I define *affective affordances* as aspects of actions and objects that can help readers express/enact, feel, and impact affective states in the narrative, giving readers internal-ontological roles. Before diving deeper into this topic, a note on the definitions of affect and emotions. In Russel's circumplex model '*affect*' is a combination of arousal (high energy vs low energy) and valence (pleasure vs displeasure). For example, high arousal and valence is happy, high arousal and low valence is angry, low arousal and low valence is sad, and low arousal and high valence is calm. (Osdoba, 2015) described emotions to be brief, intense, and transpire as a result of action or occurrence. (Mueller, Byrne, et al., 2018) described emotion as the body's complex response to external stimuli, quoting Damasio. While the terms affect and emotions are closely linked and many times used interchangeably (Fagerberg et al., 2004), I use the term *affect* as my dissertation work is better understood in the form of arousal and valence. I also clarify *affective affordances* are not about how the story itself makes the reader feel, but rather how readers can enact, express, feel, and impact the affective state of the character or story, and see the consequence of impacting the affective state play out in the narrative.

Designers can leverage *affective affordances* to provide logically convincing affective consequences to actions, rather than solely justifying the consequence based on the story. For example, creating Rangolis to set an affective tone in SR, or casting spells to impact Calliope and Minerva's affective state in TNFT were completely rationalized by the story, which may have felt like 'tools' to set the affect rather than conduits for feeling and expressing the affective state.

Since perception is directed (Svanæs, 2013), and many components of the experience may be competing for the reader's attention, it is important to explicitly call out the *affective affordance* of the action in the narrative. The character/narrative can acknowledge that the reader took an action, and how the action may feel affectively. For example, in GWO Gummy acknowledged that the reader drank their calming drink and that it has a relaxing effect.

However, just acknowledging the action and affordance is not enough. Without a logical consequence to the action, the reader may just ignore the acknowledged affordance, as seen in SR when the change in Shiva's emotions did not have a noticeable impact on the story. Moreover, the acknowledgement could be distracting as seen in GWO (how does the warmth of

belly rubs help Gummy?). With affective affordances, what could be a logical consequence? An impact on the affective state of the character could be considered reasonable as illustrated in SR, TNFT, and A Breath-Taking Journey (BTJ). I also repeat that while referring to 'consequences' I do not necessarily mean changing the plot of the story, as explained in chapter 2, there can also be non-plot-centric consequences that provide a satisfying response to the action (K. Tanenbaum & Tanenbaum, 2010).

A note of caution, affective responses are also dependent on the context of the story, and actions alone may not elicit the intended response. For example, in GWO the tension rose because Gummy was having a panic attack, not just because of the increased heart rate. In Universal Threshold Object (UTO) the tension rose as a character's life was at stake, not just due to the gripping action of the rope (Chu et al., 2015).

I elaborate on a few design guidelines for leveraging affective affordances that come from the synthesis of my three projects and the literature review – bodily actions, physiological responses, and objects and ambiences. Bodily actions can leverage LMA and help readers impact and express affect like shaking fists to cast an angry spell. Taking intentional actions that cause physiological responses can help readers impact and possibly feel the affective state like taking deep breaths to feel calm in GWO. Objects can use affectively expressive metaphors and ambient effects as seen in SR can create an affective atmosphere. Leveraging affective affordances can help readers buy into why their actions cause an affective response in the story, and possibly even feel the affective state themselves. For a quick summary refer to table 22.

9.1.1. Bodily Actions

I recommend encouraging readers to perform certain bodily actions that can help them express affective states. (Fagerberg et al., 2003) cite (Ekman et al., 2013) and described how emotions can be generated from body-based movements, explaining how moving like one is happy may make them feel warm. (Fagerberg et al., 2003) also mapped different affective states to actions with the mobile phone such as shaking and applying pressure using LMA. (Mueller, Byrne, et al., 2018) described how standing in a winner pose can have a positive affect. Similarly, I recommend that readers can perform actions rooted in LMA for impacting or expressing affect. For ex: in TNFT, instead of tapping a spell, Calliope could have performed spells through actions

such as shaking fists to cast the angry spell or slouching over to cast the sad spell. These actions could have been better than tapping a ball with a wand as the actions are more expressive of affect, increasing buy in, even if readers did not feel the affective state themselves.

Another commonly used action to impact affect is taking deep or shallow breaths. In GWO readers were asked to slow down their heartbeat by taking deep breaths amidst a panic attack. In *A Breathtaking Journey*, the reader who played a refugee had to slow down their breathing to avoid being captured. (Jung et al., 2021) described how players had to take deep breaths to stay calm and activate the invisibility cloak. These examples successfully use the act of deep breaths to express that the character is calm, which then leads to different situations in the story. Deep breaths to impact the affective state can not only increase buy-in, but may also help readers feel the emotional effect of the action themselves.

Another way to use the body for eliciting affective responses is through eating and drinking different things as seen in GWO. Well-known associations such as drinking caffeine for high energy or warm tea for feeling calm can be used, but as seen in GWO, it is useful for readers to personalize the interface, so they can consume what they find energizing or calming. Personalization can lead to more buy-in and less possibilities of readers saying, 'I'm not feeling it'. Metaphorical mappings such as those suggested by (Obrist et al., 2014) may also be used – eating something sweet for a pleasant impact and bitter for an unpleasant impact. Here again, to weave the action of eating in the story, it would be useful to think 'why does eating this sweet food cause a pleasant impact in the story?'. This concept of food consumption could be applied to TNFT where the reader as Calliope could have consumed potions (sweet/bitter) to cast different affective spells.

9.1.2. Physiological Responses

When one feels a certain way their physiology (heartbeat, perspiration, temperature, respiration) also changes (Mueller, Byrne, et al., 2018). I recommend augmenting physiological responses while the reader takes bodily actions so that readers can express and impact the affective state. A highly used example of physiology that I focus on is an ambient heartbeat sound/vibration to show the change in one's heart rate when one feels calm or anxious (UTO, GWO, GW, squirrel).

I recommend designing *activities* for the reader to perform to reproduce the intended affective and physiological state (such as increased heart rate), rather than relying on the narrative alone to raise a physiological response. For example, in UTO the vibration of the heart rate (supposedly the player's) increased when the player moved towards the right path to perhaps express that the player as the protagonist should be feeling fear, but this change in heart rate was based on the narrative, not because of the player's actions. Such examples can result in readers questioning the augmentation – 'I'm not feeling an increased heart rate'. However, in GWO the heart rate in the background decreased only when the reader took the intentional action of deep breaths, an action intended to have a calming response. Here even if the reader did not feel calm, at the very least they associated the deep breaths to the reduced heart rate, increasing buy-in. If readers can own and impact their physiological response through their actions, rather than being told what they are supposed to be feeling, they may buy into the action and intended consequences more.

This recommendation of augmenting physiological responses is not a call to measure one's physiology, but rather mimic the likely physiological response to the performed action – such as decreasing the heart rate sounds during deep breaths. Measuring physiology may shift the reader's already limited attention to reading numbers rather than performing the action and focusing on how the action feels.

(Jung et al., 2021) designed an interaction where the player's measured heart rate would be used to activate certain powers in their character. A low heart rate, presumably indicating calmness, would help the character increase the size of a fireball spell they were casting. A higher heart rate, presumably indicating energy, would help the character run faster. This example shows how just measuring the physiological response may fall short, as we cannot predict whether the player would feel calm or energized solely based on the heart rate reading. But if the player takes intentional actions that are associated with feeling calm (deep breaths) or feeling energized (jumping jacks) to impact their heart rate, we could be more confident that the player at the very least buys into the logic (and possibly even feels) that their heart rate and actions are intended to evoke certain affective responses and subsequently unlock character powers accordingly.

I recommend allowing readers to also feel another character's physiological response due to an action they may have taken to impact that character's affective state. For example, (Harley et al., 2017) describe how players could feel the heart rate of the squirrel decreasing as they stroked it. This could have been applied in TNFT as well, where Minerva could have been represented by a tangible object outside VR, whose heart rate may have increased or decreased with her state of arousal, which could have been felt by the reader when they reached out to touch her. The character's reaction to the reader can give readers stakes in the narrative and provide a satisfying response to their actions.

9.1.3. Objects and Ambient Effects

I encourage designers to embed tangible metaphors in objects so that readers can express affective states. (Macaranas et al., 2012) use physical attributes of objects as conceptual metaphors linking heavy/light and rough/smooth to negative and positive affect. In SR, the rings depicting anger could have been heavier and rougher than the others to denote displeasure and high valence. I further recommend that making the act of using the object to express or impact affect is also diegetic. For example, in SR the act of assembling a Rangoli to impact affect was diegetic as in the story Shiva immersed himself in this art form to express his feelings. Apart from objects, ambient effects can also set a mood (affective background), helping readers feel the affective tone, as observed in SR. Here as well, personalizing ambient effects to set certain moods by the reader can be more useful than relying on universal mappings.

Lastly, actions and objects can have semantic (meanings/associations) and sentimental value attached to them that can be used while interacting with other characters to impact their affective state. I term these as *semantic affordances*, explained in section 9.2.

9.1.4. Guiding Questions and Summary

A few guiding questions that designers can think of while using affective affordances:

- *What affective response is appropriate given the current context of the story? Does the reader feel/impact their own affective response, or do they feel/impact another character's affective response?*

- *What actions may help readers feel, impact, or express the desired affective state? What actions may raise the appropriate physiological response caused by the affective state?*
- *Is the association between the action and affective state familiar, personalized, or metaphorical? How logically convincing is this association?*
- *How does the change in affective state impact the story world? Why does the change in affect cause that impact?*

Table 22: Affective affordances

Affective affordances – Actions and objects can help readers feel, impact, enact/express affective states. Acknowledge the affective state and impact story in a logically convincing way. Design for the affective state that is appropriate in the context of the narrative plot.	
Concept	**Design Guideline**
Bodily Actions: Actions performed on or with the body to express or feel affect	● Use affectively performative actions to express affect. Use Laban Movement Analysis for inspiration. Ex: shaking fists to express anger ● Take deep or short breaths to feel/express calm or anxiety, respectively. ● Consume food items with well-known associations to valence like caffeine for energy. ● Use metaphors of taste like sweet for pleasant outcomes but justify why the consumption creates an affective state. ● Personalize mapping between food and affective state. Ex: asking participants to select their own calming drink
Physiological response to Action: heart rate, respiration, perspiration, temperature	● Perform activities to reproduce the physiological state of the affective response. Ex: deep breaths to lower heart rate and feel calm. ● Allow readers to own and impact their physiological response, so they do not just passively hear it changing. Ex: changing heart rate by taking deep breaths ● No need to measure the actual physiological response as it may divert attention to numbers. ● Take actions that may change the other character's affective state and physiology. Allow readers to feel this change in physiology. Ex: Feel squirrel's heartbeat lower while stroking it.
Ambience: light, sound, music, colors of space	● Use ambient effects for setting a mood as an add on to any other affective affordance
Objects	● Use tangible metaphors of objects like weight and texture to express/impact affect. Ex: heavy and rough rings in SR for expressing anger ● Justify why the object expresses/impacts the affect.

9.2. Semantic Affordances

I define *semantic affordances* as aspects of actions and objects that convey semantic (meanings/ associations) values attached to them. *Semantic affordances* can be used when readers and characters impact or express sentiments to each other through meaningful actions and objects. For example, the act of patting a character's back when they are low carries meaning (*semantic affordances*) of expressing sympathy and concern. The character may respond to such an action with gratitude. This kind of exchange between the reader and character can provide a logical and meaningful consequence to the reader's action, while taking an internal-ontological role.

While *affective affordances* in the previous section gave ways to feel, impact, and express affective states, *semantic affordances* describe how different meanings of actions and objects can be leveraged to provide meaningful exchanges between the reader and character.

From my synthesis, I arrived at two concepts that I termed as semantic affordances: semantics of actions and semantics of objects. Actions performed in different ways carry different sentiments (like jabbing vs. stroking someone) that can be performed to convey different meanings to characters. Objects too can have meanings as they carry histories and a sense of belonging. Such meaningful objects can be used to get into character and can be exchanged with other characters to show different sentiments.

9.2.1. Semantics of Actions

Actions performed in different ways hold different meanings which can be leveraged to convey different sentiments to characters. For example, lightly touching someone differs from jabbing them. As described in chapter 2, Laban Movement Analysis describes effort actions such as punch (sudden, heavy, direct),and stroke (sustained, light, indirect), among others, giving insight into how differently performed actions carry different meanings (Fagerberg et al., 2003; Schiphorst, 2009b). (Schiphorst, 2009b) applied Laban Movement Analysis (LMA) to tactile qualities that could be represented computationally. For example, tapping is a soft, short, small touch whereas jabbing is a hard, short, small touch. These theories can be used for performing such distinct actions. For example, (Harley et al., 2017) described how stroking the squirrel calmed it down. In GWO softly rubbing one's belly elicited a grateful response from gummy, but

a jab could have hurt gummy. I recommend that these various actions can be performed by the reader to express distinct sentiments, or these actions can be performed by the character they are interacting with. Gummy could also jab the reader back to show his anger, which could be felt by the reader through external modalities.

While taking inspiration from LMA, it is also worth thinking about real-life *social scenarios* during which these actions would be performed, and how one would react to these actions based on the meaning they carry. (Lankoski, 2011) discussed players react to characters in ways similar to how they would react to people, which was also observed in TNFT. Putting this concept into practice, readers could console or encourage a character by patting or hugging them, as they would do in a real-life social scenario. A hug could be augmented through wearables with heat and pressure. The reader could share a glass of wine with the character while hearing their backstory. The character could respond to the reader's actions based on social scenarios as well. For example, Minerva could have gotten angry when the reader / Calliope walked away from her.

9.2.2. Semantics of Objects

Besides performing actions with semantics, I recommend that readers can give objects as gestures to show sentiments. For example, Minerva could have become calmer (and switched to her green dress) if the reader / Calliope offered her flowers, tissues, or a calm drink. The reader could show anger towards a character by tricking them into drinking a disguised bitter drink (imagine being tricked upon!), or by taking away an object offered to the character earlier (give me back those flowers!).

Apart from gestures, objects can also hold sentiments and carry meanings of histories, memories, sense of belonging, and identity. The reader could use and wear objects that belong to the character for getting into the character's role like picking up the cloak and engraved wand in TNFT. In the Reading Glove as well, readers held objects that belonged to the character and felt like the character (K. Tanenbaum et al., 2011).

While the above-mentioned objects are meaningful to the character, I recommend that designers could also include personalized objects meaningful to the reader to bring in the reader's semantic affordances which may elicit sentimental responses. For example, in GWO the

personalized calm drink was not just calming but could have also carried history and nostalgia that could have added to the way they felt. (Vaisutis et al., 2014) identified meaningful objects as objects of comfort and routines like bowls, objects that exhibited status like collector's items, and objects that reminded them of loved ones, among others. Such objects personalized to the reader could be integrated into the narrative to bring in histories and sentiments attached to them. These objects could serve as shared diegetic interfaces between the reader and the character, just like in GWO where the body was a shared diegetic interface, increasing the reader's personal stakes and creating room for negotiations between the reader and character. For example, an old blanket or a collector's item could be negotiated between the reader and character, creating conflicts when misused by the character, and creating resolution when cared for by the character (more in section 10.2.2).

9.2.3. Guiding Questions and Summary

Here are some guiding questions for designers using semantic affordances:

- *What sentiment does the reader/character want to express? Which actions can best express those sentiments? How would they be expressed in familiar social scenarios?*
- *What meaning does the object carry for the reader/character? What values/sentiments does it hold in the story? Who does the object belong to? How can it be negotiated between the reader and the character as a shared diegetic interface?*

Table 23: Semantic affordances

Semantic affordances: Actions and objects have semantic (meanings, histories) values attached to them that can help readers express their sentiments in the story	
Concept	**Design Guideline**
Semantics of actions: Actions performed in different ways hold different sentiments (LMA). When a reader *jabs* a character, it means something different than if they *pat* them.	● Use actions with different sentimental meanings to impact other characters. Ex: jabbing to punish, petting to console. ● Leverage familiar social scenarios to express sentiments (console, concern, encourage, anger, apologize). Ex: Minerva gets angry when the reader walks away ● Give or take away objects to express. Ex: give a calm drink to console, a bitter drink to trick, or take away objects to show anger

Semantics of Objects: Objects can express sentiments as they carry histories, a sense of belonging, identity. They may belong to the reader or character.	● Use and wear objects that belong to the character to roleplay as objects can reflect histories and identity. Ex: picking up Calliope's wand engraved with her name ● Have readers bring objects with personal meaning into the story. Ex: a drink they consider calming, a collector's item. ● Increase stakes by using personalized objects that belong to the reader as shared diegetic interfaces that must be negotiated between the reader and character.

9.3. Sensorily Perceived and Physically Performed Affordances

I define *sensorily perceived and physically performed affordances* as aspects of an action that focus on how an action feels sensorily, and how the action is performed physically, which can again be leveraged to provide logically convincing consequences in the narrative based on the action's sensory, physical, and spatial impact. For example, in GWO, eating oily food made Gummy slip on the oil. This example uses the *sensory perceived affordance* of food, that is 'oily', to impact the character. *sensorily perceived and physically performed affordances* can also help readers feel actions viscerally and experience their 'lived' body (Mueller, Byrne, et al., 2018).

sensorily perceived and physically performed affordances are different from *affective* and *semantic affordances* as rather than focusing on the affective response and sentiments of the action, they focus on how the action feels sensorily, how the action is performed, what physical impact the action causes, and how to impact the narrative accordingly.

While I recommend that the action and the affordance should be acknowledged by the narrative and characters, it is especially important to acknowledge the action and how it feels while using *sensory perceived and physically performed affordances*. This is because perception is directed (Svanæs, 2013) and the sensory feeling can be easily ignored if not called attention to.

Based on my synthesis work, I describe the use of this affordance through – sensory perceptions, physically performative actions, and a combination of the above. *Sensory perceptions* refer to the localized sensations, external augmentations, and visceral reactions that actions can have, and how they can be leveraged to impact the narrative. *Physically performative actions* refer to performative actions that have a physical and spatial impact on the diegetic interfaces. These concepts can leverage how an action feels, how it is performed, and what it physically does, to impact the narrative.

9.3.1. Sensory Perceptions

(Mueller, Byrne, et al., 2018) cite (Slatman, 2016) and define perception as sensory input felt outside the body (ambience, tangibles) or on/inside the body (called localized sensations). They elaborate that localized sensations mainly occur through touch, pain, proprioception, kinesthetic sensation, and temperature perception. I recommend that designers can use various actions with different localized sensations, to impact the narrative in different ways by calling the reader's attention to them. For example, in the GWO the texture of the food - oil, was acknowledged by Gummy, and impacted the story by making the stomach walls slippery that caused Gummy to fall. Similarly, different temperatures, textures (sticky, slimy, juicy) could have impacted the reader's narrative body or the character. For example, Gummy could have felt warm/cold when the reader drank something hot/cold (more in Chapter 8). Moving beyond food, when the reader performed belly rubs in GWO, they touched their belly (sensorily perceived), which led to gummy being touched/massaged as well (story impact). Sensorily perceived affordances can be seen in (Harley et al., 2021)'s work as well. The players (as wizards) interacted with a worktable which was a metaphor for the story world. As they moved their hands across the surface of the worktable rigorously, they felt the wind on their hands (sensorily perceived), which led to creating wind in the story world (story impact). Similarly, by shaking a jug of water, the sloshing sounds (sensorily perceived) produced large splashing sounds in the story world (impact). In all these examples, the sensory impact of the action is leveraged to provide a logical consequence in the narrative, while also allowing readers to feel the impact of their actions sensorily. These examples also move beyond using sensory information to just mimic the story world's environment.

Sensory perception is not just internal to the body but can also be created through external body augmentations in the form of vibrations, heat, pressure, change in vision, among others. These external sensations may not be a way to perform an action, but rather a way to represent the consequence of an action. Nevertheless, I recommend leveraging external sensations for helping readers feel the impact of an action performed on them. For example, previous iterations of GWO had a belt that would vibrate (sensory impact) in a pattern indicating how Gummy moved through the body based on what the reader consumed (action on the reader). In TNFT, readers as Calliope could have put on a wearable cloak that would create an uncomfortable experience by vibrating or increasing pressure (sensory impact) if Minerva cast a

spell back on the reader (action on the reader) to show retaliation. Calliope's vision could have a tinge of the affective color (sensory impact) while casting the affective spell, indicating that the spell has impacted her affective response (action on the reader). This idea of external body augmentations has been used in existing works as well to create both comfortable and uncomfortable experiences. (Alam et al., 2013) created a haptic jacket that simulated actions such as touch, poke, hug, tickle through vibrations on different parts of the body. (Lopes et al., 2015) actuated human muscles to repel so that when the human hand approached the object, it looked as if the object did not want to be touched. This idea of repelling could be applied to Gummy and Minerva to show their dissatisfaction with the reader. Leveraging external sensations in these ways creates a dialogue of actions between the reader and character, where readers can feel the impact of the character's actions on them.

Lastly, designers do not always have to rely on these external modalities. Sensory perception can also be internal and visceral as seen in GWO, where the visceral reactions may be caused by what happens in the narrative alone (Gummy slithering in the heart).

9.3.2. Physically Performed

Physically performative actions are pleasurable and can engage the lived body (Bizzocchi et al., 2011; Mueller, Byrne, et al., 2018). Besides sensory perception, I recommend leveraging the physical consequence of an action to impact the story. Here, designers would call attention to the performative action and how it physically impacts the diegetic interface, rather than how the action is sensorily perceived. For example, in GWO the performative action of rubbing one's belly led to the physical consequence of almost kneading the belly and hence helping Gummy move forward. The act of chewing Gummy led to the physical consequence of breaking or changing the form of Gummy, which was narratively described by Gummy shouting and getting hurt. In a similar way, deep breaths (performed action) that lead to chest expansion (physical consequence) could have given Gummy more space in the lungs. In UTO holding the rope tightly (performed action) led to saving the character hanging from the rope (physical consequence).

I also recommend leveraging how actions change the spatial dimensions of the diegetic interface - like putting something inside the diegetic interface or taking the diegetic interface from one place to another (Echeverri & Wei, 2021). In GWO, readers had to put food inside their bodies,

consequentially giving food to Gummy. In (Harley et al., 2021) a song was localized in an orb and the song could be taken from one zone to the other by picking up and placing the orb. However, one of their examples does not integrate physical performances well. The authors talk about kneeling to enter a different space but do not answer – why does the player have to kneel to enter a different space? Similarly, in (Harley et al., 2017) why does tapping different faces of the cube play the forest song? In these examples, the physical impact of the performance does not lead to a logically convincing impact in the story.

