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Real World Risk in Speculative Fiction: How Can Cognitive Poetics be Applied to the Design of Sound-Led Text Games Which Incorporate Difficult Information?

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Abstract

This thesis documents a research project that applies cognitive poetics to the writing, design and build of three playable prototypes that combine text with spatial sound. Each prototype tells a different part of one original work of speculative fiction, the theme of which is species extinction. In order to focus the research on how texts can incorporate difficult information, the prototypes are designed with reference to narrative transportation theory. Narrative transportation is a psychological framework for measuring how involvement in a story can cause persuasive information to be absorbed and beliefs to be changed.

Throughout the thesis, three main lines of enquiry are pursued; how cognitive poetics can be used to develop an understanding of the psychological processes involved in reading, how this understanding can be used to create a user-centred writing approach, and how cognitive poetics can be synthesised with sound design theory and practice to create narrative transportation.

In part one of the thesis, the psychological processes involved in narrative transportation are researched through the application of cognitive poetics to readings of multiple texts. A specific aspect of cognitive poetics - cognitive grammar - is explored in detail, allowing for a synthesis of theories of linguistic grammar with musical grammar and cinematic sound design practice.

The second part of the thesis documents the iterative design process used to make the prototypes. During this process, design questions are addressed through the application of cognitive poetics, cinematic sound theory and musical grammar to the practice of multimodal writing. The user interaction designed into these prototypes is also informed by research into narrative transportation.

Real World Risk in Speculative Fiction: How Can Cognitive Poetics be Applied to the Design of Sound-Led Text Games Which Incorporate Difficult Information?

‘You can't just present the relevant facts and have everyone erase significant circuitry in their brains. Brains don't work that way. What is needed is a constant effort to build up the background frames needed to understand the crisis, while building up neural circuitry to inhibit the wrong frames. That is anything but a simple, short-term job to be done by a few words or slogans.’

George Lakoff. *Why it Matters How We Frame the Environment* (2010)

‘A game is a device for creating experiences.’

Miguel Sicart. *Beyond Choices: The Design of Ethical Gameplay* (2013)

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Introduction

The real-world context for this research project is the Anthropocene. Between 27th February and the 1st March 2017, the Pontifical Academy of Science called a symposium (*How to Save the Natural World on Which We Depend*) at the Vatican. In the final summary of the symposium, profit-driven consumption of fossils fuels is squarely laid out as a key driver of the environmental degradation responsible for the vast increase in species extinction currently occurring (PASS Workshop 2017)[1]. The same proceedings asked why people do not seem to care about the issue.

At an early stage, I identified that a specific challenge of writing about the way species extinction might impact the planet and, ultimately, the human species, was a phenomenon known as *reactance*. In summary, reactance is a response to the threat, or perceived threat, of loss to freedoms (Brehm, Sharon; Brehm, Jack 1981). Sharks (2016) discovered that fear appeals attempting to scare people into action in climate change communication can cause angry reactance when fear is created but no solution is offered. Sharks also concluded that approaches to the communication of the impacts of the Anthropocene that focus on messages that contain loss of freedoms (e.g. stop hunting, stop flying, stop eating meat), are likely to fail amongst audiences unsympathetic to environmental issues. Witte and Allen (2000), in their study of responses to fear appeals, define reactance as a response summed up in the phrase 'they're just trying to manipulate me, I'm going to ignore them'. They also summarised denial as the response 'it won't happen to me', and defensive avoidance as the response 'it is too scary, I am not going to think about it' (Witte and Allen 2000: 594).

[1] http://www.pas.va/content/accademia/en/events/2017/extinction/statement.html

Researching the psychology of reactance and denial led me to seek out information about how to overcome these types of responses. This was when I discovered that within public health and climate communication, narrative transportation was a psychological theory that had gained traction as a way of incorporating difficult information into persuasive fictional texts (e.g. Moyer-Gusé 2008; Moyer-Gusé, R. Nabi 21010; Morris et al 2019). It was due to studying narrative transportation theory that I avoided writing a story that focussed on loss to freedom caused by climate change. It was also why I began to study in more detail the psychological processes involved in narrative transportation.

Narrative transportation, a concept originally developed by Richard Gerrig, describes the process by which someone ('the traveller') is transported (as the result of performing certain actions) over a distance far from their world, to the extent that some aspects of the world of origin become inaccessible (Gerrig 1998: 10-11). Gerrig saw reading as a performance where readers use their own knowledge and experience to give substance to the psychological lives of characters and to bridge gaps in texts (Gerrig 1998: 2, 17). Gerrig, a psychologist, concluded that human beings approach events in stories with blueprints based on other similar events and an expectation of the stories running in the same way. This blueprint (schema) is more easily accessed than the details of the real world (Gerrig 1998: 33) and this explains why the traveller loses access to details of the original world. He asserts that this is linked to human cognitive efficiency (Gerrig 1998: 173).

Green and Brock (2000) developed a scale based on Gerrig's ideas. The scale was designed to measure the distance readers feel transported away from their actual world surroundings, how vivid the mental images they form are and how they are

affected by the story after finishing. Results of a study testing the scale showed that affinity for characters was linked to greater transportation and that beliefs were changed by fictional texts (Green and Brock 2000). They concluded that the ability of narrative to change beliefs lay in the way that doubts and emotions felt when reading and 'performing' a fictional text are real to the recipient of the text and that these emotions are more easily accessed than the schema and ideas that they use to think about issues in everyday life (Green and Brock 2000: 702).

At the outset of the research process, I decided that the question asked by the PASS workshop (why don't people seem to care about species extinction?) (PASS 21017) was one that I wanted to respond to through my research. After reading the literature on climate change communication, I began to wonder if the reason people didn't care was due to a reactance response. In line with Witte and Allen's formulation of reactance as being summed up as 'they are trying to manipulate me, I'll