9.3.3. Tight Coupling Between Sensorily Perceived and Physically Performed

The physically performed and sensorily perceived aspects can be tightly coupled and used together as well. In GWO belly rubs led to touching gummy being touched and acknowledging the warmth, while also moving forward in his journey. Here, the performative action of belly rubs led to the physical consequence of moving Gummy forward and the sensorily perceived impact of Gummy being touched and feeling the warmth. In (Harley et al., 2021) the players moved their hands (performed action) across the surface of the worktable, felt the wind on their hands (sensorily perceived), and created wind in the story world (physical impact on air). In the other example, players shook a jug with water, created sloshing sounds (sensorily perceived), and poured water out on the worktable, leading to splashing sounds (sensory impact) and an effect of water surrounding the entire narrative world (the physical consequence of pouring water).

These examples engage readers in the physical and sensorial aspects of their actions, while logically impacting the narrative, and encouraging readers to feel the impact of their actions. However, in GWO's belly rub example, the warmth was just an acknowledgement, and did not really impact Gummy's journey, which led to readers questioning how the warmth was helpful to Gummy. This example illustrates the importance of integrating logically convincing consequences of actions.

9.3.4. Guiding Questions and Summary

Here are guiding questions that designers can think of while using this affordance:

- *How does the action feel sensorily? What meaning does the sensation carry in the story?*

- *How can actions that sensorily feel different cause different consequences in the story?*
- *How can external modalities help the reader feel the impact of an action performed on them?*
- *What is the physical and spatial impact of the performed action on the diegetic interface? How would the action and its physical consequence impact the story world?*

Table 24: Sensorily perceived and physically performed affordances

Sensorily perceived and physically performed affordances – Actions and objects can feel different sensorily and be performed in various ways. This can help readers feel the sensory and physical impact of their actions. Acknowledge the sensorial and physical impact of action and impact narrative accordingly.	
Concept	**Design Guideline**
Sensory perceptions: Actions can have a sensorial impact - touch, pain, proprioception, kinesthetic, temperature, external modalities	● Use different localized sensations of performed actions to cause different impacts in the narrative Ex: oily food caused Gummy to slip. ● Create external body augmentations (vibrations, heat, pressure) to help the reader feel the impact of an action performed on the reader. Ex: Gummy moving inside the body represented through vibrations ● Use visceral reactions to feel the impact of an action performed on the reader. Ex: Gummy moving in the heart
Physically performative actions: Actions can have a physical or spatial impact on the diegetic interface (DI)	● Leverage the physical impact on the DI caused by the performed action to impact the story. Ex: chewing hurts Gummy ● Use the change in the spatial structure of the DI caused by the action to impact the story. Ex: putting food *inside* the body, *carrying* sounds in objects to another place
Tightly couple the sensorily perceived and physically performed: Use both above	● Use the sensory and physical/spatial impact of the performed action together to impact the narrative Ex: sloshing sounds (sensory) and pouring out water (performed action) from jug leads to splashing sounds and water effects (physical impact) in the narrative world.

9.4. Final Thoughts on Affordances

Besides the above *affordances*, the functionalities of objects and the body can also impact the narrative. For example, in GWO functionality of food was used to impact the body like the white blood cells weakening upon eating junk food. In (Harley et al., 2019) the functionality of messaging is used as a part of the narrative world to send messages to the reader.

One action may have many different *affordances*. For example, belly rubs led to touch and gummy moving further (perceived, performed), petting Gummy (semantic), and was relaxing for

some, also helping Gummy relax (affective). With actions that have multiple *affordances*, I recommend leveraging the *affordance* that best serves the story scenario and logically answers 'why does this action lead to this consequence'. For example, taking deep breaths to help Gummy relax during a panic attack scene uses the *affective affordance* of deep breaths, whereas taking deep breaths to give Gummy more space in the chest leverages the *physically performed affordance* of the action. In both cases, different *affordances* justify the narrative consequence of the action. How would the designer call the reader's attention to the *affordance* that best serves the story scenario? By acknowledging it in the story and using the intended *affordance* to have a meaningful impact. Acknowledging various affordances can also make the reader feel differently about the action. Designers can also use multiple affordances together by acknowledging and defining the narrative impact for each affordance.

It may not always be possible to use one of the affordances listed above as stories are not always grounded in reality and they often rely on suspension of disbelief. In such cases, we can use, what I call, 'story-based justifications.' For example, in SR the action of creating Rangolis to express affect was justified by the story. Some story-based justifications can be highly contextualized in familiar narratives, like rubbing a bottle to release a genie. Other designs may have a different research focus such as engaging with a different culture (SR).

The idea of affordances is not to drop story-based justifications completely but to use affordances to increase realism and buy-in wherever possible. Since diegetic elements exist in the reader's reality and the story world, the reader cannot be expected to buy into every fictional rule of the story world (like eating healthy food to give Gummy a boat). I recommend rooting some aspects of the experience in the reader's reality as well, and even more so when the story world is closely situated in the reader's reality like in GWO. Affordances provide that hook to reality through logically reasonable consequences to actions. While *affordances* can add realism and reason from the reader's reality, they are not in competition with the fictional and magical elements of the story world. For example, in GWO, eating oily food made Gummy slip, which leveraged the sensory affordance of food and gave a reasonable argument for readers to believe why their action impacted Gummy this way. However, in reality, Gummy wasn't really sentient, and nor was he actually slipping. So even with the use of *affordances*, there are magical elements from the story world that exist in the diegetic interactive narrative experience. Using *affordances* does not strip the narrative experience from fiction, it just becomes easier to

justify why the reader's action causes a particular consequence in the story, so the reader is not left questioning the logic or breaking out of the narrative experience.

9.5. Attributes

I define *Attributes* as levers that shape how an action is experienced. They provide more ways of representing actions and consequences that can lead to more buy in, add more stakes, and make readers feel their actions more. For example, thinking about how long an action takes to be completed, or how many times it should be repeated to be believable is termed as an *attribute*. GWO's deep breath interaction explains this particular attribute further. Asking the reader to just take one deep breath to feel calm may not have been as believable as asking the reader to take multiple deep breaths to feel calm.

From the synthesis of my three projects and the literature review, I identified the following attributes – risks (stakes that actions and consequences provide), length and repetitions (duration of performance of action, repetitions of action), range and crafting, the familiarity of action, coupling between the site of action and site of consequence, and perceived agency of consequence. These attributes act as levers to increase stakes, feel more, and add more buy in. This section defines these attributes, and I describe them in use in chapters 10 and 11.

9.5.1. Risks

This attribute can help designers think of the risks and stakes an action can offer, ask – *is the action reversible? Can the reader opt-out of the action once begun?* Actions that are irreversible and do not offer opting out may seem like they have higher risks to them irrespective of the consequence. For example, the act of eating (irreversible) in GWO seemed riskier as it could not be undone, whereas assembling Rangolis in SR was reversible or could at least be changed until the story stated. The irreversible action in GWO may have given the feeling that every action is a point of no return, raising the stakes.

The consequence too can also have high or low stakes – high stakes put characters in dire situations and low stakes are low-pressure environments that may even have inconsequential actions (Nay & Zagal, 2017) (more in section 11.1.3). A combination of reversibility, ability to opt-out, and stakes of consequence together can decide the risk.

Another concept to think of while assessing risks is the intentionality behind the action. *Is the action intentional/deliberate or is it unintentional?* Unintentional actions can lead to undesirable outcomes that can raise the stakes in the narrative, that may feel like a high-pressure situation (more in section 10.3), more so than an intentional action. For example, when readers ate junk food early on in GWO, the acid levels rose that led to an intense situation. Because they did not know how junk food would impact Gummy, they may have felt the acid attack scene was a point of high stakes (as reported in chapter 7). However later, they understood what junk food did, their choices were intentional, and they expected a negative consequence to their action. This concept can be linked to implicit vs explicit choices by (Harley et al., 2016) where explicit means one would know the consequence before taking the action, whereas in implicit they would not.

9.5.2. Length of Action and Repetitions

This attribute can help designers think of the pace or duration in which an action is completed - *how long it takes to complete the action and have an impact, what happens (impact) the longer the action is performed?* This concept can be connected to the dimension of time in LMA to describe differences in actions like punching (sudden) and stroking (sustained).

Slow-paced actions can build tension and slowly reveal the impact. For example, in UTO and BTJ holding the rope for a longer duration and holding one's breath in the back of a truck for more than a moment, built tension. In GWO chewing gummy for a while felt as if one was hurting him slowly. Slow-placed actions may also allow readers to feel an affective state more. For example: drinking a calm drink or taking deep breaths repeatedly over a longer time period may help readers feel calmer as compared to completing these actions quickly.

On the other hand, some actions may be completed almost immediately, which may be useful for providing immediate feedback to an action. Some examples are – changing ambient effects in SR, casting spells to change Minerva's affective response and dress in TNFT, feeling external vibrations due to their own or the other character's action.

GWO showed how representing an action that has a slow impact (eating and impacting the body) in an almost immediate way can lead to readers questioning the believability of the action and consequence. The same applies to representing an action with an immediate impact in a

slower way. If the action and consequence are represented at the correct pace, readers may buy into them more easily.

Another *attribute* that can be used in conjunction with pace/duration is 'repetitions'. *How many times does one repeat an action over the duration of the experience*? If the action is performed more than once over the duration of the narrative experience, like seeing one's reflection in a pocket mirror multiple times (TNFT), it may help hammer in and communicate a concept (like tethers) to the readers.

9.5.3. Range and Crafting

This attribute can help designers think of whether the action can be performed at various intensities. *Can readers perform the action at varying intensities? How would these intensities impact the story?* For example, in UTO the tightness of the rope impacted the fate of the character, faster hand movement in (Harley et al., 2021) created stronger winds. This could be applied to existing work as well – loudness of chewing or intensity of sweetness in GWO, the rigor of rubbing in *genieBottles* (Mazalek et al., 2001), among others. There are also one-and-done acts like tapping a spell with a wand, that do not take intensity into account, but the former can provide a range of impacts to an action.

Instead of just selecting a component of the interface, readers may be allowed to mix and craft different components as well. In SR, readers used a mix of rings to represent a mix of affective states. Even though there was no impact on the story, the ambience effect made it feel like there was a combination of affective states represented. Various diegetic objects together can lead to a combination of impacts – mixing and drinking different potions in TNFT to express a mix of affective states or blending different drinks in Gummy (hot and sticky) to impact the body and Gummy in different ways. *Can the reader mix different components of the interface? How would that impact the story?*

9.5.4. Familiarity

This attribute can help designers think of how familiar readers are with the action. *Is the action familiar and understood from lived experience or is it performative/abstract / out of context*? (Höök, 2009) used the term 'familiar expressions' for bodily social practices and (Svanæs, 2013)

described abstract movement as actions made outside the normal context of bodily movements. Examples of familiar actions would be using *semantic affordances* to impact the character (like patting one's back to encourage them), whereas examples of abstract actions would be belly rubs or doing strange performances in front of the mirror. Familiar actions can make consequences easier to predict whereas abstract actions may act as *body tethers*. For example, comparing the above two cases, the reader may be able to predict how the character would react to the familiar action of patting their back, whereas abstract actions like belly rubs may help bring the reader's focus to their diegetic body.

9.5.5. Coupling

This attribute can help designers think of the site of the action and consequence. *Are the action and consequence happening at the same (tight coupling) or different (loose coupling) sites?* (Echeverri & Wei, 2021) call tight coupling full embodiment – when action and consequence happen at the same site. Tight coupling may require less cognitive effort to map the action to the consequence and maybe felt sensorily on the body. Here are some examples of tight coupling (on self): taking deep breaths to feel calm, belly rubs to touch Gummy, eating oily food to make the stomach's walls slippery, drinking a potion and seeing a change in vision (TNFT), external vibrations due to own actions or other character's actions on one's body. Examples of tight coupling on another character are: petting a squirrel and feeling the heart rate change (Harley et al., 2017), and throwing/giving spells to Minerva, and seeing her dress change. In all these examples the sites of the action and consequence are the same.

However, tight coupling may not always be possible. Some examples of loose coupling are jumping/waving in Tangible Comics (Samanci et al., 2007), Rangoli changing the ambience, opening portals on the ground through the mobile-AR (Harley et al., 2019). In all these examples the site of the action and consequence are different and are justified by the modality (mobile or big screens), or through the story (SR).

The wrong kind of coupling may lead to confusion, pulling people out of the experience. In TNFT, the reader cast a spell by tapping the wand to a spell in front of them, but the impact was on Minerva and Calliope, which led readers confused about who the spells were impacting. Giving Minerva the spells (tight coupling on Minerva) or drinking potions to cast spells (tight coupling

on Calliope) could have been easier to understand as they use the embodied metaphor of something going 'inside' or being 'given to' the character (Bakker et al., 2012).

9.5.6. Perceived Agency

This attribute can help designers think of the reader's mental model of the perceived agency of the narrative consequence. *Does the reader have agency over what they are impacting in real life?* If not, then the impact could be justified through the story, or the interaction may be less believable. For example, in SR, readers could impact the ambience of the world which had to be justified through God-like superpowers. Some examples where readers may feel they should have agency over the consequences are - impacting one's own affective state (TNFT), and impacting the other character's affective state through *semantic* actions like petting a squirrel to calm it down.

Readers may also have less agency over the impact which may lead to a feeling of helplessness (Harrell & Zhu, 2009). An example of less agency was seen in GWO where readers felt they did not have agency over their internal body in real life, and hence felt helpless in the story. Designers could also use the 'Range' attribute here, where the reader would have to perform the action with more intensity to have even the slightest impact.

If the perceived agency (less or full) of a consequence does not match the rules of real life, then more suspension of disbelief may be required. For example, in TNFT some participants felt they did not have agency over Calliope's emotions which felt less believable to them.

9.5.7. Guiding Questions and summary

Table 25: Attributes

Attribute and Guiding Questions	Design Guidelines
Risks: Stakes defined by action ● Is the action reversible? ● Is the action intentional/deliberate or is it unintentional?	● Use Irreversible actions for higher risks/stakes. Ex: chewing Gummy ● Give the ability to opt-out for lower risks/stakes. ● Use unintentional actions with negative consequences for higher risks/stakes. Ex: eating junk food and hurting Gummy without knowing how junk food would impact Gummy.

Length of Action and Repetitions: duration and frequency of an action ● How long does it take to complete the action and have an impact? How many times does one have to repeat an action to complete it? what happens (impact) the longer the action is performed? ● How many times is the action performed over the narrative experience?	● Use slower-paced actions to build tension, slowly reveal the impact, or feel affect. Ex: sipping tea slowly and multiple times to feel calm, rather than sipping it just once ● Repeat actions to feel the impact of action more, hammer in the message. Ex: seeing one's reflection in the mirror multiple times to hammer in how the reader looks in the narrative world
Range and Crafting: crafting an action by manipulating the interface in different ways ● Can readers perform the action at varying intensities? How would these intensities impact the story? ● Can the reader mix different components of the interface? How would that impact the story?	● Perform actions at varying intensities for varying impacts on the story. Ex: tightness of rope in UTO defined if character survived ● Mix different components of the interface to represent a 'mix' of actions. Ex: crafting a mix of emotions through different colored Rangolis and ambient effects.
Familiarity: familiar actions ● Is the action familiar and understood from lived experience? ● is the action performative / abstract / out of context?	● Use the reader's existing knowledge for familiar actions so they can predict the intended consequence. Ex: patting someone's back to encourage them or empathize with them ● Use Abstract actions that are not familiar to the reader for performative actions and *body tethers*. Ex: belly rubs
Coupling between action and consequence ● Are the action and consequence happening at the same site (tight coupling) or different (loose coupling) sites?	● Use tightly coupled actions to feel sensorily and take less time to decipher. Ex: stroking squirrel to lower its heart rate ● Justify loosely coupled actions through story. Ex: creating a Rangoli (tangible interface) to impact the ambience of the story world (ambient effects)
Perceived Agency ● Does the reader have agency over what they are impacting in real life? ● How much agency does the reader have? (Less or full agency)	● Justify consequences that the reader does not have agency over in real life through the story. Ex: Ability to impact Minerva's emotions was justified through spells ● Use actions with limited perceived agency for readers to feel helpless (repeat). Ex: trying to help Gummy by impacting one's blood over which they do not feel much agency over

9.6. Example of Affordance and Attributes in Use – Body Tethers

I describe how *affordances and attributes* are used together for the design guideline called *body tethers* which were introduced in Chapter 8. Body tethers are interactions with the body that remind readers that their body is a part of the story world. Designers can acknowledge how the action feels *sensorily* and impacts the reader's body *physically* (sensorily perceived and physically performed) leading to a narrative impact (belly rubs examples). Use *abstract* (*familiarity*) and performative actions that one would not take in normal contexts to bring focus to the body (deep breaths). Use the *intensity* (*range and crafting*) of the performed action like the rigor of rubbing one's belly to call attention to the body. Seeing one's body in the mirror gives readers a visual tether, giving them a physical presence in the story and changing their identity visually. *Performative actions* like waving one's hands around can make this visual tether stronger. I recommend *tight coupling* of the action and consequence on the body, in a place where the impact of the action can be felt (mouth, stomach, Calliope's vision tinge). This can help readers feel the action viscerally. *Repeat* these actions throughout the narrative for constant tethering. Position the body as a *shared diegetic interface (semantic affordance)* between the reader and the character to raise personal stakes and to bring focus to the body (Gummy moving towards the heart caused a visceral reaction).

9.7. Summary

In this chapter, I described design guidelines to leverage *affordances* and *attributes* while designing for internal-ontological roles such that readers buy into why their actions lead to particular consequences and feel the impact of their actions (RQ1).

If the consequence of one's diegetic actions are not logically convincing, people might question why their actions cause a particular impact in the narrative, possibly breaking them out of the experience. On the other hand, I argue that leveraging *affordances* and *attributes* can provide logically convincing consequences, reduce the possibility of readers questioning the logic between the action-consequence and breaking out of the experiences, and can even help readers feel the impact of the action sensorily and emotionally as a part of the story world, providing lived experiences.

Calling out the action and the affordance in the narrative, and having a subsequent impact on the action can help readers feel like they have stakes in the story world as well as direct their attention to how the affordance feels.

I introduced three kinds of *affordances*. *Affective affordances* refer to aspects of body actions and objects that can help readers feel, impact, and express /enact affective states in the story. They can be leveraged by allowing readers to take bodily actions to express emotions, perform intentional actions that are linked to physiological changes, use objects with metaphorical mappings to affect, and by creating affective ambient effects. *Semantic affordances* refer to the semantic (meanings) values attached to body actions and objects that can help readers express their sentiments in the story. Actions like jabbing and patting, leveraging social scenarios like walking away from a character to show anger, using meaningful objects to take a character's role or to negotiate with a character, are a few techniques that illustrate how to design for using semantic affordances. *Sensorily perceived and physically performed affordances* are aspects of an action that focus on how an action feels sensorily, how the action is performed physically, and the action's sensory, physical, and spatial impact. A few techniques to apply this affordance are – designing for localized sensations, external body augmentations, and the physical - spatial impact a performative action has on the diegetic interface.

I term *attributes* as levers that shape how an action is experienced. They provide more ways of representing actions and consequences that can lead to more buy in, add more stakes, and make readers feel their actions more. I identified the following attributes – risks (stakes that actions and consequences provide), length and repetitions (duration of performance of action, repetitions of action), range and crafting (intensity of action, ability to mix several actions together), familiarity of action, coupling between the site of action and site of consequence, and perceived agency of consequence.

In summary, while thinking of actions and consequences in interactive narratives, designers can ask: *What will the reader impact in the narrative such that they feel they have stakes? What kind of actions can the reader take to impact that component?*

Why does this action cause this consequence? What affordances and attributes may help answer the above question in a logically convincing way? How might the affordances and attributes help readers feel the impact of their actions in an affective or sensorial way?

Chapter 10. Design Guidelines – Character Engagement

In this chapter, I give design guidelines to answer my second RQ2: How can diegetic elements support aspects of character engagement (CE) such as - understand and adopt character goals and motives, feel for the character and root for them, feel what the character feels affectively, or/and take the character's identity, when readers interact with another character or take a character's role?

Often while consuming a story, one may relate to the characters, understand what they are going through, and maybe even lose one's sense of self. This phenomenon is called character engagement (or character identification) (Cohen, 2001; Green & Jenkins, 2014; Smith, 1995). CE can broaden the reader's perspective as the reader understands the world from a different point of view, lead to increased enjoyment, understand events in light of one's own life, and facilitate intense emotional responses. CE is important to study not just because of the numerous possible benefits listed above, but also because it increases our pleasure of experiencing and connecting with a narrative, driving the art of storytelling further.

Existing diegetic narratives have edged around topics of character engagement like feeling the protagonist's heart rate in an attempt to identify with the character's fear (UTO), holding one's breath to feel anxiety like the character would feel and possibly developing empathy (BTJ), or using meaningful objects the character once used to feel connected to the character (Dagan, 2018; K. Tanenbaum et al., 2011). However, there is still a dearth of recommendations on how to design for CE leveraging diegetic elements.

Diegetic elements have the potential to facilitate CE as they bring the reader closer to the character's world in a tangible way. For example, in Harley's work, readers could actually hold the squirrel and feel it respond to their actions, which would not have been possible digitally. Diegetic meaningful objects (like in the Reading Glove) that belong to characters may help readers take a role. Readers may also engage with characters by taking actions that leverage *semantic affordances*. They may be able to feel more *affectively* and understand what the character is going through if *affective and semantic* affordances are leveraged (holding one's breath in BTJ). When supporting ontological roles, diegetic narratives can make readers feel responsible for their actions (GW, SR), and feel for the character (GWO, TNFT). Given that

diegetic elements can bring readers closer to the story world and feel more affectively, it is worth exploring how they may support CE.

While the last chapter described how to provide logically convincing consequences to diegetic actions, and how to design such that readers may feel the impact of their actions, this chapter describes how diegetic elements can support CE and how *affordances and attributes* can be applied for increasing CE as well. As explained in chapter 2, the aspects of CE that I focus on are:

- Understand character's goals, motives, knowledge, actions (alliance (Smith, 1995))
- Align and adopt character goals, root for them, feel for their success/failures, feel for the character (allegiance – both cognitive and empathetic components (Smith, 1995))
    - Note: Although Smith does not write about 'adopting' goals as it does not make sense while viewing a film, goal adoption is relevant in interactive narratives
- Feel what the character feels affectively (empathy (Smith, 1995), affective empathy (Levenson & Ruef, 1992), bleed from transformation (T. J. Tanenbaum, 2015))
- Take the character's identity when the reader plays the character's role (transformation, surrender identity and adopt other's (Tal-Or & Cohen, 2010), (T. J. Tanenbaum, 2015), (J. H. Murray, 2016))

Based on the synthesis of my work and insights from the literature review, in this chapter, I describe design guidelines that explain how endowing readers with responsibility can give them goals and stakes in the narrative, ways in which adopting character goals through shared interests can build allegiance, how creating and resolving conflicts with characters can help build trust, how navigating high-stakes scenes to help the character can build allegiance and also cause readers to *react*, and ways in which readers can wear a *mask* to take a role by interacting with the character's objects, changing their visual identity, and taking actions that the character would take. I explore CE through both a first-person perspective (when the reader takes a character's role), and through a second-person perspective (when the reader interacts with another character).

10.1. Endow with Responsibility and Impact Narrative

If readers are endowed with some responsibility in the narrative, they may have a clear goal, take *desired* actions, take on a role, and may be motivated to contribute to the story and help

the characters. One way to endow the reader with responsibility, is by allowing them to impact the narrative, giving them stakes in the story world. Both these concepts are important for building CE as they give readers goals and motivations. In this section I cover what readers can be endowed with while taking a role (first-person perspective) or interacting with another character (second-person perspective), and how they can feel responsible if they can impact the narrative such that they have stakes.

10.1.1. Endow Readers with Responsibility

I recommend endowing readers with the character's responsibilities, their actions, emotions (SR,TNFT), and what the character cares for so they can take the character's role. Taking a character's role can help readers understand the world from the character's perspective, and possibly even feel what the character feels (SR). These roles could be designed to show readers various perspectives from marginalized characters (egg in Tangible comics, refugee in BTJ) to powerful fictional characters (SR), giving a view of worldly challenges. (Pratte et al., 2021) term this as a *first-person perspective* for developing empathy. However, these *first-person perspective* roles can lead to readers thinking 'what would I do in this situation' rather than thinking from the character's point of view (Pratte et al., 2021).

Designers can also endow readers with the responsibility of a second character's (Gummy, Minerva) physical or mental well-being. Such situations open the possibility for readers to understand the character's situation and feel for the character. This responsibility can give the reader a *second-person perspective* of the situation that can allow them to question their own beliefs and attitudes (Pratte et al., 2021). Readers may be given a 'facilitator' role which means they cannot directly impact the other character but can help them indirectly as seen with Gummy and Minerva. Readers could only help Gummy by impacting their body, they could not affect him directly. Similarly, readers could cast spells on Minerva to bring out her perspective on the situation but could not change her decision. Such facilitator roles can put readers in more sympathetic roles, rather than 'God-like/puppet master' roles, making more space for character engagement. With second-person perspectives, in general, it can be effective to build the reader's relationship with the character early on for them to care about the character and take on the responsibility. For example, in GWO readers had to chew Gummy which made them feel guilty for putting him in a bad situation through an unintentional action. This guilt set them up

for the story experience as they felt they had to help Gummy escape the situation, pledging their allegiance to him. Familiar pre-defined relationships can also help. For example, in TNFT readers entered as Minerva's sister and felt compelled to help her emotionally as her sibling.

10.1.2. Allow Readers to Impact the Narrative

One way to give readers responsibility is by allowing them to impact the story world such that they have stakes, whether it be their own actions, emotions, or the wellbeing of another character. If readers can impact the story and have stakes in the narrative, they may feel responsible, feel sympathy, and be more invested in what happens to the characters.

With this, we come back to the concept using *affordances* and *attributes* that help design logically convincing consequences to actions. Acknowledging the action, the affordance, and having a logical consequence can help readers buy into why their actions have the intended impact. Having contrasting consequences to different actions can help readers feel like they have different choices and that those choices matter - like positive and negative affective responses of a character by taking affectively performative actions.

The *attribute - perceived agency* can be used to provide limited or less agency to the reader. (Harrell & Zhu, 2009) elaborated how limited agency could convey a sense of confinement or helplessness, feeling the frustrations of the character (Pratte et al., 2021). For example, in GWO readers reported feeling as helpless as Gummy when he was lost in their bloodstream as blood is not something they felt they had agency over. The *range attribute* can be used in combination with limited agency as well, defining the ability of the reader to impact the story world. The reader may have to perform the action at full intensity, only to have a minimal impact on the story world, feeding into the feeling of helplessness and limited agency. For example, imagine Calliope trying to calm Minerva down using different affective affordances, only to see the slightest tinge of green (calm). The reader may also have full control rather than limited agency and have the ability to decide at what intensity they want to impact the story world (using angry-red rings in SR), which can lead to richer performances.

What could readers impact in the story world such that they have stakes? I have given examples from my own work -emotions and actions of their character, or physical and emotional wellbeing of another character. I have not given examples from literature, mostly since other

works provide snippets of stories rather than full narrative experiences. While I refrain from giving more specific examples as it is outside the scope of this dissertation, I reiterate that 'impact' does not have to be plot-centric. Interactive plot-centric models put the onus on authors to create multiple branching narratives and give readers the anxiety of the path not taken. More than the outcome, receiving a satisfying response to one's action (K. Tanenbaum & Tanenbaum, 2010), knowing the intent behind the action (Harrell & Zhu, 2009), and how the reader feels about the consequence is important (Nay & Zagal, 2017). Rather than what outcome to choose, readers can be given the choice of how an outcome plays out (Nay & Zagal, 2017; T. J. Tanenbaum, 2015). For example, Minerva would always choose not to marry Arthur but the way she arrived at that decision depended on the reader's actions, which gave them stakes and responsibility for Minerva's well-being. Such choices can shift the reader's focus to roleplaying and character engagement rather than worrying about the path not taken.

10.1.3. Guiding Questions and Summary

- *What is the reader endowed with in the narrative? What are they responsible for?*
- *Are they responsible for another character's well-being? Why would they care about this character?*
- *What can readers impact in the story world? Does this give them enough stake in the story to make them feel responsible?*

Table 26: Endow with responsibility and impact narrative

Endow with responsibility and impact narrative: Give readers responsibility and stakes in the story so they have a goal, take desired actions, contribute to the story	
Concept	**Design Guideline**
First-person perspective: readers take a character's role and are responsible for them	● Endow with character's responsibility, their emotions, actions, care for what character cares for. Ex: caring for the state of the world in SR, as Shiva. ● Design roles to show various perspectives – marginalized (BTJ - refugee) or powerful (SR - God)

Second-person perspective: readers are responsible for a second character	● Endow with other character's physical or mental well-being. Ex: taking care of Gummy or Minerva ● Allow readers to facilitate or help the character rather than directly impacting them in a God-like / puppet master way. Ex: Gummy could only be helped/hurt by impacting the body ● Build relationships early on so readers care about helping the character. Ex: readers were guilted into helping Gummy after they chewed him
Impact story: readers should be able to impact the story, so they have stakes and feel responsible	● Acknowledge the action and *affordance* used so readers experience a logically convincing consequence to the action. ● Have contrasting consequences to different actions so readers feel their choices matter. Ex: positive affect spells made Minerva optimistic while negative affect spells made her show her frustration. ● Provide limited perceived agency for readers to feel helpless. Ex: feeling helpless when Gummy was lost in the bloodstream as perceived agency over one's 'blood' is low ● Give readers stakes in the story by giving them the agency to choose *how* an outcome plays out rather than *what* outcome plays out. Ex: Having agency over how Minerva reached her immutable decision of not marrying Arthur

10.2. Adopt and Align with Character Goals and Interests

To achieve character engagement, readers should share the character's knowledge, understand their goals, motivations, actions (alliance), adopt those goals, and root for the character (allegiance) (Green & Jenkins, 2014; Smith, 1995).

Readers may adopt character goals if the goals are clearly communicated and if readers receive reinforcing feedback from the character. Shared diegetic interfaces between the reader and character can add personal stakes and goals for the reader, which when aligned with the character's goals can create allegiance. Creating conflicts by negotiating these shared diegetic interfaces and resolving those conflicts can help build trust and foster allegiance between the reader and character. Moments of affective sync- that is when the reader and the character feel similarly, can help align the reader's and character's interests. Lastly, it is easier to root for characters that are likable. I describe these design guidelines in more detail.

10.2.1. Communicate and Reinforce Character Goals

I recommend communicating character goals early in the narrative – who the readers are, what they need to do, and what they are endowed with, and what are they motivated by. While playing a role, the character's goals and what they are responsible for can be communicated through backstories (section 10.4). While interacting with another character, receiving reinforcing feedback from that character (encourage to keep going/beg to stop) can help readers know the goals of the other character. Characters may guilt, blame, and question their loyalty to deter readers, or express comfort, gratitude, and compliment to encourage them. For example, in GWO, Gummy expressed gratitude when the reader helped their body and Gummy, whereas he guilted the reader when they took actions that hurt their body and Gummy. This feedback from Gummy reinforced that the reader's goal was to help Gummy by helping their bodies. *Semantic affordances* can also deliver reinforcing feedback like the squirrel's heart rate reducing on stroking it.

Communicating and reinforcing goals is an important step, as without understanding the goals, the reader will not have much success in building CE. Once the reader understands the character goals (alliance), the next step for them is to adopt these goals as their own so they can root for the character (allegiance).

10.2.2. Negotiate Shared Diegetic Interfaces

One way to create allegiance is by negotiating shared diegetic interfaces between the reader and the other character they interact with (second-person perspective). The body (GWO), *semantic* objects (personal to the reader like an old blanket), and even shared physical spaces like ambient environments could be shared and negotiated between the reader and characters. This can give readers their own personal goals and stakes in the narrative. These goals could be aligned with the other character's goals to build allegiance. Both readers and characters could work towards similar goals, or benefit/suffer due to the same action. For example, in GWO readers and the Gummy worked towards the shared goal of keeping the body (shared DI) healthy and both suffered when the reader ate unhealthy food. It is important to avoid long-term conflicts in the narrative (like readers viewing their bodies in a negative light as Gummy

was trying to escape them) so that readers like the character. However, creating and resolving short-term conflicts by negotiating shared DIs can be productive for CE.

10.2.3. Create Conflicts and Resolve

Short-term conflicts can bring focus, add variety, and raise the reader's investment as the reader's personal stakes are involved. Characters could create uncomfortable situations through the shared diegetic interface to express displeasure with the reader or to convey naivety. For example, to express anger, Minerva could have cast a spell to cause thunderstorms (shared physical space), or cast a spell on Calliope that could be felt physically by the reader through external modalities (body). Gummy conveyed naivety by going into the reader's heart (shared DI - body), he could have expressed stress as well by accidentally harming the reader's body.

After creating conflicts, if the character works to resolve the dispute, readers may be able to trust the character and not view them negatively. Resolution can help build allegiance by showing the reader the character reciprocates and cares for them as well. This can be done by the character trying to diffuse the situation of conflict. For example, after throwing her angry fit, Minerva could have apologized to Calliope by giving her a family heirloom (use *semantic affordances* to apologize). The character could also reciprocate in kind by showing they care for the reader. For example, Gummy could have helped heal the reader's body if he unintentionally caused harm. Creating this form of reciprocation may make readers feel obliged to return the favor to the character (Roberts et al., 2009). In these ways, characters can express pleasure or displeasure by negotiating shared diegetic interfaces and helping or hurting the reader.

10.2.4. Create Moments of Affective Sync

Affective affordances can be used to create affective sync between the reader and character, that is, where both feel pleasure or displeasure together due to narrative occurrences, and perhaps due to the reader's bodily actions that may produce the intended physiological response. This can create allegiance and align interests as it produces a situation that both the reader and character like or dislike. For example, in GWO drinking the calm drink created a relaxing point for both the reader and the character, where they could share a slow moment together. Whereas the increasing heart rate scene created a point of tension for both, and the

reader was encouraged to act in the interest of the character and for themselves to an extent. However, I recommend designing intention plot points in the story for sync in affect such as – bringing the character from a state of peril to calmness (Gummy in acid attack), comforting the character, or navigating a high-stakes scene. Otherwise, the reader may feel the same as the character, but it may not contribute to character engagement. These intentional plot points allow the reader and character to experience an affective moment together. The affective moment can be strengthened by leveraging affective affordances, so readers not only feel the affective state due to the narrative occurrences, but also perhaps due to their physiological reaction (like taking deep breaths to feel calm). While we may not be able to guarantee if the reader would physiologically feel the intended affective state, by leveraging affective affordances, they will at least logically connect their action to the affective state.

10.2.5. Create Likable Characters

Lastly, likable characters are easier to build allegiance with. If the reader does not like the character, they may act towards shared goals but not root for or feel for the character (as observed in GWO). (Lankoski, 2011) gives an example of this, elaborating that if players liked and had to protect their character, they would feel fear when he was in danger, but if they did not like the character, they may feel frustrated. (Roberts et al., 2009) second this argument by discussing that the more we like someone, the more we want to help them. Likable characters could do good for the reader, reciprocate, express gratitude, compliment the reader, or even act helpless and be dependent on the reader.

10.2.6. Guiding Questions and Summary

- *What are the goals of the character? Who are they, what are they endowed with? How is this information communicated to the reader?*
- *What shared diegetic interfaces (DIs) could be used in the narrative? Who has ownership over the DI? How can the shared DI increase personal stakes and add personal narrative goals for the reader? How would the reader's goals align with the character's?*
- *What conflicts can be created through the shared diegetic interfaces? How would these conflicts be resolved? How would this conflict resolution strengthen the relationship between the reader and the character?*

Table 27: Adopt and align with character goals and interests

Adopt and align with character goals and interests – understand character goals, adopt those goals as own, root for characters, have similar interests/motivations	
Concept	**Design Guideline**
Character goals: who they are, what they are endowed with, their motivations	● Communicate character goals and responsibility through backstories. Ex: looking at old photographs of Minerva and Calliope to understand Calliope's need for helping her sister. ● Receive reinforcing feedback from characters to understand goals. Ex: Gummy encouraged readers when they helped him and guilted them when they hurt him.
Shared diegetic interfaces (DIs) : DIs shared between reader and other character - objects, body, physical space (ambience)	● Add personal stakes and goals for the reader through shared diegetic interfaces (Dis). Align these goals with the other character's goals. Ex: the body was a shared DI between the reader and Gummy that gave readers personal stakes ● Ensure both reader and character work towards similar goals or benefit/suffer together. Ex: helping body helped Gummy
Conflict and resolve – conflicts between the reader and character bring focus and resolutions foster allegiance by building trust	● Create short-term conflicts by negotiating shared diegetic interfaces (Dis) to raise reader's investment. Ex: Gummy slithering through reader's heart where body is the shared DI ● Use shared DIs to create uncomfortable situations for the reader when the other character expresses displeasure. Ex: Minerva casts a thunderstorm when angry at Calliope ● Resolve conflict by diffusing the situation, reciprocating in kind, showing the reader that the character cares for them and the shared DI. Ex: Gummy helps the reader's body if harmed earlier
Affective sync: when reader and character feel pleasure or displeasure together narratively and physiologically	● Use Affective Affordances to create situations that both characters find pleasing/displeasing, so their interests align. Ex: share a calming drink together ● Design intentional plot points for affective sync – bringing the character from peril to calm, comfort character, navigate high-stakes scene together.
Likable characters: characters that can be seen in a positive light	● Create likable characters who reciprocate, express gratitude, compliment, act helpless and may be dependent on the reader.

10.3. Navigate High-Stakes Scenes

High-stakes scenes are points in the story where the situation is dire, perhaps a character's life is in danger. Such points in the story create urgency for the reader to act and feel concerned, responsible, and sympathetic for the character (GWO). They can also build empathy as defined by Smith – where the viewer feels emotionally for the situation the character is in. Some examples of high-stakes scenes are – Gummy burning in acid, getting a panic attack at the heart,

escaping the white blood cells, saving another character hanging at the end of the rope in UTO, avoid being caught in BTJ, and saving or destroying the world in SR.

One way to create high-stakes scenes, is by allowing readers to cause unintentional harm to the character, which can again build sympathy and a sense of responsibility. 'Open choices', that is, providing readers with less backleading on what to do to help the character, can lead readers into taking actions that can cause unintended negative consequences.

Lastly, during high-stakes scenes, readers may feel the pressure to *react*, that is, act without thinking, which may help them take the character's role. I describe these concepts in more detail below.

10.3.1. Allow for Unintentional Harm to Character through Open Choices

High-stakes scenes consist of dire situations, that can be created when readers take actions that cause unintentional harm to the character. This may lead to feelings of concern, responsibility, and sympathy. For example, when readers accidentally hurt Gummy in the WBC scene, they felt guilty and responsible for him. If the reader does not fix the situation, these points in the story can lead to high-stakes scenes. There can be lasting and worsening consequences such as – Gummy burning in acid, losing limbs in the acid (worsening consequence), and referring to his lost limbs later when he is incompetent at a task (lasting consequence). Attributes such *irreversible actions* can make readers feel like the stakes are higher as the action cannot be undone. Slow-paced actions can add tension as well (section 9.5).

One way to create high-stakes scenes is by giving readers *open choices* – this means less backleading for taking the *desired* action, that is, actions that readers are expected to take to stay in role and maintain story coherence. With open choices, readers are free to explore, and they may take actions that unintentionally harm the character. For example, in GWO, when readers were encouraged to try a variety of food items, they ended up hurting Gummy by eating junk food. Open choices may also make readers feel like they are taking a long time to proceed if they do not know what to do. This can make the situation feel direr even if the plot is not. Open choices may make readers feel like they have more narrative agency or are at a crucial decision point (GWO).

10.3.2. Enable Readers to React

High-stakes scenes are a possible place for readers to *react* – act without thinking, which can make readers feel and think like the character (T. J. Tanenbaum, 2015). In SR, readers reported feeling transformed when the world was in danger. To create possibilities for readers to react, the stakes should be high, and readers should know what action would lead to what consequence. Using *affordances* and *familiar* mappings of action-consequence pairs can lead to instinctive actions as they reduce the cognitive task of associating the action with the consequence. For ex: taking deep breaths during the panic attack scene in GWO was instinctive. If the mapping is not familiar, the association would have to be built through practice before readers can be expected to react. For example. in SR readers had to build the mapping between the rings and the emotion through practice, and the high-stakes scenes were placed at the end of the stories.

10.3.3. Guiding Questions and Summary

Here are some guiding questions for creating high-stakes scenes:

- *What situations can feel dire, of high-stakes, and give readers an urgency to act?*
- *How might the reader's actions lead to high-stakes scenes? How might the reader unintentionally harm the character? How can there be lasting and worsening narrative consequences to such actions?*
- *Will the reader be able to react in the high-stakes scene? Would they know what action to take and what consequence it would lead to?*

Table 28: Navigate high-stakes scenes

Navigate high-stakes scenes -dire situations, urgency to act, help readers feel responsible and sympathetic	
Concept	**Design Guideline**
Unintentional harm to character – when reader's take actions that may accidentally hurt the character	● Provide readers the possibility of unintentionally hurting the character, which can lead to high-stakes scenes. Unintentional harm to the character can lead to sympathy, concern, feeling responsible. Ex: helping Gummy survive the acid attack, where the reader's actions could have caused him more harm. ● Have lasting and worsening consequences that lead to high-stakes scenes if the reader does not fix the situation. Ex: Gummy's limbs burn in the acid attack that he refers to later

	● Make stakes seem higher through irreversible actions, raise tension with slow-paced actions. Ex: chewing Gummy slowly as he shouts
Open Choices – less backleading for characters to take the desired action	● Give open choices to provide the possibility of unintentionally hurting the character leading to high-stakes scenes. Ex: readers were encouraged to explore different food items where junk food ended up hurting Gummy
Urgency to React – act as the character without thinking in high-stakes scenes	● Use affordances and action-consequence pairs with familiar mapping so actions are instinctive, and readers can react in high-stakes scenes. Ex: taking deep breaths during a panic attack ● If the action-consequence pair is not familiar, build knowledge of action-consequence mapping through practice. Ex: colors of Rangoli to affect were acknowledged multiple times.

10.4. Wear a Mask to Take a Role

Tanenbaum quote Keith Johnstone (Johnstone, 1992) and (J. Murray, 1997) to describe how seeing oneself in a 'mask' can lead to identity transformation. She says, "if one does what the character does (BM), wear their clothes, move and speak with their voice, then one experiences transformation" (T. J. Tanenbaum, 2015). Here, losing sense of one's identity is an important step as well, so they can take on another identity. From my studies, I did not find anecdotes of participants losing their identity, and so I refrain from giving recommendations on the same. However, I did observe them react to visual transformations (TNFT) and behavioral mimicking (SR, TNFT). I take inspiration from this concept of wearing a (metaphorical) mask to describe how the reader may take a character's role by looking like and behaving like the character using diegetic objects and actions.

I elaborate on how readers can ease into the role and understand the character's personality and motivations (alliance) by exploring narratively embedded backstories. As seen in TNFT, visual transformations can show readers what they look like as the character, which may help them take on another identity. Behavioral mimicking, that is taking the actions a character would take, and impacting the affective state of the character, can encourage readers to position themselves in the shoes of the character. I describe these concepts in more detail below.

10.4.1. Explore Narratively Embedded Character Backstories

I recommend that readers can be eased into their character by telling them who they are, their goal, and how to perform. Character backstories are one way to describe the character's motivations, personality, and relations with others (recognition and alliance - (Smith, 1995)). Backstories are important for understanding the character's hardships (refugee in BTJ) and for taking a role the reader knows nothing about, like Calliope. Backstories can also describe the other character's past, encouraging readers to build and invest in the relationship (second-person perspective). Moreover not having enough background information about the character may deter the reader from taking the role (T. J. Tanenbaum, 2015).

How can readers explore backstories that are embedded into the story world? Readers can explore (or wear as seen in (Dagan, 2018)) objects that carry histories and details about a character's personality (*semantic affordances*) while coming into the character's role. For example, the reader as Calliope could have picked up her wand engraved with her name and her cloak, while approaching the mirror with an internal monologue describing what these objects mean to her and how they fit with her personality. While interacting with another character, readers can exchange such objects to know more about the other character and their relationship. For example, Minerva could have shown Calliope an old photograph, that when casting a spell upon would play out the memory in the photograph. Such exchanges can help build relationships and describe why characters care about each other.

Familiar social scenarios can be leveraged for characters to reveal their backstories – like sharing backstories while drinking wine together or eating nostalgic food. *Affective affordances* can be applied to reveal different emotionally colored backstories –nostalgic sweet vs bitter food could show pleasant vs unpleasant memories. *Slower-paced actions* and *repetitive actions* can be used to reveal things bit by bit, the more the reader performs the action, the more they would know. For example, in GWO sipping wine repetitively could get Gummy tipsy that would make him disclose more about himself.

10.4.2. Visual Transformations

As observed in TNFT, visual reflections can be used to show the reader how they look when they transform into the character they are playing. While this can help readers take on a character's

identity it may also help them leave behind their own identity, as they see someone different in the mirror reflection (TNFT). While the transformation in TNFT was abrupt, slow-paced transitions may allow readers to observe their visual identity gradually changing as they come into character (collect and wear objects, explore backstories). Readers may consume magic food items to transform, as it signifies putting something inside one's body. Actions, objects, and food items that readers interact with to transform into the character can also be a metaphor for the character's personality. For example, eating something spicy to transform could signify a fierce character, or wearing something heavy could signify the weight of responsibilities on the character's shoulders (SR). A mix of such metaphors may describe a more complex personality.

Readers can be encouraged to take performative actions when they see their visual reflections (like waving one's hand), to help them realize it is their reflection and their visual identity that is changing. If readers see themselves as the character *repeatedly* throughout the experience, they may be able to maintain a visual *tether* to their identity. In TNFT, the mirror could have turned himself into a pocket mirror for Calliope to carry.

In these ways, readers can have a consistent and gradual *mask effect*. Transformations need not just be visual. Readers may also try to perform an action that can only be completed once they transform into the character – like casting a spell successfully.

Lastly, just as readers ease into the character, they could ease out as well to avoid abrupt endings and take them back into their reality (TNFT). Readers may reverse the visual change slowly by replacing objects and clothes worn, and watching their reflection change back.

10.4.3. Behavioral Mimicking and Impacting Affective State

(Bizzocchi et al., 2011) described that *behavioral mimicking* occurs when a player's interaction mimics real-life actions of the character, stating that it can help readers enact. I recommend that designers can backlead readers into doing what the character would do like casting spells or making Rangolis. Readers may take *semantic actions* that describe the character's personality or state – like casting spells only to have them backfire describing being in the shoes or a rookie fairy, or breaking objects that the character picks up to show anger issues. Other characters interacting with the reader can also take *semantic actions* that describe power dynamics such as bowing to Queen Calliope or being scared of Shiva.

I recommend that readers can also be allowed to impact the affective state of the character they play. This can help them take the character's role because when one is endowed with the character's emotions, they must put themselves in the character's situation (Calliope, Shive, BTJ). Readers can perform actions that leverage *affective affordances* to help them feel a certain way – bodily actions like taking deep breaths, changing physiology through intentional actions, or consuming a calm drink, among others. Actions and affective mappings can be personalized which may help readers *feel* the affective state. Readers could be asked to *repeat* these actions multiple times so they can feel the impact of the action more (keep sipping the calm drink). These actions may eventually help readers feel what the character feels affectively, or at least buy into why their actions are eliciting the intended affective consequence.

10.4.4. Guiding Questions and Summary

- *What objects and social scenarios can help describe character backstories? How would the reader explore these objects to understand the backstory?*
- *What actions might the reader take to transform into the character? What do these actions say about the character's personality? How will the reader get the feedback of their gradual transformation (visual or action-based)?*
- *What actions can the reader take that are unique to the character and describe the character's personality? How would other characters treat the reader's character?*
- *What actions might the reader take to impact or mimic the character's affective state? How can we help readers feel how the character would feel affectively?*

Table 29 : Wear a mask to take a Role

Wear a mask to take a role – ease into character's identity by understanding backstory, visual transformation, behavioral mimicking and impacting character affect	
Concept	**Design Guidelines**
Narratively embedded character backstories – backstories describing character's motivation, personality, relationships with other characters.	● Explore and wear meaningful objects with histories and personalities (semantic affordance), that belong to the character to ease into the role. Ex: The reader as Calliope wears her cloak, finds her wand, and hears an internal monologue describing how these objects fit her personality ● Exchange meaningful objects with other characters to listen to backstory and build relationships. Ex: Minerva and Calliope reminiscing over a photograph ● Use familiar social scenarios for other characters to share their backstories. For ex: drinking wine together.

	● Use slow-paced, and repetitive actions to reveal things bit by bit. Ex: sipping wine repeatedly to get Gummy tipsy and reveal stories over time
Visual Transformation – see oneself visually transform into the character through a mirror.	● Use slow paced transitions so readers observe their visual identity change gradually as they collect objects and explore backstories. ● Use a mix of actions and objects as metaphors for the character's personality. Ex: spicy food signifies a fierce character ● Take performative actions in front of the mirror, see reflection repeatedly throughout the experience. Ex: waving hands in front of a mirror. ● Perform an action that can only be completed by the character once the reader fully transforms. Ex: casting a spell successfully ● Reverse visual transformation, replace objected used and clothes worn, exit as self to avoid abrupt endings
Behavioral Mimicking - Mimic actions the character would take	● Perform *semantic* actions that describe the character's personality or state. Ex: cast spells that backfire as a rookie fairy ● Describe power dynamics when other characters take semantic actions while interacting with the reader. Ex: bowing to Queen Calliope
Impact affective state of the character: Impacting affective state of one's character can encourage readers to take the character's point of view	● Use *affective affordances* to impact the reader's affective state. Ex: deep breaths, intentional actions that change physiology. ● Use *personalized* and *repetitive* actions to feel the affect more. Ex: drinking personalized calm drink repeatedly

10.5. Summary

In this chapter, I give design guidelines to answer my second RQ: How can diegetic elements support aspects of character engagement (CE) when readers interact with another character or take a character's role.

I recommend endowing readers with responsibility and stakes in the story, so they have a goal, take *desired* actions, and contribute to the story. They can be made responsible for a character's well-being, character actions, and emotions while playing the character's role or while interacting with another character. I recommend allowing readers to impact the narrative world such that they have stakes. Acknowledging the action and *affordance* used, having a logically convincing consequence to action, and having contrasting consequences to different actions can help readers impact the narrative. The reader's actions do not have to impact the plot of the story, rather they can impact *how* an outcome unfolds, mitigating the reader's burden of the path not taken and the author's problem of creating branching narratives.

I recommend helping readers understand the character goals, adopt those goals as their own, root for characters, and have similar interests/motivations. Character goals can be clearly communicated in the beginning and be strengthened by giving reinforcing feedback from the character. One way of aligning the interests of the reader and character is by designing for actions that make the reader and character benefit or suffer together. Shared diegetic interfaces between the reader and the character (like the body in GWO) can be used to add personal stakes for the reader. These shared diegetic interfaces can be negotiated between the reader and the character to create small conflicts. Resolution of these conflicts can help build trust and foster allegiance. Having points in the story where readers can share moments of pleasure or displeasure together (affective sync) can also help align interests and build allegiance. If the character is likable, achieving CE can be easier.

Navigating high-stakes scenes where the character is in danger can help readers feel responsible and sympathetic, and it may also encourage them to *react*, act without thinking. *Open choices*, that is, choices with less backleading, can provide readers the possibility of unintentionally hurting the character, which can further lead to lasting and worsening consequences if the reader continues taking *undesired* actions. Readers can be given opportunities to *react* through high-stakes scenes. Using *affordances* and action-consequence pairs with *familiar* mappings may help make actions instinctive.

Exploring character backstories through meaningful objects and familiar social scenarios like sharing while drinking wine together, can help readers understand more about the characters. Readers can be assisted in wearing a *mask* by helping them slowly visually transform while they use *semantics* objects and perform *semantic* actions that are metaphorically linked to the character's personality. Readers can be shown their reflection repetitively throughout the experience and can be asked to perform various bodily movements in front of their reflection to help them realize that they have transformed into another character, possibly leaving their identity behind. Just as readers ease into their new character identity, they can be eased out as well. Lastly, readers can be given opportunities to take actions that the character would take (like casting spells) and impact the character's affective state so they can think from the character's point of view.

Chapter 11. Design Guidelines – Navigating Complexities

In this chapter, I give design guidelines to answer RQ3: what complexities might readers face while taking internal-ontological roles and engaging with characters in diegetic interactive narratives? How can readers be assisted to navigate these complexities such that they can intentionally impact and engage with the story?

There are certain *complexities* that readers need to navigate through while engaging with diegetic interactive narratives before they can fully immerse themselves in the narrative, such as – who their character is, how to interact with the interface, and how they may impact the narrative, among other things. All this information must be understood and retained by the reader as they consume the story, which can easily get overwhelming. If readers are struggling to navigate through the complexities of the system, their actions may be more exploratory than intentional (SR), they may not be able to understand the story completely (TNFT), and they may not be able to build CE (SR, TNFT). Readers are more likely to enjoy and reap the benefits of storytelling if they are not tangled in these *complexities*.

From the observations of my three studies, I identified a few common complexities that readers face while taking internal-ontological roles and engaging with characters in diegetic interactive narratives - readers need to understand who their character is (visual, backstory), their relationships with other characters, their goals, motivations, and responsibilities, how to perform actions and recognize *desired* actions (actions that aid story coherence, CE, and roleplay), and what actions map to what consequences. In this chapter, I describe how designers may help readers navigate these complexities. While there may be many more complexities in diegetic systems, I identified and focused on the ones relevant to my other two research questions. The table below illustrates the complexities readers had to navigate in TNFT, SR, and GWO

Table 30: Complexities of each system

Concepts	TNFT	SR	GWO
Who are they?	Calliope, queen of fairy godmothers, authority figure	Shiva, God of destruction, has a temper	Themselves
Relationships with characters	Loving sister to Minerva	Most powerful God	Caretaker of Gummy and their body

Goals, motivations, and responsibilities	Help Minerva through a pivotal life moment as she is her sister	Maintain balance, take care of the world and the river because they are God	Help Gummy out of their bodies as they are responsible for his situation
Ways to perform actions	Cast affective spells with a wand to change the conversation tone	Assemble Rangoli's to express Shiva's emotions	Consume various food items and perform body actions to help or hinder body and Gummy
Desired actions	Talk to Minerva, respond with empathy	Express emotions that are true to how Shiva would react in the situation	Help body and subsequently help Gummy
Agency	Impact affective tone of the dialogue, but can't change Minerva's decision	Impact affective state of Shiva and the story world but can't change the plot	Impact the body and subsequently Gummy, make his life easier or harder, but can't change the plot
What actions map to what consequences	Red – angry, green – calm, yellow- happy, blue - sad	Red – angry, green – calm, yellow- happy, blue - sad	Healthy food helps the body and Gummy, unhealthy food does not

In SR, readers took nearly half the experience to understand their role, what they had an impact over, and what colors mapped to what affect. Only then were they able to impact the narrative intentionally. In TNFT, readers who missed the mirror's context-setting in the beginning due to lack of attention were not able to take Calliope's role at all and were not motivated to converse with Minerva. In GWO readers made intentional decisions from the start as it was the easiest to understand. This was because readers did not have to take a role, the mapping between the action and consequence was based on existing knowledge, and Gummy backled them every step of the way. These examples show how important it is to help readers navigate the above complexities before they can meaningfully engage with the story.

As described in these guidelines, I identified that complexities vary based on:

- The role the reader takes: readers may take a role where they are familiar or unfamiliar with the character's personality, or they may enter as themselves. Taking an unfamiliar character's role can be complex while entering as oneself can be simple.
- Differing degrees of interactivity available (various interactions available like eating, assembling Rangolis, casting spells, and moving around) in different modalities (VR/

tangibles): VR provides more degrees of interactivity than tangibles, which can give readers more ways to interact, making the system more complex.

- Mapping between the action and consequence: familiar and logical mappings can be easier to decipher.

From the insights of my three studies, I learned that helping readers navigate complexities is not straightforward. Readers cannot be given all the information at once (TNFT) and even information given in tutorials may not carry over (SR,TNFT). Easing readers into all the information repeatedly can help them understand and retain what is necessary. Readers can be eased into a role by providing multiple backleading cues spread across the different interaction modalities, repeatedly. Readers can be backled into taking the *desired* actions (actions designers wish readers would take for story coherence and CE), yet still, be given space to take undesired actions that may cause intended negative consequences.

Besides understanding their role and how to perform, readers need to understand what consequences their actions may have in the narrative. Mappings between action-consequence pairs can be simplified or complicated using different *affordances* and *attributes*. Lastly, readers can be kept engaged and satisfied through the experience by dynamic scene shifts, a variety of actions and affordances, hooks in the beginning, and gradual endings.

In this chapter, I describe the above design guidelines in more detail to help readers navigate complexities. I use the term *navigate* because designers may choose not necessary to eliminate or simplify all complexities for the reader, as some complexities can be engaging and add to CE (more details in the chapter). Oversimplifying or guiding the reader too much may make them feel like they do not have much agency, or it may leave them unchallenged. I recommend helping readers navigate complexities such that they are not left overwhelmed, nor bored. While most of these guidelines are focused and abstracted for interactive narratives that include diegetic elements and position readers in internal roles, sections 11.3 and 11.4 include some guidelines that are more broadly applicable as well, as they discuss concepts like the importance of providing repeated feedback and ways to keep readers engaged.

11.1. Ease into Role

When playing a role, readers can engage in different kinds of pleasure – deciphering who they are, enacting, knowing more about the character, and building relations with other characters. However, to take on the role, readers must know who their character is and how to perform. The complexity of taking on the role is defined by who readers enter as. Entering as themselves requires the least onboarding (GWO), followed by entering as a familiar character (SR), and the most onboarding is required for those entering as an unfamiliar character (TNFT). This is because they must understand the character's personality and goals to act meaningfully. This section describes how to ease readers into their roles without overwhelming them, so they feel confident about how to perform.

In-world tutorials that are a part of the narrative experience can help readers perform a role if the experience is filled with repeated backleading cues. Different modalities (VR, tangibles) provide different degrees of interaction, that can all be used to communicate roleplay expectations. Lastly, low-stakes environments can help readers rehearse how to perform their actions. I describe these concepts in more detail below.

11.1.1. In World Tutorials

In world-tutorials can be used for communicating role expectations to the readers - who they are, their goals, responsibility, motivations, relationships, and how to perform actions. By 'in-world' I mean a tutorial that is a part of the narrative experience, like the Mirror in TNFT. The narrative experience can be filled with backleading cues and guideposts woven into the story world. For example, in TNFT there were multiple such cues embedded in the narrative and there could have been more – the Mirror addressing the reader as Calliope, showing them their visual reflection as Calliope, other characters bowing to Calliope, and trinkets and clothes to come into the character and learn backstories. Tanenbaum described this concept as defining scripts so readers can practice how to perform. While it is important to define scripts and give cues to the reader, this information must be spread throughout the experience and should not be given all at once. For example, in TNFT since all context was given in one conversation, readers lost attention and were not able to absorb all the information. This hindered them in taking Calliope's role. The information (who the reader is, their goals, responsibilities, and motivations,

how to perform actions, and opportunities to practice the role) could have been spread out and given in steps and small interactions, one concept at a time, all the while leading them to Minerva. The Mirror could have turned himself into a pocket mirror for readers to carry around and pull out as needed. Similarly, in GWO, information was spread out throughout the experience as Gummy told readers where he was, the problems he faced, and what might help him for every hurdle he encountered.

11.1.2. Repeat Role Information Across Different Degrees of Interaction and Modes of Feedback

The modality (VR, tangibles) of the system can offer different degrees of interaction (various interactions available) and modes of feedback. For example, TNFT (VR) allowed readers to walk around in the space, take different actions like touching things and casting spells, and had visual and audio feedback. Whereas in GWO and SR, the only actions allowed were eating and assembling Rangolis respectively, and both had only audio feedback. This meant that readers in TNFT had more freedom of interaction than in GWO and SR because in GWO and SR readers were constrained to interact only with the tangibles and could not walk around in the space, unlike TNFT. Moreover, readers in TNFT had to pay attention to multiple modes of feedback (visual and audio), as compared to GWO and SR where readers only received audio feedback (excluding the ambient feedback in the background).

The different degrees of interaction and modes of feedback show how modalities like VR can provide rich possibilities of interaction but can also become overwhelming because of the various possibilities. One way to make the experience less overwhelming is by reinforcing information about the reader's role through these different degrees of interactivity and modes of feedback in *redundant* ways. This means they should all tell the reader similar information about their role while working in harmony with each other. For example, In TNFT audio, visual, actions all told the reader that they were Calliope while communicating different aspects of the role. The Mirror gave readers visual feedback showing what they looked like as the character, it gave audio feedback by calling the Calliope, and the action of casting a spell was an action Calliope would take. In SR, both the Rangoli and the ambience worked in harmony to tell the reader that they were Shiva. The story referred to the reader's Rangoli as 'Shiva's' Rangoli, and referred to the ambient effects as an expression of Shiva's affective state. (Clifton et al., 2013)

also mentioned that the use of multiple cues (verbal, audio-visual, and mimetic) can help readers understand how to perform an action.

11.1.3. Low Stakes and Rehearsals

Readers can be put in low-stake situations to be given a chance to rehearse their role before they are put in high-stakes situations (T. J. Tanenbaum, 2015). By low-stakes I mean consequences that are not carried over, no one is in danger, and the impact may even be humorous. These low-stakes situations can also help readers understand how to interact with the system. For example, in TNFT, readers could have practiced their spells on animals and other characters before talking to Minerva. In SR, there were low-stakes situations such as the other characters fearing Shiva, that helped readers map colors to affect. Making actions *reversible* and giving readers the ability to opt-out can help decrease the stakes. Furthermore, such interactions could be *repeated* enough times for readers to get practice and feel confident in performing their role.

11.1.4. Guiding Questions and Summary

- *Who does the reader enter as (themselves, a known character, an unknown character)? How much backleading will they need to understand their role?*
- *What backleading cues can tell readers about their role, goals, responsibility, and ways to perform? How can this information be given as part of the narrative in digestible sizes over time and repeatedly?*
- *What are the different degrees of interaction (actions) available in the system? What are the different modes of giving feedback? How can the different degrees of interaction and modes of feedback work in harmony to reinforce role information to the reader?*
- *What low-stakes scenes can be introduced for readers to practice their role?*

Table 31: Ease into a role

Ease into a role – Communicate information about the reader's role repeatedly, and give them space to practice their role	
Concept	**Design Guidelines**
In-world tutorials – tutorials that are a part of the narrative world and describe the role readers are playing,	● Fill experience with backleading cues and guideposts woven into the story world. Ex: Mirror

their goals, responsibilities, motivations, and how to perform actions	calling readers Calliope, showing their reflection, trinkets and clothes to come into character ● Spread out cues throughout the experience, give information in small steps – one concept at a time, not all at once, and repeat these cues throughout. Ex: the interactions with the Mirror could have been spread out and repeated
Different degrees of interaction and modes of feedback – various kinds of interactions available in the narrative, and the different ways in which they can get feedback (audio, video)	● Reinforce roleplay information through different degrees of interaction and modes of feedback while they work together in harmony. Ex: Mirror showed reader's their reflection (visual), called them Calliope (audio), and taught them how to cast spells (action)
Low-stakes and rehearsals – situations where no one is in danger and consequences do not carry over so readers can practice how to perform actions	● Practice how to perform the role and take actions in low-stakes scenes until the reader feels confident. Ex: Calliope could practice spells on animals before interacting with Minerva ● Use reversible actions to decrease the stakes. Ex: assembling Rangoli rings was reversible but eating in GWO was not

11.2. Backlead to Desired Actions with Opportunities to Make Mistakes

A designer may want readers to take certain *desired* actions, for readers to stay in their role, to build CE and maintain story coherence (section 2.3.4). Examples of desired actions from my works are – helping Gummy rather than hindering him (GWO), engaging in conversation with Minerva (TNFT) rather than just exploring, and creating affective responses suited for the moment (SR). Sometimes readers may take undesired actions like wanting to explore rather than engaging with characters in TNFT. These undesired actions may also cause unintended negative consequences (*mistakes*) in the narrative like hurting Gummy or creating an ambience that does not match the affective tone of the story (SR). However, designers need not aim for eliminating undesired actions and *mistakes* completely, as they can provide agency, bring focus, add variety, help decipher complexities, and aid CE. This section describes how readers can be backled to take *desired* actions, with opportunities to make *mistakes*.

11.2.1. Explorations vs. Desired Interactions

Often in novel interactive experiences, readers desire to explore the system to understand how they can interact. This was observed in TNFT where many readers wanted to explore the story world and interact with the environment rather than solely talking to Minerva. There may be tension between the reader's desire to explore the system and the goals of the designer such as encouraging the reader to perform a role or build CE. However, I recommend that rather than viewing the goals of the reader and designer to be at odds with each other, designers can leverage the reader's *desire to explore* as a way to aid their goals of building CE – such as easing readers into a role through exploration. For example, in TNFT readers could have explored the story world to find trinkets and photographs to understand the backstories of the character, fulfilling their desire to explore while getting into character.

Readers can also be encouraged to behave a certain way by leveraging social scenarios and character reactions. For example, Minerva always looked at the reader wherever they went, which readers felt was an invitation for them to go talk to her instead of just exploring the area. Furthermore, Minerva could have gotten angry and guilted the reader if they walked away from her, imitating real-life social behavior. (Lankoski, 2011) also encouraged using social norms rather than introducing hard constraints like not *allowing* the reader to physically move around.

I also recommend that readers can be given space to explore the system early on and play out their curiosity before getting deeper into the narrative. In GWO, readers were encouraged to try a variety of food items in the beginning, and in SR readers were encouraged to explore the different ambient effects in the tutorial. However, this was not the case in TNFT, and readers had to balance their willingness to explore the spells with having a meaningful conversation with Minerva.

11.2.2. Deter from Undesired Actions and System Boundaries

In interactive stories with ontological roles, different actions may lead to different consequences where some actions and consequences may be more *desirable* to maintain story coherence and aid CE than others (like helping Gummy rather than hindering him). I recommend that readers can be steered away from actions that are less desirable. For every less desirable action, the

reader takes (like hurting Gummy), the story situation can be made worse, the character may express betrayal (GWO), guilting the reader.

While some readers may deter from taking the undesired action through the techniques above, others may not. After repeating the same undesired actions multiple times, the reader may either hit a boundary (like hearing a repeated dialogue or not being able to progress with the story) or the story may proceed despite the undesired action. For example, in GWO if the reader did not eat fiber in the bowels, Gummy would keep pestering them, guilting them more every time. But after three tries, readers would hit a repeated dialogue, knowing they must eat fiber to proceed. I could have designed this such that instead of hitting a repeated dialogue, the story would still proceed despite the reader's actions of not eating fiber. Gummy could turn back from the bowels (which happens anyway), saying 'If we don't find Ana, it's on you!'. This would make readers feel like their actions had a consequence in the story, rather than hitting a boundary and feeling they must follow Gummy's every command to proceed with the story. Given the readers' experiences in GWO, I recommend leading readers away from system boundaries so they do not hit a repeated dialogue as they may feel they have less agency or are doing something 'wrong'.

I define *threshold* points as the number of times readers are willing to make the same choice without feeling like their choices will not play out in the story and they must follow the character's lead to proceed. Threshold points may be different for every experience, but as observed in GWO, readers explored a certain choice twice and then proceeded with what Gummy wanted. Readers can be pestered to take the desired action up to the threshold point, after which the story should proceed with whatever action the reader takes.

Designers may choose not to backlead readers into taking the desired action right after they take an undesired action as this may make readers feel a lack of agency. Readers can be given an opportunity to explore, even after taking undesired actions. However, I recommend giving readers a direct call to action after the *threshold* point, so they do not feel confused.

While I have discussed how to backlead readers, they should not be seen as agents trying to mess with the system, but rather as people who want to engage with the story at their best. From what I observed in my three studies, people always wanted to engage meaningfully in their first encounter with the system. Only after the experience was over, were they curious to explore the system more by making choices they had not made the first time around. This is

similar to what Tanenbaum described - 'diegetic scripts should give an invitation for performing in good faith, as if the world would reward the reader for their performance'.

11.2.3. Give Opportunities to Make Mistakes

While exploring the system and learning how to perform, readers may take undesired actions that cause unintentional negative consequences in the narrative (like hurting the character). I term these unintentional negative consequences as *mistakes*. While section 10.3 discussed the importance of mistakes for high-stakes scenes and CE, this section focuses on complexity and understanding the system.

Mistakes can lead to high-stakes scenes (section 10.3), bring the reader's focus back to the experience, add variety, help in understanding the mappings between actions and consequences, and help readers decipher how much agency they have. In GWO, the white blood scene broke the reader's mental model of eating healthy food to help Gummy, as they had to eat unhealthy food to slow down the white blood cells to help Gummy. This scene added variety and brought focus. In SR, the scenes that had a mismatch between the affect and story helped readers decipher what they had agency over. Given these benefits of making mistakes, I recommend that designers do not need to aim for eliminating mistakes and undesired actions completely. In fact, if readers take only desired actions, the experience may end up being less engaging and perhaps even monotonous (like eating only healthy food in GWO).

Given that mistakes can be helpful, how can readers be given space to make mistakes? Readers can be encouraged to explore a variety of actions available, out of which a few may have negative consequences. This can also serve the reader's desire to explore. For example, in GWO, Gummy encouraged readers to explore a variety of food items early on, out of which a few food items led to the acid attack. Similarly, in TNFT, readers could have been encouraged to try all the spells on different characters, where the angry spell would have made the character storm off.

Adding more complex but performatively rich actions (section 11.3) like actions with multiple affordances or actions that have varying intensities, can also lead to mistakes. Another concept that can be used here is *open choices* (section 10.3.1), choices that provide the reader with less backleading for taking the desired action. Open choices can again encourage readers to take different actions that possibly lead to negative consequences.

Lastly, if the undesired action is repeated multiple times, the reader can be led into a high-stakes scene (section 10.3). In GWO, the acid scene started with Gummy burning, but if an undesired action was repeated, he started losing his limbs in the acid, making the situation direr. Warning the readers of the high stakes can bring focus and build mental models. In GWO, after the acid scene readers realized they had to pay attention to the acidic qualities of food as well. In SR, many readers said that they confirmed their mental model of the mapping between the Rangoli colors and affect only after the high-stakes scene of the world being destroyed.

11.2.4. Guiding Questions and Summary

- *What are the desired actions and behaviors required from the reader to maintain story coherence and aid CE?*
- *How can readers be given space to explore the system? How can the reader's desire to explore be leveraged to aid CE?*
- *What are the boundaries of the system? How can readers be nudged away from the boundaries, so they do not hit repeated dialogues/block story progression?*
- *How can readers be led to make mistakes (unintentional negative consequence)? How might the reader benefit from making mistakes (CE, high-stakes scenes)?*

Table 32: Backlead to desired actions with opportunities to make mistakes

Backlead to desired actions with opportunities to make mistakes – desired actions are actions that designers wish readers would take for story coherence and CE. Mistakes are actions that lead to unintended negative consequences.	
Concept	**Design Guidelines**
Exploration vs. desired actions– Readers may want to explore the system like in VR, but designers may want them to engage with the narrative and characters	● Leverage *desire to explore* to ease readers into the role. Ex: explore trinkets and photos to learn more about backstory ● Make space for exploration early on to let readers play out their curiosity. Ex: encouraging reader to try out all food items in GWO ● Encourage desired behavior by leveraging familiar social scenarios. Ex: Minerva constantly looking at Calliope invited readers to engage with her
Deter from system boundaries: Taking repeated undesired actions may result in readers hitting repeated dialogues or not being able to progress (system boundaries)	● Lead readers away from hitting system boundaries so they do not hit a repeated dialogue and feel like they have less agency or are doing something 'wrong'. Ex: readers felt like they had to follow Gummy's orders to proceed with the story ● Backlead readers away from undesired actions by making situations worse and guilting readers. Ex: Gummy burning in acid and then losing limbs

	● Give readers opportunities to explore even after they take an undesired action, do not backlead them to take the desired action right after so that they do not feel a lack of agency.
Mistakes – Undesired actions that may cause unintentional negative consequences. Mistakes help add variety, bring focus, build CE, build mental models,	● Let readers make mistakes, there is no need to eliminate undesired actions completely. Encourage readers to explore as many different actions as possible, out of which a few may have negative consequences. Ex: hurting Gummy by eating candy ● Use complex but performatively rich actions (section 11.3) Ex: crafting a mix of emotions through different ambient effects. ● Use *open choices* – provide less backleading to the desired action. Ex: Gummy just asking for help in the intestine scene rather than hinting how he could be helped ● Convert repeated mistakes into high-stakes scenes (section 10.3). Ex: eating healthy food in the WBC scene repeatedly led to Gummy's life being in danger

11.3. Complexity of Deciphering Mapping Between Action and Consequence

I term the 'complexity of the interface mapping' as how difficult it is for the reader to understand the mapping between the action and consequence and predict the impact of their actions. Complex interfaces can keep up engagement levels as readers decipher the system (SR). However, the pleasure of deciphering the mapping between and action and consequence is not narrative and may seem puzzle-like. Furthermore, the more the complexity, the longer it would take the reader to understand how the system works and while readers are engaged in these complexities, they may not be able to build CE or perform a role. I describe how to simplify the complexities of the interface using *attributes* and *affordances*.

On the other hand, if the consequence to every action is predictable and simplified, readers may build CE early on, but may also feel unchallenged or bored. One way of keeping the experience challenging and engaging is by introducing complex but performatively rich actions. These actions are not complicated because their consequences are difficult to predict or understand, but rather they provide more performative and interpretive options to readers, which can make them complex. These actions can also provide opportunities to make *mistakes* (section 10.3).

Lastly, a few more concepts can help simplify complexities of the interface mapping like receiving reinforcing feedback from various modalities, asking the reader to personalize certain action-consequence mappings, and through pre-experience tutorials. These last few guidelines are more abstract and maybe broadly applicable to storytelling systems outside diegetic tangible narratives as well.

11.3.1. Simplify Complexities through Affordances

Affordances can make mappings between the action and consequence easier for the readers to predict, understand, and remember (unhealthy food harms the body, deep breaths feel calm) as they provide logical connections between actions and consequences. Acknowledging the affordance and specifying contrasting consequences to actions can help reaffirm the mapping between the action and consequence for the reader. I do not recommend avoiding the use of affordances to add complexities, as providing logically believable consequences to actions can increase buy-in. However, certain affordances can be easier to understand and remember than others.

Sensorily perceived affordances can be easier to understand and remember than the other affordances as readers are guaranteed to sensorily feel the impact of the action. For example, Gummy slipping on oily food stuck with readers as they had a visceral reaction to it. This does not mean that designers should *only* use sensorily affordances, they merely provide a possibility of simplifying complexities. Other affordances should also be used to add variety and engagement.

With *affective* affordances, metaphorical mappings may be more difficult to understand than familiar body actions. For example, performing deep breaths to calm down is easier to understand and remember than using a tangible metaphor like touching something soft, as familiar actions offer more buy-in and less cognitive load. More the cognitive load, the more time it may take for readers to feel the affective response.

While using *semantic* affordances, designers should be cautious about the fact that actions may carry different meanings in different cultures. For example, showing encouragement or anger to someone may be different in different cultures. *Semantic* affordances may not be understood by everyone and may require more practice and time to understand and remember.

Attributes can also simplify or add complexities. *Familiar actions* (deep breaths vs. tapping a spell) and *repetitions* (like body tethers) may help readers understand and remember mappings between actions and consequences. When *attributes* such as coupling and perceived agency do not mimic real-life rules, the interface can become more complex (not recommended). Actions using such attributes would need more backleading, repetitions, and story-based justifications.

11.3.2. Use Multi-Modal Feedback to Reinforce Mappings

Different modalities of feedback (visual, audio, haptic, ambience, among others) can be layered in harmony and work in sync to give readers similar multiple reaffirmations of the mapping between the actions and consequence. For example, in SR the acknowledgement of the Rangoli colors and intended affect, was reaffirmed by the mood the ambience set. Even with all the different sensory information, readers did not feel overwhelmed as all modalities communicated the same information. Similarly, (Höök, 2009) described unity between modalities so that different sensory information like colors, gestures, music, haptics are all in harmony. This concept can be applied while leveraging *affective affordances* as well. Verbal acknowledgement of the affordance, ambient feedback, physiological response to intentional actions, and feeling another character's physiological response to the reader's actions, all can be layered together to reinforce the affective state set by the action.

11.3.3. Provide Complex but Performatively Rich Actions

Some actions may be complex, not because of complex action-consequence mappings, but because of the rich interpretive and performative options they may provide. These complex actions can be used to add variety and challenge and keep up engagement levels, as over-simplified mappings of interfaces can be monotonous and boring. These actions can also give readers opportunities to make *mistakes* (section 11.2.3).

Sometimes an action may have a variety of *affordances,* where the reader would have to predict which affordance best fits the situation. For example, in GWO the tea was hot (sensory) and calming (affective), giving readers multiple interpretive possibilities. In such cases, I recommend keeping the outcome of the action – positive/negative, consistent throughout the experience to avoid confusion and to help create a mental model. For example, in GWO if the tea always had a

positive impact on Gummy, it would ease the reader's anxiety of which affordance of the tea was being used when.

Similarly, multiple actions may have similar affordances which may feel like they have similar consequences. For example, deep breaths and drinking a calming drink both leverage affective affordances and have a calming impact. In such cases, readers can be backled into taking the desired action, or all possible actions could lead to the intended consequence.

Actions that allow readers to represent *varying intensity* and *mix* components/actions together, can be more complex but can also provide rich performance opportunities such as - mixing affective components to represent a blend of emotions. In such cases, different possibilities with different actions can be introduced sequentially. For example, in SR readers were allowed to mix different colored rings to create a mix of emotions, but each color and its effect could have first been introduced sequentially before readers started mixing the rings.

11.3.4. Personalized Mappings and Tutorials

Personalized interfaces can help readers understand and remember the mapping, especially while using *affective affordances* (calm drink) as explained in section 9.1. Readers can be asked to personalize the interface components within broad categories and constraints as well. For example, in GWO, I asked readers to plate food items in the broad categories - two healthy foods, two unhealthy foods, and a calming drink, among others. This helped readers decipher the mappings quickly in the narrative experience as they already knew the association between the food items and the possible consequences on the body. This strategy can also encourage readers to bring in items that hold personal meanings to them (semantic affordances and shared diegetic interfaces).

Lastly, pre-experience tutorials can be used to give context (ex: what are Rangolis), practice controlling the interface (VR), and explore different actions available before starting the narrative experience (SR). While in-world tutorials can help readers ease into the character, pre-pre-experience tutorials can be useful for preparing readers for the story world. While deciding between the two, designers can think whether the piece of information is better if told (outside world tutorial) or enacted (in-world tutorial).

11.3.5. Guiding Questions and Summary

- *How easy/difficult is it for the reader to predict, understand, and remember the action's narrative consequence? How can attributes and affordances simplify the mapping between the action-consequence pairs?*
- *How can an action provide rich performative and interpretive possibilities? Does the action have multiple affordances? Can the reader perform the action at varying intensities? Can the reader mix different components of the interface to perform the action?*
- *What modalities of feedback does the system have? How can they perform in harmony to give the reader the same information about the mapping?*
- *Can the interface be personalized for the reader? Can the interface be divided into broad categories within which readers may be able to personalize certain components?*

Table 33: Complexity of interface mapping

Complexity of interface mapping – how difficult or easy it is for the reader to understand, predict, and remember an action's consequence.	
Concept	**Design Guidelines**
Simplify complexities through affordances: *Affordances* and *attributes* can make mappings easier to understand, predict, remember as they provide logical connections between actions and consequences. Some affordances and attributes can be easier to understand and remember than others.	● Use *Sensorily perceived* affordances over other affordances to simplify complexities as readers are guaranteed to sensorily feel the action. Ex: hot tea will feel hot ● Use familiar body actions rather than metaphorical mappings while using *affective affordances* to simplify complexities, as metaphors can be more difficult to understand and remember. Ex: touching something soft to signify calmness (metaphor) vs. deep breaths to keep calm ● Be cautious while using *semantic affordances* as meanings of actions may vary with culture. Ex: thumbs-up gesture holds different meanings in different cultures. ● Use *attributes* such as *familiar actions (*deep breaths*), repetitions* (body tethers) to simplify complexities. When attributes such as *coupling* and *perceived agency* do not mimic real-life rules, they can add complexities.
Reinforce feedback from various modalities: modalities through which feedback is given – visual, audio, physiological response, ambience, among others	● Layer different modalities of feedback in harmony to give similar multiple reaffirmations of the mapping between the action and consequence. Ex: verbal acknowledgement of mapping Rangoli colors to affect was reaffirmed by the mood the ambience set
Complex but performatively rich actions: Some actions may	● Use actions that may have multiple *affordances* to add multiple interpretive possibilities. Keep the consequence of

be complex, not because of complex action-consequence mappings (like in the rows above), but because of the rich interpretive and performative options they may provide. Use these actions to keep up engagement levels and add variety as oversimplified interfaces can be boring	an action consistently positive or negative to avoid confusion. Ex: tea is warm (perceived) and calming (affective) but always had a positive impact in GWO ● Use multiple actions that may have similar *affordances* to provide rich performative opportunities. Ex: taking deep breaths and drinking a calming tea have the same effect. ● Sequentially introduce possibilities of actions that offer *attributes* such as varying *intensities*, allow *mixing* of components. Ex: sequentially introduce each color of the Rangoli before revealing colors can be mixed.
Personalized mappings: Personalize mappings and interface components for the reader to simplify complexities	● Ask readers to personalize the mapping between the action and consequences especially for *affective affordances*. Ex: choosing a drink that the reader finds calming ● Ask readers to personalize the components of the interface within broad categories and constraints. Ex: asking readers to choose any two healthy foods in GWO

11.4. Engaging and Satisfying Experiences

Throughout this chapter, I have described different complexities that may overwhelm readers if they are not able to successfully navigate through them (the reader's role, interface mapping complexity, among others). In the last section, I explained how the complexity of the interface mapping could be simplified using *affordances* and *attributes*. However, very simple interfaces where consequences to every action are predictable may get boring. In response, I introduced complex but performatively rich actions to keep the experience challenging and engaging. In this chapter, I introduce other techniques that can keep readers engaged. I recommend striking a balance such that readers are not overwhelmed, nor are they bored.

Narrative experiences with changing scenes can keep up engagement levels by breaking the monotony. I describe how scene shifts could be applied in diegetic tangible narratives. Using a mix of different actions, objects, and affordances can also add variety. Lastly, creating captivating beginnings and gradual endings can help provide a wholesome satisfying experience. These guidelines are more abstract and maybe broadly applicable to storytelling systems outside diegetic tangible narratives as well.

11.4.1. Dynamic Shifts in Scene

Narrative experiences can have changing scenes, logical breaks, and shifts in tension. A scene in a diegetic tangible narrative could consist of a physical space, characters, tasks, audio, and/or visuals. Changing one or more of the components listed above could signify a scene change. For example, in GWO the story moved from organ to organ, accompanied by different soundscapes and visceral descriptions. Moreover, Gummy encountered a different hurdle at every scene which helped keep up the reader's interest levels. In GWO, changing scenes came with a change in physical space, task, and soundscape. In SR, the scene change was more obvious as the story was divided into *chapters*, where the reader could change the ambient settings.

However, there were no scene changes in TNFT as readers just conversed with Minerva for 7-8 minutes in one location. Different scenes could have been designed to scaffold the reader's knowledge about the role. Readers could have picked up their wand, transformed, and practiced spells, all in different phases/locations. Minerva herself could have moved around as conversation arcs changed. These scene shifts could have engaged readers as they would explore different areas and would not be stuck in the same place talking to her.

Different scenes of the story may help provide step-by-step information to readers, introduce possible actions, allow readers to practice actions, and pace out major story events. This can help readers manage cognitive load and feel engaged. Scene changes can be created through shifts in tension as well – moving from high-stakes scenes, to resolving the scene, followed by a slower moment (calm drink), repeating the cycle. This was a successful strategy in GWO.

11.4.2. Variety of Actions, Objects, and Affordances

Different kinds of actions, objects, and *affordances* can give a range of interaction mechanisms that can keep up engagement levels. For example, in GWO a variety of affordances were used as readers were asked to eat something that feels a certain way or performs a certain function. Furthermore, readers could also perform body actions like belly rubs and deep breaths, which felt unique and broke the monotony of eating. This could have been applied to TNFT if readers drank different potions, performed body actions to cast spells, and explored and exchanged objects with Minerva. This design would have encouraged readers to perform various actions while using different affordances.

I recommend that a variety of different actions, objects, and affordances can break the monotony, keep readers engaged, and steer designers away from over-simplifying the system.

11.4.3. Captivating Beginnings and Gradual Endings

Creating captivating beginnings can hook readers into the narrative experience. In GWO, chewing Gummy and hearing him scream was a good hook as it startled the reader and guilted them for eating a sentient being. In TNFT, the visual transformation was a good hook as readers were pleasantly surprised to see themselves in VR. Adding unexpected and surprising scenarios early on can help create such hooks.

Lastly, just as it is important to have a strong beginning, it is also important to have a gradual ending. In most of my designs, the ending of the experience was abrupt, leaving the readers hanging. Readers should be eased out of the experience – characters can iterate the story conclusion and bid farewell to the readers, the interface can vanish, and those who visually transformed into the character can turn back into themselves. Applying this to my work, in TNFT, spells could have disappeared, Minerva could have walked away, the mirror could have told the reader that they tried their best, and the reader could have been asked to drop their wand and cloak. In SR, the ambience could have turned into neutral shades of white, and Shiva could have said farewell to the other characters. In GWO, the story pace could have slowed down, Gummy could have gone to the bowels where he was supposed to exit, and he could have thanked the reader, and said goodbye. In these ways, having captivating beginnings and gradual endings can help provide a wholesome satisfying narrative experience.

11.4.4. Guiding Questions and Summary

- *Does the experience have changes in scenes and shifts in tension? What are the different components of a scene (physical space, characters, tasks, audio, and/or visuals)? How can one or more of these components vary to specify a change in the scene?*
- *How many kinds of actions, objects, and affordances are available? Are there enough varying interactions to keep the experience non-monotonous?*
- *How can a narrative hook be created in the beginning to capture the reader's interest?*
- *How can the readers be eased out of the experience such that the ending is not abrupt?*

Table 34: Engaging and satisfying experiences

Engaging and satisfying experiences: strike a balance or readers are not bored nor overwhelmed	
Concept	**Design Guideline**
Dynamic shifts in scenes: change in scenes, logical breaks, shift in tension	● Change one or more components of a scene (physical space, characters, tasks, audio, and/or visuals) after logical breaks in the story to break the monotony. Ex: sounds, space, and hurdles changed for Gummy as he went from organ to organ ● Use change in scenes to provide step-by-step information, introduce and practice actions, and pace out major story events. Ex: in TNFT, readers could have picked up their wand, visually transformed, and practiced spells all in different scenes. ● Cycle between high-stakes, resolution, and slower calmer moments. Ex: In GWO, the high-stakes acid attack scene was followed by sharing a calming drink.
Variety of actions, objects, and affordances: Use different actions, objects, and affordances in the experience to add variety	● Use different actions, objects, affordances to make the experience non-monotonous. Ex: In GWO readers could eat, drink, and perform bodily actions while engaging with sensorily perceived and affective affordances.
Captivating beginnings: Beginnings that hook the reader's interest	● Capture the reader's interests through unexpected, surprising scenarios at the beginning of the experience. Ex: Chewing Gummy and hearing him scream startled readers and made them want to help him throughout the experience.
Gradual Endings: endings that are not abrupt	● Ease readers out of the experience in the end by iterating the story conclusion, characters bidding farewell to the readers, and visually transforming the reader back to themselves. Ex: in TNFT, spells could have disappeared, Minerva could have walked away, and the reader could have dropped their wand.

11.5. Summary

I identified a few common *complexities* that readers may face while taking internal-ontological roles and engaging with characters in diegetic interactive narratives - readers need to understand who their character is, how to perform actions and recognize *desired* actions, and what actions map to what consequences. All this information must be understood and retained by the reader as they consume the story, which can easily get overwhelming and hinder story coherence as well as CE. On the other hand, oversimplifying or guiding the reader too much may make them feel like they do not have much agency, or it may leave them unchallenged. I recommend helping readers navigate complexities such that they are not left overwhelmed, nor bored.

I recommend easing readers into their role by communicating information about the role repeatedly. In-world tutorials can be used to fill the experience with backleading cues that are spread out throughout the experience, giving information in small steps, one concept at a time. Roleplay concepts can be reinforced through different degrees of interaction (different kinds of interactions available) and modes of feedback working in harmony to provide similar information to the reader. Readers can be given opportunities to practice how to perform the role in scenes with low stakes.

I recommend backleading readers into taking *desired* actions with opportunities to make mistakes. Desired actions are actions that designers wish readers would take for story coherence and CE. With novel experiences, readers may wish to explore the narrative world and the actions available to them rather than interacting with characters or taking other *desired* actions. However, the goals of the reader and designer do not have to be at odds with each other. The reader's *desire to explore* can be leveraged to ease them into their role as they explore backstories and trinkets. Readers can also be given space early on in the experience to play out their curiosity. Furthermore, readers can be backled away from *undesired* actions by worsening and lasting consequences to actions, and by guilting readers for those consequences. Repeated undesired actions may eventually lead readers into hitting system boundaries (like hearing a repeated dialogue) which may make them feel like they are doing something 'wrong', which makes it all the more important to backlead them away from such boundaries.

However, this does not mean that readers always need to be led into taking the desired action. Mistakes are unintended negative consequences that can occur when readers take undesired actions. An experience where the reader only takes desired actions can become less interesting, while mistakes can add variety, add CE, and bring focus. Readers can be encouraged to make mistakes by allowing them to explore as many different actions as possible, out of which a few may have negative consequences. Open choices, which provide less backleading, can also lead readers into making mistakes. Repeated mistakes can be converted into high-stakes scenes.

I term *complexity of the interface* as how difficult or easy it is for the reader to understand, predict, and remember an action's consequence. *Affordances* and *attributes* can simplify interface mapping complexities as they provide logical connections between actions and consequences. Some *affordances* and *attributes* can be easier to understand and remember

than others. For example, *sensorily perceived* affordance almost guarantees that the reader will feel the action sensorily if brought attention to, which cannot be said for *affective* affordances. *Semantic affordances* too should be used with caution as actions may have different meanings in different cultures. *Attributes* such as *familiar actions* and *repetitions* can simplify complexities further. Lastly, asking the reader to personalize certain components in the interface can help them understand and remember the mappings between actions and consequences.

However, an oversimplified interface where the consequences are always predictable may make the experience monotonous. Providing complex but performatively and interpretively rich actions can keep readers challenged. Actions that have multiple *affordances* can add multiple interpretive possibilities. Multiple actions that may have similar *affordances*, actions that offer *attributes* such as varying *intensities*, and allow *mixing* of components, can provide rich performative opportunities. Using a variety of actions, objects, and affordances can also keep the experience challenging and non-monotonous.

The experience can be kept engaging through dynamic shifts in scene and tension. Scenes can be changed by a shift in the physical space, characters, tasks, audio, and/or visuals after logical breaks in the story. Capturing the reader's interests through unexpected and surprising scenarios in the beginning can hook them into the experience. Lastly easing readers out of the experience in the end can make the experience wholesome and satisfying.

Chapter 12. Conclusion

Tangible and bodily interactive narratives can facilitate multi-sensory and transportive experiences. Diegetic elements that are a part of the reader's reality and are a part of the story world, can provide readers gateways to enter and interact with the narrative world. While many novel storytelling systems apply the concept of diegesis, there is a dearth of knowledge in how to effectively design diegetic elements. In this dissertation, I provide design guidelines for creating diegetic elements in tangible and bodily interactive narratives, mainly in three less explored areas - help readers take internal-ontological roles, provide support for character engagement, and help readers navigate complexities of the novel system so they can fully engage with the narrative and characters. The research questions I address are:

RQ1: How can different diegetic elements be designed to position readers in internal roles (inside the story world) and ontological (impact story world) roles such that they feel the impact of their actions, and buy into why their actions cause a particular consequence?

RQ2: How can diegetic elements support aspects of character engagement (CE) such as - understand and adopt character goals and motives, feel for the character and root for them, feel what the character feels affectively, or/and take the character's identity, when readers interact with another character or take a character's role?

RQ3: what complexities might readers face while taking internal-ontological roles and engaging with characters in diegetic interactive narratives? How can readers be assisted in navigating these complexities such that they can intentionally impact and engage with the story?

I designed, created, user-tested (experience observation and interviews), and analyzed three storytelling systems sequentially to provide design insights into the three questions. Each system has varying diegetic elements, ways of engaging with characters, and aspects of complexity.

Shiva's Rangoli (SR) is a tangible interactive storytelling installation where the reader takes the protagonist, Shiva's role, and impacts his affective state through a diegetic tangible interface and diegetic ambient effects. The Next Fairy tale VR (TNFT) is a pre-show experience to a play where readers are encouraged to understand the antagonist of the play – Minerva, by playing

Minerva's sister, Calliope's role. They converse with Minerva by casting spells that change the affective tone of the dialogue between the characters. The system is full of diegetic backleading cues and diegetic actions to help readers play Calliope's role. Gummy's Way Out (GWO) is a food-based interactive narrative where the reader eats a gummy bear and then helps him find his way out through their body by consuming various diegetic food items and taking different bodily actions. The reader's body is placed in a diegetic role, and they are endowed with the gummy bear's well-being, who gives readers constant guidance on what to consume and how to help him.

I analyzed the insights from all three systems, along with the insights from existing works in literature to give design guidelines for creating diegetic elements focusing on the three research questions. These guidelines give intermediate-level design knowledge and are not universal, but they are abstract enough to provide design insights for creating tangible and bodily interactive storytelling systems using diegetic elements.

In the first set of design guidelines, I described how to leverage *affordances* and *attributes* to create logically convincing narrative consequences to the reader's diegetic actions in the story world. If the consequences of the reader's diegetic actions are not logically convincing, readers might question why their actions caused a particular impact in the narrative, perhaps breaking out of the experience. *Affordances* and *attributes* encourage designers to think about 'why does this action lead to this consequence?', hence they can reduce the possibility of readers questioning the logic between the action and consequence, creating more buy in. They can also help readers feel the impact of the action sensorily and emotionally, engaging their *lived* bodies. The reader's attention can be directed to the action and how it feels by acknowledging the action and the affordance in the narrative. Furthermore, if the action has a logical consequence in the narrative, readers may feel like they have more stakes in the story. From the analysis of my works, I identified the following affordances:

- *Affective affordances*: aspects of bodily actions and objects that can help readers feel, impact, and express /enact affective states in the story, like taking affectively performative bodily actions to impact the character's emotions (TNFT: taking deep breaths to cast the calming spell)

- *Semantic affordances*: aspects of bodily actions and objects that convey semantic (meanings/ associations) values attached to them, that can help readers express their sentiments in the story, like jabbing vs. patting someone or exploring objects/trinkets that hold value to the character (TNFT: Looking at old photographs and trinkets with Minerva to know more about their backstory)
- *Sensorily perceived and physically performed affordances*: aspects of an action that focus on how an action feels sensorily, how the action is performed physically, and the action's sensory, physical, and spatial impact, like leveraging the localized sensations (such as taste) of an action to impact the narrative (GWO: Gummy slipping on the oil in the greasy food consumed by the reader).

I term *attributes* as levers that shape how an action is experienced. They provide more ways of representing actions and consequences that can lead to more buy in, add more stakes, and make readers feel their actions more. I identified the following attributes – risks (stakes that actions and consequences provide), length and repetitions (duration of performance of action, repetitions of action), range and crafting (intensity of action, ability to mix several actions together), familiarity of action, coupling between the site of action and site of consequence, and perceived agency of consequence.

In the next set of design guidelines, I described how diegetic elements can help create character engagement, both from a first-person perspective (when a reader is playing a character's role) and from a second-person perspective (when the reader interacts with another character). Endowing readers with responsibility in the narrative such as the well-being of a character can give readers goals in the story world. Encouraging readers to adopt character goals by having similar interests and motivations can help them root for the character. Diegetic interfaces shared between the reader and character (such as the body in GWO) can add personal stakes for the reader which can be leveraged to create and resolve small conflicts between the reader and character, which in turn can aid allegiance. Actions that make characters and readers benefit and suffer together can also support allegiance. Navigating high-stakes scenes and giving readers *open choices* where they are backled less, can lead readers into taking actions that cause unintended harm to the character, which can further lead to feelings of sympathy and responsibility. Readers can be encouraged to wear a *mask* to come into character, by exploring the character's backstory through *semantic* objects, slowly visually transforming into the

character by performing *semantic* actions, performing actions the character would take, and by easing out of the role in the end.

In the third set of design guidelines, I described how to help readers navigate complexities they may face while interacting with diegetic narratives, so they can fully engage with the narrative and take intentional actions rather than exploratory ones. I identified that readers need to understand who their character is, their goals and responsibilities, how to perform actions and recognize *desired* actions, and what actions map to what consequences. These complexities can change based on the role the reader plays, the *degrees of interactivity* in the system, and how difficult it is to understand what action leads to what narrative consequence. Trying to navigate all these complexities while listening to the story can get overwhelming but having no complexities to overcome may not keep the reader challenged and engaged. I give design guidelines to help readers navigate complexities such that they are not overwhelmed, nor bored.

I recommend easing readers into their role by saturating the experience with backleading cues that are repeatedly spread out throughout the experience. In novel experiences, readers may feel like they want to explore the system. The reader's desire to explore can be leveraged to help them get into character, and readers can be given space for exploration early on in the experience. Readers can be deterred away from *undesired* actions and system boundaries (like hitting repeated dialogues) through worsening and lasting consequences to actions and by guilting readers for taking those actions, so they do not feel a lack of agency. However, undesired actions do not need to be eliminated completely. Readers can be given space to take undesired actions and make *mistakes*, that is, cause unintended negative consequences like unintentional harm to the character as mistakes can add variety, aid CE, and bring focus. *Affordances* and *attributes* can be leveraged to make logical connections between actions and consequences that can be easy to understand and remember. Providing complex but performatively and interpretively rich actions like actions that have multiple affordances, can avoid oversimplification of the system, and keep readers challenged. Lastly, the experience can be kept engaging through dynamic shifts in scene and tension, captivating beginnings, and satisfying endings.

Designers can use the above design guidelines while creating diegetic elements for tangible and bodily interactive narratives that can help readers buy into the consequences of their actions, feel the impact of their actions, engage with characters, and navigate through system complexities. While this work is likely to benefit the TEI community, storytellers and designers beyond academia can also use this work. There has been a recent rise in interactive TV shows and narrative games (tangibles and VR) that can benefit from leveraging diegetic elements, affordances, and identifying complexities. Interactive theater, mixed reality spaces (like Meow Wolf), and amusement parks already integrate tangible and bodily interactions, place readers inside story worlds, and have the advantage of engaging people in popular story worlds. They can use these dissertation design guidelines to further think of ways to give readers ontological roles by applying different affordances. Interactive dining experiences can leverage the rich affordances and storytelling opportunities of food to created food-based interactive narratives. Museums may find this work useful for retelling stories from history, where the *plot* can not be changed, but readers can still be given internal-ontological roles to relive stories from different cultures and different time periods, by interacting with various diegetic relics. Marketing companies can use this work to create stories that viewers can connect with, leveraging their tangible products as diegetic objects. Beyond storytelling, analog games can apply affordances to game mechanics by thinking about the underlying question– '*why does this action cause this consequence in the game?*' The TEI community beyond storytelling working on playful and reflective design areas such as enchanted IoT, engaging with memories, self-reflection, among others can also apply the concept of diegesis and affordances to think about possible actions and consequences of those actions.

There is much more to be explored in this domain of diegesis beyond this dissertation. All my studies were conducted in controlled environments, and how these guidelines evolve in the real world (amusement parks, mixed reality spaces, interactive dining) is yet to be explored. In real-world deployments, there are more stakeholders like storytellers and chefs who can bring in more perspectives. The researcher is not present while the reader interacts with the system, which may unfold more complexities. There may be multiple participants experiencing the system at the same time which presents many challenges like how to give narrative stakes to everyone, and how to manage interactions amongst participants. On the other hand, amusement parks may have the ability to engage people in popular story worlds which gives

them the advantage of leveraging the participant's existing knowledge about the story world and characters. Real-world deployments can also explore the long-term use of interactive narrative systems rather than one-time novel experiences, and how such experiences can be designed to offer participants something more with every return visit.

There were a few less-explored design areas mentioned in the dissertation, that can be investigated further. I wrote about using external vibrations to feel the character's physiology in TNFT and to feel Gummy moving inside the body in GWO, but I was unable to test these ideas. Augmenting sensory experiences in interactive narratives to help readers feel the impact of their actions is worth exploring as they can add realism. Another untested design area that is worth exploring further is integrating diegetic objects in the story world that have personal meaning to readers (like a collector's item), as such objects can add personal stakes in the narrative for the reader. These objects can act as shared diegetic interfaces between the reader and character and can be used to negotiate relationships between them.

There are a few theoretical concepts in the dissertation that can be explored further as well. The *affordances* that I identified come from limited work, and there may be more ways to logically connect diegetic actions and consequences. Similarly, there may be more complexities that readers may need to navigate beyond the ones mentioned in this dissertation, that need more investigation. While most of my dissertation work comes from a designer's point of view, research from a story writer's perspective can also drive the diegetic interactive narrative space further by exploring concepts such as how the story can backlead readers through complexities, and how to pace out the story so readers are not overwhelmed.

As the mediums of storytelling progress, we must continue to strive for creating storytelling experiences that inspire, move, and evolve us. Diegetic tangible and bodily interactive narratives have the power to bring readers closer to the narrative through rich multi-sensory experiences. I hope this dissertation inspires designers and storytellers to leverage the poetic and transportive concept of diegesis to help readers step into, enact, impact, and feel fictional and magical worlds.

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Appendix A. Shiva's Rangoli Interview Questions

Story Comprehension

1. In your own words, what were the stories about? How did they end?
2. Would you please speculate on what might happen next in the stories?
3. Was there any point where you felt distracted/confused?

Engagement and Motivation

4. Were you engaged and or immersed in the experience? What connected/immersed you most to the experience?
5. Did you listen to both stories all the way through? Why or why not?

Mental Model

6. How do you think the system works? Could you the behavior of the system?
7. How did you interpret the mapping of the Rangolis? How long did it take you to figure out this mapping?

Ambience and mood

8. Was there a relationship between the mood you created and the story content?
9. At any point, did you perceive any mismatch between the story content and the ambience?
10. Were the stories happy or sad? Why? What was the overall mood of the experience?
11. What did setting up an ambience do for you? <probes> Set emotional context? Just drive the narrative? Means to decision-making? Or something else?

Decision making and choice

12. Could you describe your decision-making process when selecting Rangoli?
    a. Did you try to use the Rangoli to direct the outcome of the story?
13. Did you feel like you were given narrative choices by the system?

a. (If yes) How did you feel about those choices?

14. Do you think the story would be different if you experienced it a second time, and made different choices?

15. Do you feel like the ending reflected your choices with the Rangoli? What kind of ending did you expect from the story?

Character engagement

16. Which of the characters, if any, did you relate most closely to?

17. What do you think your role was within the experience? Why?

Closing

18. Is there anything you would like to change about this experience?

19. How else would you use this system?

Appendix B. The Next Fairy Tale Interview Questions

Experiences

1. Do you like theater and/or musicals? Have you seen one before? how many?
2. Have you ever experienced virtual reality before? When / How?

Comprehension

3. In your own words, what was this conversation about?
4. Walk me through what happened in the experience. How do you think this experience worked?
5. Was there any point where you felt distracted/confused?

Engagement and motivation

6. Were you engaged and or immersed in the experience? What connected/immersed you most to the experience?
7. Did you listen to the experience all the way through? Why or why not?

Mental model

8. What did the balls do? What did they represent?
    a. What did the different colors represent?
    b. What was their effect on the experience?
9. How long did it take for you to get the hang of everything? What helped?
10. What were the toughest things to understand?

Decision making and choice

11. Describe your decision-making process when selecting the spells? how did you choose what spell to select next?
    a. Did you try to use the spells to direct the outcome of the conversation?
    b. What all were you able to control or manipulate in the experience/conversation?
    c. <prompt> What were you able to influence in the conversation?
12. What kind of ending did you expect from the conversation? Why?
    a. Do you feel like the ending reflected your choices with the spells?

13. Do you think the conversation would be different if you experienced it a second time, and made different choices? In what way?

Character engagement

14. What do you think your role was within the experience?
15. Why do you think you were Calliope (or someone else)?
16. How did you feel about adopting this role? What did it allow you to do / not do? would you have preferred another role (like just being an observer, or a third person guiding the characters?)
17. Who did you personally feel like? Calliope, an actor, a player, an observer, or anything else?
    a. What made you feel this way? Anything in the system?
    b. How was your experience with the mirror?
18. What is your view on Minerva, how is her character?
19. Do you feel inclined to watch the original musical after this experience? why or why not?

VR specific

20. Do you feel you could have done more in this VR experience?
    a. What else did you want to do in this experience?
21. How did you find the interaction with the emotion spells? Would you have preferred something else?
22. What did you like about the experience?
23. What did you not like about the experience? What would you change?

Appendix C. Gummy's Way Out Interview Questions

Personal

1. Briefly describe your experience with Interactive Storytelling. Any experiences before this?
2. Briefly describe what role does food play in your life? What is your relationship with food?

Opening

5. In your words, what was this experience about?
6. Would you say you were engaged in the experience? What kept you engaged?
7. Were there points where you felt confused or did not know what to do? Felt confused? Overwhelmed? where? Why?
    a. (prompt) Did that impact your experience? How?
8. Were there any points that you found dull / boring / going slow / dis-engaged? where? Why?

Choices

9. Let's talk about how you chose what to eat. What did you choose to eat and why?
    a. (prompt) Let's talk about specific examples from as much as you can remember – stomach acid, spleen, bowels, heart.
    b. (prompt) Were your choices guided by the gummy bear / what you like or dislike / what your felt was good for your body? Why?
10. How do you think your choices were impacting the experience? what were you able to control manipulate in the experience? Give examples you remember – stomach, intestine, spleen, blood, bowels heart
    a. (prompt) What effect do you think your choices / actions had on the gummy bear?
    b. (prompt) How did you feel when your choices / actions had a good or adverse effect on the gummy bear? give examples

11. How easy/difficult was it to predict / anticipate what impact your choice would have on the gummy bear? how did you figure this out? Was there a mismatch of expectation and what happened anywhere?
12. If you were to experience this again, are there any different choices you would make? Which ones and why?
13. (optional) Were there any points where you felt your choices would have a big impact on the gummy bear? Where? Why?
    a. What choice did you make then? Why?

Engagement with Gummy

14. When the experience started, how did you feel about eating the gummy bear?
15. What were your feelings towards the gummy bear? What made you feel this way, specific examples?
16. How would you describe your relationship with it? What made you feel this way, specific examples?
    a. (Prompt if needed) Did you feel responsible / concerned or care about Gummy? Why or why not? Any specific examples?

Body

17. What was your role in this experience? who were you?
18. What role did your body play in this experience? what made you feel this way?
    a. (prompt) What was the mental image you had in your head during the story? What in the system helped to create this image?
    b. (prompt) Did you feel like you / your body were a part of the story world? In what way? What helped? Specific examples.
19. How did you feel about this role and your body's role? What did it enable you to do? How did it add to the story experience?
    a. (prompt) Imagine this experience was digital and your body was not a part of the experience. What would it take away?
20. Were there points in the experience where your attention was drawn to your body / thought about what's happening in the body? When and why? What did that add?

21. How easy/difficult was it to figure out that your role, relation with Gummy, the body was the interface, and how you were supposed to interact? What helped?

Act of eating

22. Which of these foods do you like / dislike?
23. In this experiment, the gummy bear was telling you the impact of what you just ate on the gummy and on your body. How was that experience? How did you feel while eating these foods?
24. Did you enjoy eating the healthy / unhealthy foods in the experience? why or why not? - Specific examples
25. How would this experience be different if it were digital, and you were not actually eating?
    a. What would be taken away from the experience?
    b. Would the choices you made change? Why or why not? Specific examples
    c. Do you think the way you felt for Gummy would change? Why or why not?
    d. To summarize, what did the act of actually eating / putting something in your body and impact Gummy enable you to do? What did it add for you in the story experience (compared to digital)?

Emotion personalization

22. Tell me about the calm drink, why did you choose it? When do you drink it?
23. In the experience, Gummy prompted you to drink the calm drink. How was that experience? Anything the stood out?
    a. (prompt) how did you feel while drinking it? Why?
24. What happened to Gummy? how did that make you feel? why?
25. To summarize, what did this segment add to your experience of the story? What did it enable you to do? OR If this were digital what aspects of the experience would be taken away?

Body acts

26. There were points where Gummy asked you to rub your stomach. How was that experience? Anything the stood out?
    a. What did you choose to do and why?
    b. How did you feel while taking this action? why?
27. What did this segment add to your experience of the story? What did it enable you to do? OR If this were digital, what would be taken away?

28. There were points where the gummy bear asked you to take deep breaths – heart, blood. How was that experience? anything that stood out?
    a. What did you choose to do and why?
    b. How did you feel while taking these deep breaths? Why?
29. What did this segment add to your experience of the story? What did it enable you to do? OR If this were digital, what would be taken away?

Wrap-up

30. What did you enjoy the most? Favorite parts? Why?
31. What did you take away? What helped?
32. Did this change your feelings or the way you view your own body / health / eating? How? Why or why not?
33. Did anything feel off? Any suggestions? What would you change?

Appendix D. Shiva's Rangoli Narratives

The River

Positive affect	Negative affect
In an era of early civilization, marked as the Golden age of truth and enlightenment, the Gods looked upon from up above marveling at their creation and the harmony within. The 3 Gods Shiva, Vishnu and Brahma were in a deep heated discussion. Brahma was known for his creations. The humans, the earth, and every tiny spec of life owed their existence to him. Vishnu was the maintainer, the delicate balance that made life possible was his responsibility. The almighty Shiva was known for his destruction. He destroyed what was no longer meant to be, giving space to new creation.	In an era of early civilization, marked as the Golden age of truth and enlightenment, the Gods looked upon from up above marveling at their creation and the harmony within. The 3 Gods Shiva, Vishnu and Brahma were in a deep heated discussion. Brahma was known for his creations. The humans, the earth, and every tiny spec of life owed their existence to him. Vishnu was the maintainer, the delicate balance that made life possible was his responsibility. The almighty Shiva was known for his destruction. He destroyed what was no longer meant to be, giving space to new creation.
Shiva was in the midst of making the perfect Rangoli, a beautiful symmetric pattern on the floor of his abode. Shiva often practiced this art form to express himself, as his Rangolis reflected how he felt. The Rangolis would shape the ambience of the heavens and everywhere on earth, mirroring his state of mind. Brahma and Vishnu approached Shiva and as they looked upon the vibrant Rangoli filled with shades of yellow and green, they were delighted to see that Shiva was in one of his good moods. The skies were light, harmonious and chirpy reflecting Shiva's pleasure. Brahma and Vishnu never thought twice before approaching him on such days, and so they decided that it was the perfect time to confront him on one of their never-ending arguments, Shiva's destruction.	Shiva was in the midst of making the perfect Rangoli, a beautiful symmetric pattern on the floor of his abode. Shiva often practiced this art form to express himself, as his Rangolis reflected how he felt. The Rangolis would shape the ambience of the heavens and everywhere on earth, mirroring his state of mind. Brahma and Vishnu approached Shiva, and as they looked upon the bold Rangoli filled with shades of blue and red, they understood that Shiva was not in the best of his moods. The skies were dark, gloomy, and enraged, reflecting Shiva's displeasure. Brahma and Vishnu always thought twice before approaching him on such days, yet today they mustered the courage to confront him on one of their never-ending arguments, Shiva's destruction.
"Do you remember the beautiful ice age that once existed?" asked Brahma. "You just had to melt that down didn't you, Shiva?" Shiva's rangoli was turning into shades of yellow and green as he maintained his calm during the argument. He pacified Brahma, "The ice age had gone too far, and no living thing was able to survive in those conditions. It is that melt down that helped you create those humans."	"Do you remember the beautiful ice age that once existed?" asked Brahma. "You just had to melt that down didn't you, Shiva?" Shiva's Rangoli was turning into shades of blue and red as he was getting annoyed and angry with Vishnu and Brahma. He snapped back, "The ice age had gone too far, and no living thing was able to survive in those conditions. It is that melt down that helped you create

Vishnu too joined in the argument, “And what about the era of the dinosaurs, that meteor was just out of rage Shiva! Do you know how hard I worked to maintain balance in that environment?” Shiva laughed, “Oh that was one of your most boring works, all those dinosaurs did was eat each other, there was absolutely no spice to it.” Brahma and Vishnu decided to take advantage of Shiva’s unusually cheerful mood and ambushed him by expressing their unhappiness as he destroyed everything they created and maintained. After a long discussion, Shiva finally gave in and promised them this. “Fine! One creation and that is it. This creation will exist till you both do. It will die when time itself ceases. I shall not touch this creation of yours.”	those humans.” Vishnu too joined in the argument, “And what about the era of the dinosaurs, that meteor was just out of rage Shiva! Do you know how hard I worked to maintain balance in that environment?” Shiva dismissed his remark saying, “Oh that was one of your most boring works, all those dinosaurs did was eat each other, there was absolutely no spice to it.” Brahma and Vishnu ambushed Shiva by expressing their unhappiness with him as he destroyed everything they created and maintained. After a long discussion, Shiva finally gave in and promised them this. “Fine! One creation and that is it. This creation will exist till you both do. It will die when time itself ceases. I shall not touch this creation of yours.”
Vishnu and Brahma were delighted and after giving it a thought they went to Shiva with the proposal of the river Jhanvi. “I would like to create an eternal river,” said Brahma. “This river would be the heart and soul of all the living” added Vishnu. “And to maintain the purity of Jhanvi we wish to give her special powers. She will be capable of granting people what they wish for but only if their intentions are of utmost purity, if not, Jhanvi has the freedom of teaching them a lesson in her own way.” Shiva warned them “I hope you both know what you are doing, eras will come and go but Jhanvi will be a part of every time that comes into existence.” Braham and Vishnu nodded in joy. Shiva took a drop of his sweat and released it down onto the mighty Himalayan Mountain range. The mountains parted, giving way to Shiva’s droplet as it transformed into the holy river.	Vishnu and Brahma were delighted with their victory and after giving it a thought they went to Shiva with the proposal of the river Jhanvi. “I would like to create an eternal river,” said Brahma. “This river would be the heart and soul of all the living” added Vishnu. “And to maintain the purity of Jhanvi we wish to give her special powers. She will be capable of granting people what they wish for but only if their intentions are of utmost purity, if not, Jhanvi has the freedom of teaching them a lesson in her own way.” Shiva warned them “I hope you both know what you are doing, eras will come and go but Jhanvi will be a part of every time that comes into existence.” Braham and Vishnu nodded in joy. Shiva took a bead of his sweat and released it down onto the mighty Himalayan Mountain range. The mountains parted, giving way to Shiva’s droplet as it transformed into the holy river.
The Gods visited the human in their dreams to tell them about the new river, and her mystical powers. The humans worshipped the river and took good care of her. They witnessed her magic, as she granted peace and prosperity to those with a pure conscience and righteously punished those who came to her with dark desires. The lands flourished and Jhanvi fulfilled her duty for years and years.	The Gods visited the humans in their dreams to tell them about the new river, and her mystical powers. The humans worshipped the river yet feared her rage. They witnessed her magic as well as her darkness, as she granted peace and prosperity to those with a pure conscience and her wrath was unleashed on those who came to her with impure desires. The lands flourished and Jhanvi fulfilled her duty for years and years.

As the eras went by, the tale of the river started to lose its charm. Many people no longer believed in her magic. They became ignorant and stopped to care for the river. Jhanvi was no more a home to the thousands of creatures that lived within her. Many of the other rivers dried up because of the humans, but not Jhanvi, she was meant to go on forever. While a few humans still believed in her powers and fought for her, Jhanvi remained unhealthy, and her tainted aura trickled down to the humans as well. Humans started falling sick and their numbers decreased drastically.	As the eras went by, the tale of the river lost its charm. People no longer believed in her magic. They became ignorant and stopped caring for the river. Jhanvi was no more a home to the thousands of creatures that lived within her. Many of the other rivers dried up because of the humans, but not Jhanvi, she was meant to go on forever. She was unhealthy, unhappy and her tainted aura trickled down to the humans as well. Humans started falling sick and their numbers decreased drastically.
From up above Shiva, Vishnu and Brahma observed with deep concern. Vishnu said, "I was unable to maintain her purity. I will fix Jhanvi." Shiva was feeling oddly calm that day and his serenity was echoed by the rare sunny and gentle lands. He looked at Vishnu and pacified him, "This is not your fault Vishnu, this era has witnessed humans in their most unpleasant form. They are responsible for her, and they shall fix her". The Gods once again paid a visit to the humans in their dreams and asked them to restore the river's purity. From the very next day, humans started cleaning out Jhanvi and tried their best to restore her. However, the majority of the race was still ignorant, and the process of the cleansing was a slow and painful one. The river occasionally bestowed her magic on the ones that tried to save her, yet she continued to punish the ones that polluted her.	From up above Shiva, Vishnu and Brahma observed with deep concern. Vishnu said, "I was unable to maintain her purity. I will fix Jhanvi." Shiva was feeling upset that day, and his annoyance was echoed by the dingy and sad lands. He frowned at Vishnu and patronized him, "You are not the only one to blame, Vishnu. This era has witnessed humans in their ugliest form. They are responsible for her, and they shall fix her. "The Gods once again paid a visit to the humans in their dreams and demanded them to restore the river's purity, warning them of the repercussions. From the very next day, humans started cleaning out Jhanvi, trying to restore her in fear of the consequences. However, the majority of the race was still ignorant, and the process of the cleansing was a slow and painful one. The river continued to punish the ones polluting her, raising a havoc of illness on them.
Vishnu and Brahama were extremely concerned. "Shiva, the river will kill the humans, we can no longer control her. She must be stopped," said Vishnu. As Vishnu and Brahama continued to pester Shiva, Shiva sat down and started creating a rangoli, a form of art he practiced to clear his mind. Brahma and Vishnu looked down at the rangoli, trying to assess Shiva's temperament, and thus the fate of the river Jhanvi that lay in his hands.	Vishnu and Brahma were extremely anxious. "Shiva, the river will kill the humans, we can no longer control her. She must be stopped," said Vishnu. As Vishnu and Brahma continued to pester Shiva, Shiva sat down and started creating a Rangoli, a form of art he practiced to clear his mind. Brahma and Vishnu looked down at the Rangoli, trying to assess Shiva's temperament, and thus the fate of the river Jhanvi that lay in his hands.
Vishnu and Brahma felt a ray of hope as they saw the Rangoli made with sparkling patterns of yellow and green. The skies turned peaceful	Vishnu and Brahma were terrified as they saw the Rangoli made with daring patterns of red and blue. The skies turned bloody and

and joyful as Shiva's tranquility flooded into the human world. Shiva exclaimed, "Because of my vow, I cannot take away the river, but I can try to purify her, however, the repercussions of her cleansing are beyond my control". As Shiva spoke, he began to purify Jhanvi, and rains trickled down on earth. It rained for days, weeks and then months. As the river's purity was restored from the new rains, the humans struggled to survive the harsh new lands that were born, and their numbers started to decrease. On the 108th day of the rain, when the last few humans stood on earth, Jhanvi rose to massive heights. She whispered to the humans, "I once gave you peace and prosperity, but you made me incapable of nurturing you any further. The Gods have granted me a new life. I will continue to fulfill my duty; I hope this time you fulfill yours". As the river's words vanished, the last of the surviving humans ran frantically, hoping to seek any source of shelter left untouched by the river's cleansing. The next day, the rains stopped, and Jhanvi sparkled under the sun, in all her glory.	mournful as Shiva's rage flooded into the human world. Shiva exclaimed, "The humans have brought this upon themselves. Because of my vow, I cannot take away the river, but I can give her a new home where she will once again be pure and looked after." Shiva broke into his unstoppable dance 'Tandava' and the lands flooded with rains. It rained for days, weeks and then months. As the river's purity was restored from the new rains, the humans grew lesser in number. On the 108th day of the rain, when nearly the entire human race was wiped out, Jhanvi rose to monstrous heights. With all her power and rage she roared to the humans, "I once gave you peace and prosperity and you paid me back by defiling me. Do you not realize that my water is feeding you? I am the very reason you survive. But you have defiled me enough, and it is time this stops." As the river's words vanished, the last of the surviving human race came to an end. The next day, the rains stopped, and Jhanvi sparkled under the sun, in all her glory.
"Shiva! The cleansing gave Jhanvi a new life, but I am yet to find any humans that survived." exclaimed Brahma. Shiva replied calmly, "You made me promise that I could not destroy Jhanvi, this was the only way to end the madness. The humans' havoc had not only touched Jhanvi but nearly everything you created. I give you a blank canvas once again Brahma, now create creatures that are worthy of the river and whatever else we have to offer."	"Shiva! You destroyed the human race!" exclaimed Brahma. "They were my most intelligent creation." Shiva replied calmly, "Had they been that intelligent they would have taken care of the holy river. You made me promise that I could not destroy Jhanvi, this was the only way to end the madness. The human's havoc had not only touched her but nearly everything you created. I give you a blank canvas once again Brahma, now create creatures that are worthy of the river and whatever else we have to offer."

The Medicine

Positive Affect	**Negative Affect**
Vayu and Rekha were a happy and pious couple that lived in a village just off the banks of river Jahnvi. They worked as farmers and their wages were just about enough for them to live a comfortable life. Soon they were blessed with a baby girl, who they called Nandini. Nandini was the heart and soul of her parents. The years went by, and the small	Vayu and Rekha were a happy and pious couple that lived in a village just off the banks of river Jahnvi. They worked as farmers and their wages were just about enough for them to live a comfortable life. Soon they were blessed with a baby girl, who they called Nandini. Nandini was the heart and soul of her parents. The years went by, and the small

family took care of the farms and made their living.	family took care of the farms and made their living.
Vayu was a sincere devotee of God Shiva. He firmly believed in the scriptures that perceived the world as an image of Shiva's aura as they believed that the Earth's skies would shape themselves to reflect Shiva's emotions. They also stated that Shiva's Rangolis were a holy form of art as he often expressed his feelings through these Rangolis. Vayu's devotion towards Shiva was remarkable. On happy and harmonious days like today, Vayu's prayers would always be answered. On such days, the blissful lands would fill the sky with a tinge of yellow and green, as they mimicked Shiva's Rangoli and his cheerful mood.	Vayu was a sincere devotee of God Shiva. He firmly believed in the scriptures that perceived the world as an image of Shiva's aura as they believed that the Earth's skies would shape themselves to reflect Shiva's emotions. They also stated that Shiva's Rangolis were a holy form of art as he often expressed his feelings through these Rangolis. Vayu's devotion towards Shiva was remarkable. Even on sad and stormy days like today, Vayu's prayers were not left unheard. On such days, the harsh and dark lands would fill the sky with a hint of red and blue, as they mimicked Shiva's Rangolis and his unpleasant mood.
Money was a never problem with just Vayu and Rekha, but as Nandini grew up, Vayu wished to provide her with all that she wanted and more. One night, Nandini started shivering, and she woke her parents up complaining. "Mother, I feel very cold and my body hurts." Vayu rushed her to the village hospital where the doctors looked after her overnight. As dawn broke, Nandini's condition worsened. The doctors tried to diagnose her all night but were unsuccessful. Heart-broken yet hopeful, Vayu took Nandini back home.	Money was never a problem with just Vayu and Rekha, but as Nandini grew up, Vayu wanted to provide her with all that she wanted and more. One night, Nandini started shivering, and she woke her parents up complaining. "Mother, I feel very cold and my body hurts." Vayu, panic stricken, took her to the village hospital where the doctors kept her overnight. As dawn broke, Nandini's condition worsened. The doctors tried to diagnose her all night but were unsuccessful. Heart-broken yet hopeful, Vayu took Nandini back home.
With all his determination, Vayu prayed to God Shiva for help. Shiva was at his abode, gazing at the lively yellow and green Rangoli he had just created. The Heavens and the lands were bright, jovial, and peaceful as they symbolized Shiva's state of mind. Shiva immediately went to visit Vayu in his dreams and whispered "My child, I have heard your prayers. Go to river Jhanvi and ask her what you want. She will grant your wishes if your intentions are pure." Jhanvi was born from the essence of God Shiva. Hence her personality, temperament, and powers were all an embodiment of the mighty God himself.	With all his determination, Vayu prayed to God Shiva for help. Shiva was at his abode, gazing at the vivid red and blue Rangoli he had just created. The heaven and the lands were catastrophic and gloomy as they symbolized Shiva's state of mind. The infuriating day was hindering Shiva's rationality; hence he asked the holy river Jhanvi to help his devotee instead. Jhanvi was born from the essence of God Shiva and thus, her personality, temperament, and powers were all an embodiment of the mighty God himself. Shiva told Vayu, "My child, I have heard your prayers. Go to river Jhanvi and ask her what you want. She will grant your wishes if your intentions are pure."
Vayu abruptly woke up and ran to the river in the dead of the night. He bowed down and	Vayu suddenly woke up and ran to the river in the dead of the night. He bowed down and

prayed to her for Nandini's health. The calm and shimmering river came to life and softly whispered, "Vayu, you have a clear heart and a pure conscience, take my water and tomorrow, let the first ray of light hit the water you have taken. The water will turn golden, ask your daughter to take a sip of this and her health will be restored." Vayu carried her water in his flask and followed river Jhanvi's instructions. At dawn, Nandini took a sip of the holy water and the color on her face immediately returned. She gained her health back in no time. Vayu and Rekha felt relieved and thanked the Gods and the river for their grace.	prayed for Nandini's health. The holy river came to life and roared back, "Vayu, you have a clear heart and a pure conscience, take my water and tomorrow, let the first ray of light hit the water you have taken. The water will turn golden, ask your daughter to take a sip of this and her health will be restored." Vayu carried her water in his flask and followed river Jhnavi's instructions. At dawn, Nandini took a sip of the holy water and the color on her face immediately returned. She gained her health back in no time. Vayu and Rekha felt relieved and thanked the Gods and the river for their grace.
After a few days, Vayu headed out to the vibrant village market. "Vayu, how is Nandini now?" asked a familiar voice. Vayu turned to find his friend Vijay calling out. Vayu told Vijay that Nandini was doing well and that he had finally found a medicine that worked. He hid the details of his encounter with the river. "That is good news, Vayu. This disease seems to be spreading in the village". said Vijay. Vayu exclaimed, "that is terrible, have the doctors found a cure, yet?" Vijay told him that they were unsuccessful, and the patients' conditions were aggravating. A streak of greed glimmered in Vayu's eyes as he realized that he was the only one with the cure. He started to imagine a life full of prosperity for Nandini. "I will get more medicine from the merchant. Just a sip of it will work but it costs 2 gold coins for every sip. Ask the ones affected to come to me for the medicine." Vayu gave a sip of the golden water to everyone in need, charging two gold coins each. Soon, Vayu had a sack of gold, and the flask of the holy water was empty.	After a few days, Vayu headed out to the noisy and murky village market. "Vayu, how is Nandini now?" asked a familiar voice. Vayu turned to find his friend Vijay calling out. Vayu told Vijay that Nandini was doing well and that he had finally found a medicine that worked. He hid the details of his encounter with the river. "That is good news, Vayu. This disease seems to be spreading in the village". said Vijay. Vayu exclaimed, "that is terrible, have the doctors found a cure, yet?" Vijay told him that they were unsuccessful, and the patients' conditions were aggravating. A streak of greed glimmered in Vayu's eyes as he realized that he was the only one with the cure. He started to imagine a life full of prosperity for Nandini. "I will get more medicine from the merchant. Just a sip of it will work but it costs 2 gold coins for every sip. Ask the ones affected to come to me for the medicine." Vayu gave a sip of the golden water to everyone in need, charging two gold coins each. Soon, Vayu had a sack of gold, and the flask of the holy water was empty.
Karma came to pay a visit to Vayu, as the day that the flask was empty, was when his wife Rekha fell prey to the disease. A distraught Vayu ran to river Jhanvi and pleaded her for more holy water. The serene river tinted with the green-yellow skies, rose and said, "I am sure, that the water you took last time could cure your wife. Let her sip that water." Vayu, ashamed to tell the river that he had made	Karma came to pay a visit to Vayu, as the day that the flask was empty, was when Vayu's wife Rekha fell prey to the disease. A distraught Vayu ran to the river and pleaded her for more holy water. The agitated river tinted with the blue-red skies, rose and thundered, "I am sure, that the water you took last time could cure your wife. Let her sip that water." Vayu, ashamed to tell the

money by selling that water to those in need, quickly lied to her, “my daughter was very ill, and it took the whole flask to cure her.” The river gleamed and gently whispered, “Very well, then. Take more water and do the same as last time. Your wife will be cured.” Vayu followed her instructions, and Rekha was in full health the next day. Vayu was relieved, but his greed was still unsated. He continued to sell the holy water as medicine to those in need.	river that he had made money by selling that water to those in need, quickly lied to her, “my daughter was very ill, and it took the whole flask to cure her.” The dark river mysteriously whispered, “Very well, then. Take more water and do the same as last time. Your wife will be cured.” Vayu followed her instructions, and Rekha was in full health the next day. Vayu was relieved, but his greed was still unsated. He continued to sell the holy water as medicine to those in need.
After a few days, Rekha screamed, and Vayu came running to her aid. “Vayu, I cannot see anything. Everything is dark. What is happening to me?” yelled Rekha. Vayu was scared and suddenly heard a mob ragefully knocking at his front door. “Vayu, open up! The medicine you gave my daughter, it has turned her deaf.” Said one of the villagers. “My husband has been paralyzed ever since he drank that medicine, what have you given us,” shouted a lady. A terrorized Vayu bundled himself in a corner and realized what had happened. He was full of shame and guilt. That night, he made his way to the holy river again.	After a few days, Rekha screamed, and Vayu came running to her aid. “Vayu, I cannot see anything. Everything is dark. What is happening to me?” yelled Rekha. Vayu was scared and suddenly heard a mob ragefully knocking at his front door. “Vayu, open up! The medicine you gave my daughter, it has turned her deaf.” Said one of the villagers. “My husband has been paralyzed ever since he drank that medicine, what have you given us,” shouted a lady. A terrorized Vayu bundled himself in a corner and realized what had happened. He was full of shame and guilt. That night, he made his way to the holy river again.
Vayu confessed his sins to River Jhanvi and begged for her forgiveness as he prayed for the health of his people. The river rose up and with a calm voice called out to him, “I know what you did Vayu. Since you lied to me and sold the holy water, your intentions were of greed and your soul was not pure. The second flask of water cured the villagers but also took something away from them. I am glad that you have realized your mistake. However, I do not have the ability to undo the sufferings, only God Shiva has that power. That night, Vayu prayed to Shiva. In his dreams, he caught a glimpse of Shiva creating the perfect Rangoli. Vayu knew that Shiva’s Rangolis often reflected the God’s temperament. He felt that this Rangoli was going to determine his fate.	Vayu confessed his sins to River Jhanvi and begged for her forgiveness as he prayed for the health of his people. The river rumbled, “I know what you did Vayu. Since you lied to me and sold the holy water, your intentions were of greed and your soul was not pure. The second flask of water cured the villagers but also took something away for them. I am glad that you have realized your mistake. However, I do not have the ability to undo the sufferings, only God Shiva has that power. That night, Vayu prayed to Shiva. In his dreams, he caught a glimpse of Shiva creating the perfect Rangoli. Vayu knew that Shiva’s Rangolis often reflected the God’s temperament. He felt that this Rangoli was going to determine his fate.
The Rangoli sparkled with intricate designs of yellow and green. Shiva was content and joyous, and the earth’s radiance expressed his emotions. Shiva forgave Vayu saying,”	The Rangoli glared with intricate designs of red and blue. Shiva was vexed and displeased, and the earth’s somber skies expressed his emotions. Shiva scolded Vayu

Vayu, to cure the ailing, cook with the river's water and feed the ones suffering for a few days, once you make up for your sins, their suffering will be undone."	for his sins, but took pity on the victims of Vayu's doings, "To cure the ailing, cook with the river's water and feed the ones suffering for a few days, once you make up for your sins, I will see when the suffering can be undone," said Shiva.
Vayu followed Shiva's instructions, and hoped with all his heart that his wife and the villagers would be healthy and jovial again. Rekha's condition gradually improved as Vayu repented for his actions. With all the gold collected, he not only fed the ones suffering but the entire village itself. He prayed to the river and to the Gods for the health and happiness of his people, hoping for the unwell to recover soon.	Vayu followed Shiva's instructions, and hoped with all his heart that his wife and the villagers would be healthy and jovial again. Rekha's condition gradually improved as Vayu repented for his actions. With all the gold collected, he not only fed the ones suffering but the entire village itself. He prayed to the river and to the Gods for the health and happiness of his people hoping for all the unwell to recover soon.

Appendix E. The Next Fairy Tale Narrative

MIRROR: Calliope! Calliope! I know you're near, my queen. You are needed. Calliope? Great Mother defend me, that woman spends more time mingling with the commoners than she does among her own people. Calliope!

(MIRROR cuts off when he sees the reader / CALLIOPE, who speaks in CALLIOPE's voice.)

CALLIOPE: I'm here, Mirror. Stop your fretting.

MIRROR: My word, Calliope! You look like a peasant when you take that form. Please take your true shape quickly! We have serious matters to discuss.

(Reader transforms into CALLIOPE.)

CALLIOPE: How's this?

MIRROR: Better. I can never take you seriously while you're traipsing about in your disguises! Now, your sister is quite distressed over this Arthur situation. She is fretting just up ahead and needs your guidance.

CALLIOPE: (sigh) She doesn't listen to what anyone says.

MIRROR: Ah, but your way with words--enhanced with a bit of magic--could help her see reason. Emotion spells have helped you resolve conflicts before.

CALLIOPE: Perhaps. But they don't magically change minds, Mirror. They just bring out what part of us truly wants to say.

(CALLIOPE summons emotion spells.)

MIRROR: Should you make sure you've still got the hang of them?

CALLIOPE: It isn't that difficult, Mirror. First, you grab an emotion spell. (Pause) Then, you tap it with your wand. (Pause) And the emotional atmosphere of the conversation shifts to match.

(As she tries out all four, in any order):

Angry spell - CALLIOPE: This spell charges the air with frustration or anger--sometimes, you just need to get something off your chest!

Sad spell - CALLIOPE: This spell lowers the energy and brings forth the sadness that has been suppressed.

Calm spell - CALLIOPE: This spell brings calm that can soothe distressed hearts and bring peace.

Happy spell - CALLIOPE: This spell encourages positive energy and helps the mind banish negativity!

(After she tries all four spells)

MIRROR: Excellent spellcasting. Now please go speak to your sister about her quest! Use whatever emotional tone is necessary to resolve this.

(CALLIOPE progresses and eventually encounters MINERVA.)

MINERVA (to herself, as CALLIOPE approaches): The whole thing is ridiculous. Asking me to marry him, as if that were an option. As if he weren't asking me to give up all that I've worked for, all that I am. He will understand. He'll have to. Kings don't marry for love, and Fairy Godmothers do not at all. No use dwelling on what we can't change. The other Godmothers will disagree, of course. Those fools would choose love over duty, every last one of them. Well, someone has to uphold this order. Someone has to advise my sister, so she doesn't ruin the kingdoms with her strange ideas. Merlin knows what would befall the Fairy Godmothers if I left Calliope to her own devices. I can't serve the world if I leave my station, running off to get married like a lovesick girl. A Fairy Godmother's choices are not her own, though all the world seems to have forgotten that.

(Conversation between Calliope and Minerva: Readers can change the arousal between every dialogue but can change affect only when the scene ends. Every row of the table comprises a scene).

Positive Affect	Negative Affect
CALLIOPE: You seem troubled, sister.	CALLIOPE: Talking to yourself, sister? Haven't you anything better to do than wander about looking troubled?

(MINERVA stops and sees her for the first time.) MINERVA: Calliope. It's good to see you. CALLIOPE: Shouldn't you be with Arthur? MINERVA: Yes. I can't stay long, but I needed a moment away. The war is getting worse. Arthur has yet to take the throne. He refuses to see wisdom.	(MINERVA stops and sees her for the first time.) MINERVA: Troubled, my queen? You could say that. The kingdoms are at war, in case you haven't noticed. Hatred and violence plague the people, and now Arthur, the only king who could unite them, is acting like a fool.
CALLIOPE: All heroes lose their way at some point, Minerva. That's where Fairy Godmothers come in. If Arthur cannot see his path, you must show it to him. The world cannot afford him failing this quest. MINERVA: I know what's at stake, sister. If Camelot never comes to be, the world will never know peace.	CALLIOPE: That doesn't sound like Arthur. I named you his Fairy Godmother, Minerva. If your hero has lost his way, it's your duty to guide him. The world will never know peace if Camelot doesn't come to be. MINERVA: You think I don't know that? You think I don't know what it means to be his Fairy Godmother, or what could happen if I fail this quest?
CALLIOPE: It took decades to find a true king, one who can forge a kingdom of light in this age of darkness. Arthur is our last hope. You have to pull yourself together for his sake. MINERVA: I'm fine. Arthur is the problem. He doesn't understand duty, or what it means to rule. He refuses to make the sacrifices a king must make.	CALLIOPE: You seem to have lost focus on the mission. MINERVA: You seem to forget I've spent decades searching for a worthy king, actually doing something to end this war. CALLIOPE: Yes. And you've come too far to fall apart now. MINERVA: I'm not falling apart. The world will need Arthur in the years to come, and I mean to see him on the throne. No matter what objections he may have.
CALLIOPE: What do you mean? MINERVA: I've told Arthur Camelot must have a queen. He says he won't have anyone but me. CALLIOPE: Don't you love him? MINERVA: Of course, I do. I've loved him since we began our quest to forge Camelot. Arthur is the greatest man I've ever known. He may become the greatest king who ever lived.	CALLIOPE: What do you mean? MINERVA: He wants me to marry him, the fool man. He refuses to take any other woman as his queen. CALLIOPE: Marry him if you wish, Minerva, but know it will end your time as a Fairy Godmother. You cannot fulfill your duties to the order if you leave Avalon.

CALLIOPE: So? Marry him. MINERVA: Have you lost your beans? I would have to leave Avalon. I would have to give up my wand, give up my place as a Fairy Godmother! I can't do that. Not when the world is at war, and the people need us most.	MINERVA: I know that, and I'm not going anywhere. It terrifies me to think what would become of the Godmothers if I left.
CALLIOPE: You love this man. If you want to marry him, you have my blessing. MINERVA: What I want doesn't matter, Calliope. I am needed at Avalon, as you are. Would you abdicate your throne and every responsibility that comes with it, just to marry the man you love? CALLIOPE: Yes. I believe I would. MINERVA: You shouldn't say things like that, Calliope, even to me. You are the Fairy Queen.	CALLIOPE: What is that supposed to mean? MINERVA: Mother would never have approved of the way you rule, breaking our customs left and right. Merlin knows what would happen if I weren't around to advise you. CALLIOPE: Don't flatter yourself. We'd be just fine if you left. If you want to marry Arthur, no one will stop you. MINERVA: I will never leave Avalon. I am sworn to the Fairy Godmothers, as you are. There are people I must protect, responsibilities I must bear! Can you honestly say you'd throw all of that away, in my position?
CALLIOPE: I am not speaking as your queen, Minerva. I am speaking as your sister. If this is the life you want, no one will blame you for leaving Avalon. MINERVA: I'd be leaving everything I've ever known. CALLIOPE: Most Fairy Godmothers make that choice eventually. You have served the kingdoms well for many years. It is your right. MINERVA: I cannot leave Avalon. And I don't believe you will either, whatever you may say. We have too much work to do. The Fairy Godmothers cannot rest until the world knows peace.	CALLIOPE: I believe I would, in your position. MINERVA: That isn't something one likes to hear from their queen. CALLIOPE: As your queen, I would have you remember your place. You are this man's Fairy Godmother, and you will see him safely on the throne of Camelot. MINERVA: And will you command me to marry him, too? CALLIOPE: If marrying him is the only way to make him take the throne, so be it. You will have to leave Avalon, but it will be for the good of the realm. MINERVA: I will never leave Avalon. Do you understand me? I will never stop being a Fairy Godmother, not until the day I die. I swear it.

CALLIOPE: The Fairy Godmothers aren't just tools that protect the kingdoms. We are people. We must protect the world, but we must also be a part of it, to know what we are protecting. Rejecting all happiness won't make you stronger, Minerva. You can't go on like this. MINERVA: I can. I must. The world needs me, as it will need this king and his kingdom in the years to come. I mean to find the best possible queen to rule at his side. CALLIOPE: It seems Arthur has already found her. MINERVA: Not me. The Duke of Cornwall has a daughter. Guinevere. Her father's armies will serve Camelot well.	CALLIOPE: A true Fairy Godmother wouldn't mope about like this. You claim to be the one who gets things done, Minerva. Well, I command you to do something about this. Pondering your troubles in the woods isn't helping anyone. MINERVA: It will be dealt with. CALLIOPE: How? MINERVA: Arthur will marry the queen I choose for him. I will make him see reason. CALLIOPE: You must find a great queen. Someone worthy of Camelot. MINERVA: Of course. The Duke of Cornwall has a daughter. Guinevere. Her father's armies will serve Camelot well.
CALLIOPE: Her father's armies? That won't do, Minerva. If you aren't to wed him yourself, you must try to find him a good queen. Someone he will love. MINERVA: I can't…that isn't necessary. What matters is that Camelot will be strong in the years to come. Love won't protect Arthur's castle walls when his enemies come down on him. He'll thank me for it one day. CALLIOPE: Minerva— MINERVA: I'm sorry, sister, but I've been away too long. My hero will be wondering where I am. Please excuse me. (She exits.)	CALLIOPE: Her father's armies? You are trying to find the best possible queen. MINERVA: I am trying to do what is best for Arthur! What is best for the world. That is what Fairy Godmothers do, what we are. You of all people should know that. Camelot will need armies in the years to come, and I'm going to make sure it has them. I must be off to speak with Guinevere's father. If you will excuse me. My queen. (She exits.)

Credits Roll

Appendix F. Gummy's Way Out Narrative

(As reader chews a gummy bear): Ah, ouch! That hurts, ouch! Hello, it's me the gummy in your mouth, could you stop doing that? (Ughh) It's so slobbery in here! Wooooh, oops. I think I am stuck in your pipe…. Hey, you up there, I'm talking to you, little help here please…drink something to wash me down this pipe.

(Table describes the possible actions and dialogues)

Solid food	**liquid**
Oh no, no, this isn't helping me slide, stop making things worse! ouch ouch, what a bumpy ride! Well,' at least I'm out of the pipe, no thanks to you!	Weeee, now that's a water slide!

STOMACH (gurgling churning and voice echoes)

Great, now I am in this dark pit (bubbling / rumbling noises), your stomach! ooh I see tacos, yum! Wooah, the fleshy walls just churned it into pieces, ok stay away from the walls. What's this lovely river, aah, it burns, it's acid! This place is scary, how am I going to get out of here, I need to get back to my gummy family. Looks like the only way to get out is down. Well, thanks a lot for swallowing me! Now help me out by sending in some food so I can cross this acidic river in your stomach, don't let me die in here, I am still young. C'mon, start eating!

Number / food	**Healthy food**	**Unhealthy food**	**water**
First time	Mmm, this will make a good boat…oooh, many excited tiny creatures are rushing up to this piece of food (murmurs). 'Hey! Tiny creature, what's going on?' (murmurs) hmmm, they call themselves gut bacteria and 'claim' to help your stomach, also they love this kind of food. Well, keep sending in more food!	Sugar: Uh oh, what did you just eat? my dear bacteria friends are dying because of this! Noooo tiny thing! Eat something else before we have a massacre. OR Oil: (Phat) Oouch! I am slipping on all the oil you just ate! your fleshy	Well, that doesn't help, how do I make a boat out of this to cross the acidic river! Put in something solid! (loop)

		stomach walls seem to be working too hard, it's scary!! This is causing so much damage! Eat something else!	
Second time	yes, yes, this is good! This pit doesn't seem so dark and scary anymore, and the acidic river is calm. My bacteria friends are healthy and hard at work, and since I am in a gracious mood, I'll go help them, and you, keep eating, I'm almost across the river	(Progress to next dialogue below table)	
Third time	Nice, good for boat and bacteria! Now let's add some variety and mix it up in here. Eat something else (loop)		

(After eating second unhealthy food item)

Wait why is everyone suddenly panicking in here (bacteria panic)? Uh oh, what did you just eat? All that sugar/oil! It's making this acidic river rise! (Swirling acid sounds). Too much acid, this river is spinning out of control, (screams)…. my bacteria friends are dying! Hurry! drink something to tame this acidic river, your belly walls are on fire! (splish) Aaaah it hurts!

Number / food	**Water or healthy calming drink**	**Anything else**
First time	(Progress to next dialogue below table)	(Screams) no no no! the acid is still rising, ahhh, it burns, my arm, my arm is burning, help! Drink something to tame this acidic river down before I lose more of precious parts.
Second time		(Screams) Are you trying to kill us all in here, I've already lost my arm! I'm going to burn in here if you don't drink something to keep this acid in check, ahhh (loop)

(Swirling noises coming to a stop, bacteria calming down): "Ah…yes! Keep going, this is making the acid retreat! It's soothing my burns (ahh), The monstrous river is finding its peace. Keep drinking, I can see the walls of your stomach again, bruised but healing, that was such a narrow escape! you caused a lot of panic in here (bacteria sighing). We all need a breather now, drink something that will help us, and you relax!

Calm drink	Energizing drink	Anything else
Ahhh (long sigh), that feels nice, very nice. Every corner of your stomach is softening. I'm 'finally' going to take a few moments to relax by this tranquil river, you should do the same! Keep sipping (3 deep breaths, and sighs) (progress)	Well, this doesn't seem very relaxing, everyone is super charged in here now! Oooh, I buzzed up too, I'm going to row faster, faster (panting), uh oh, this is making the acid rise again (progress)	C'mon we all deserve a break! Drink something that will help us relax!" (loop)

oh, looks like I'm almost at the end of the river… hey you up there! Why don't you Give a light rub to your belly, that should help me make the final push.

Belly rubs	Food / drink	No belly rubs
Yes, more more! I can feel the heat it's helping. Oooh I feel that nice massage, thanks friend, now I know I can count on you to help me out. A final push and, yayyyy, I'm out of the stomach! I survived the acid river. Next stop, home to my gummies! (progress)	No more food, please! Stop disturbing the river while I'm still in here. A belly rub will do the trick! (loop)	Ufff, fine, I'll just waddle myself, even though I am so bruised from all the acid. Uh uh, almost there, you don't care about me at all, thanks for nothing! I'll make it to my gummies! (progress)

INTESTINE (wind sound)

Oh no! I don't see an escape anywhere nearby. Just a long, very long twisty turny path ahead. Well, I'm not going back into acid, so forward it is, into your small intestines.

(Humming) so many big bumps in here, (panting) I'm soo tired (whiny), I'm not in the best shape of my life (falls). Oops, uh oh, uhhhhh, I think I am stuck. I'm stuck in between these big bumps in your intestine, (struggling) I don't know how to get out. Help!

Number/ Food	Gummy Bear	Anything Else
First time	(Progress)	Well, that was an attempt but it's not working, I 'm still very stuck in between these bumps! Try something else or I'll be here in your intestines forever!!
Second time		How was that supposed to help? Still so stuck! nooo I can't die in here, well, I have one last idea … send in one of my gummy friends to help, they will set me free, and we will escape together!

Third time		Still stuck! You need to send in a gummy friend, don't worry we all are strong, they will survive the acidic river and find their way to me (loop)

(Ouch ouch, (sobs)….weeeeee….phat) Ana is that you (inaudible-gummy?) Ana over here, (gummy), help me Ana (mmmm), oh finally free!! (Scolding gummy -what were you thinking?) I know, I'm sorry I left our packet (scolding), I'm sorry you had to risk your life and come looking for me (scolding)… I'm sorry…wait what, you know the way out (yes)? Bowels? Oh, the large intestine! then what are we waiting for, let's go! Uff all this excitement is making me tired (me too)! Hey, you there, send in something sweet so we get a jolt of energy (ana agrees)! Sweets, sweets, sweets, sweets!

Sugary unhealthy food	**Anything else**
Yay sweets! (yum yum) we stuffing our faces. C'mon Ana let's race through these intestines (tuk tuk tuk…. panting) (progress)	Uff fine, you want us to go on exhausted! (panting) We aren't moving until you send something to zap us with some sweet energy (hmph) (loop)

Wait, wha…. huuuuu, your intestine walls are moving further away, the pressure here is not right (Ana gasps)! (2 gummies Gasping for air), oops, I think the sweets did this (you think?) Oh, can't breathe, can't breathe! Quick, drink something to reduce this horrible gas here.

Number/ Food	**Water / healthy calm liquid**	**Anything Else**
First time	(Less panting) Oh yes! that helped all the nasty toxic air pass, can finally breathe again! we live! (Claps, ana rejoices)! (panting) Now that we are done with our shenanigans let's just peacefully walk through these intestines (Ana agrees, tuk tuk) (Ana shouts – Gummy!) What now? (Horrified sound), the intestine walls are sucking everything, food is disappearing! Can't we catch a break! Ana, we have to hold on to something! (Ana shouts fading) No! not strong enough to hold on (Ana shouts fading), the walls are taking us….ahhh its so dark (pop)	(Panting) What are you putting in here (yeah, what are you)? This awful gas is just increasing! Oh, we are filling up with too much air, we're going to burst (Ana cries)! Help!!! This will be a pathetic way to die! Hurry (both)!

	(progress)	
Second time		*(*More gasping*)* oh now you are just trying to kill us, aren't you? There is barely any good air left (pop, Ana shouts) Wait what's happening (horrified sound), (pops) the intestine walls are sucking everything, food is disappearing! Ana, we have to hold on to something! (Ana shouts fading) No! not strong enough to hold on, the walls are taking us….ahhh its so dark (pop) (progress)

BLOOD (stream sound)

Uggghhh, blood, so much blood, no it's not mine, it's yours! the intestines threw us into your bloodstream! Well, I guess that what happens to most food, right Ana? Ana? Oh no, I don't see Ana! Ana where are you? There are so many ways she could have gone – lungs, liver, brain, this place is huge! I can barely waddle through this blood. Hey, Mr. red blood cell can I get a ride please? I need to find my friend. (murmurs)…he says I need to pay him with oxygen! Take deep breaths, send some o2 down here so I can find Ana.

Deep breaths	**No deep breaths**
yes! Yes (deep breaths) Ah! Keep those deep breaths going, the more oxygen we have, the faster this red blood cell goes! (Deep breaths) Oh I see Ana (claps), she's headed towards, what's that called, Spleen! Thanks for the o2, now let's catch up to Ana! (pop) (progress)	C'mon why can't you send me oxygen? All you have to do it breathe deep! oh I see Ana, she's headed towards, what's that called, Spleen! ohhh, If I miss her this one is on you. (loop)

SPLEEN (wind sound effect)

Oooh, the spleen, so many muscular and strong white blood cells here. Lots of scary signs here too, they say– 'filter the scum', 'keep it pure and fresh', 'keep out intruders'…. hmmm, excuse me Ms. White blood cell? (alarms go off – intruder alert) What me? No, I am not an intruder, I mean, I'm an outsider, but…. oh no, oh no, time to run (shooting noises). Aaahhh, A little help, here! Your body's immune system is going to kill me! Eat or drink something to slow down these white blood cells! buy me some time!

Number / food	Healthy food	Unhealthy food
First time	(Shooting) Oh no oh no oh no, that's just feeding your white blood cells! They are getting bigger and stronger (more shooting)! Ouch, that hit my shoulder, ahhhh, they think I am scum but I promise I won't hurt you. Put in some junk to dial them down!	(Shooting decreases) Yes! Whatever you just put in is slowing down the white blood cells, they are getting weaker! It's working! Put in something else to slow down this army, and I'll be out of here.
Second time	(Shooting increases) What did you put in? they are getting faster and multiplying! Are you even on my side? Ahhh, my leg, they shot my leg. They will kill me; you have to put in junk food to slow down your army of white blood cells	(Shooting decreases): That helps me! The white blood cells are weakening in numbers. I'm dodging their bullets, uh oh, but so are these other intruders and nasty-looking scum. I am almost out (pop) (progress)
Third time	(Shooting increases) Aye, another helpful serving to your immunity! you want me dead, don't you? (shooting) Ahhh this one went straight through my heart…too many holes in me…. I can't go on, they are too many…oh, take care of Ana, help her out. XXXXXXXXX END XXXXXXXXX	

BLOOD (stream sound)

Phew, what a narrow escape! I'm sorry you had to take a hit for me friend! You have a strong army fighting scum for you. Well, Ana wasn't there, looks like we missed her. Hmmm, she said she knew the way out, bow-bow-bowels! Yes bowels – the large intestine! maybe she is there already. Alright, Mr. red blood cell to the bowels! (murmurs) This one says you need to hydrate for it to move, so send in some liquid!

Healthy liquids	Anything else
Ahhh yes, well hydrated and Mr. red blood cell is picking up the speed (claps). Bowels and Ana, here I come! (progress)	This isn't helping you hydrate! This red blood cell refuses to move without a dose of water! How am I supposed to get to your bowels? (loop)

BOWELS (rumbling sound)

Oh, (belching sound), your bowels! Well, I must waddle through this mess to find Ana. Uh oh, remember all that junk food you just ate? Well, now there is a massive pile of hard brown rocks blocking my path. (Puts strength) can't move them, poor fluffy me! Help me clear the pathway, eat something to soften things here so I can go through.

(If Gummy lost any limbs) This is really tough without my other limbs, the ones I lost thanks to you!

Number / food	Healthy food / water / fiber	Unhealthy food / no fiber
First time	This helps, the pile of rocks is breaking, it's softening! I can almost waddle through, put in more stuff like this!	Nooo, you are making this massive pile of rocks bigger and harder! This is the opposite of helping, you need to soften this mess, not build it up more!
Second time	Yes! Everything inside is getting softer and softer! I'm almost through, uuuuh, give a slight rub to your lower belly and ill be out of here (progress)	Uh oh, you are making it soooo much worse! the pile is getting bigger and bigger, it's about to fall! Avalanche! Quick, soften this up so these hard rocks don't fall on me! At least try not to kill me!
Third time		Do you want me to die! Drink some water, make this poop mountain softer!!! (loop)

Belly rubs	No Belly rubs
Ahh, yes, more rubs, more, the heat is helping! I feel that lovely massage, thanks for the support friend, what would I do without you! Weeee, I'm out of that mess! Wa---I see a light, no it's THE light! It's the way out!! Oh, so close, but (snap finger) no, not without Ana! She's not here, back into the bloodstream. (progress)	No belly rubs? Fine! I'll just push through this mess myself, without any help from you! Haha, I'm out. Wa---I see a light, no no it's THE light! It's the way out!! Oh, so close, but (snap finger) no, not without Ana! She's not here, back into the bloodstream (progress)

BLOOD (stream sound)

Uff, finally out of those bowels…. Alright Mr. red blood cell, I'm out of ideas (hopeless), just take me wherever (sigh) (blood flow noises for a while)! Oh Ana, where are you (heart beats in background, growing stronger) Woah, what is that giant beating blob? It is the heart! I'm heading into your heart!!

HEART (heartbeat sound)

Amazing, so this strong beautiful muscle keeps you alive? ok here I come, I promise I'll be gentle. Woah, woah, woah, (all that food has increased your heart rate) it's beating too fast for me to waddle in! Slow down your heart rate so I can go inside and look for my friend, have something that will make you feel calm.

Calm drink / deep breaths / water	**Energy drink**	**Food**
(Fast to steady heartbeat): Ahhhh, there we go, a steady and strong rhythm. This feels nice, very nice (let out a sigh of relief), your heart looks relaxed and easy, I can move through this. (progress)	(Heart beats faster): No, no, what are you doing? This is making your heartbeat faster, I'm losing control, your heart may just throw me out! Aye, fine! I'll waddle my way through this bouncy house with no help from you. <phat> Uff, please dink something to lower your heart rate! (loop)	No, you need to relax! Drink something that makes you feel calm, slow down, so your heartbeat is slow and steady, and I can waddle my way through (loop)

Okay, we need to maintain this steady rhythm as I search through your heart for Ana. Now keep eating and drinking so your muscles are strong, and the beat is steady for me to waddle in, and no sudden movements!

Number / food	**Healthy food / liquid**	**Unhealthy food / liquid**
First time	This is good! Your heart muscles are getting stronger! I give them a nice massage for you! (Long sigh) Keep at it, maintain the slow and steady.	Ouch, ouch, ouch, well that made your heart dance, thanks for the bumpy ride! Your heart muscles are working way too hard, this can't be good for you either! Put in something to slow it down in here!
Second time	yes! It's helping, slow, slow! Oh, I have looked through your entire heart, Ana isn't here! (sobs) (progress)	Yeah, that was supposed to slow down your heart rate? So difficult for me to navigate! I can't find Ana in here! (cries) (progress)

Ana are you even alive? Did she leave without me? what if the white blood cells caught her? (hyperventilate)? Oh, is this going to be my life? Fighting to survive every second (sniffles) (hyperventilation increases)! Will we ever get out of here (sniffles)?! Oh, I can't breathe, It's too much (heartbeat increases, gummy gasping)! Is this a panic attack? Send more air, take deep breaths! help me.

Deep breaths	No deep breaths
(Fast to steady heartbeat): (deep breaths), okay, this is working, (deep breaths) we just need to relax here! Keep those deep breaths going. Yes, your chest is expanding, there is more space in here, it feels less cramped. Oh, thanks for helping me through that, I knew you had my back! Must not lose hope, I will find Ana (heavy breathing)! (Shrieking ana and pop) (progress)	After everything we've been through, you don't want me to live (panting)? (Shrieking Ana) (Incomprehensible Ana – Gummy, Gummy, nooooo, panicking, stay with me) Ana, you found me! Help her get out human (panting), goodbye! (Ana - Gummyyyyy) Xxxxxxxx END xxxxxxxxxx

Wait, wha…Ana! Is that you (gummy!!! I found you I found you) are you real, pinch me, ouch! I have been looking everywhere for you (I have been looking everywhere for you, what happened to your arm?) Yes, I lost an arm… but you look so strong!! (murmurs) What, you were off fighting scum? Oh Ana, thanks for rescuing me! (Gummy, ofc I would). Now let's get out of here (yes, yes), next stop (together – to the bowels) Hey you up there! Can you imagine we are still alive? We trust you to give us a smooth journey out! Oh, and thank youuuuuu!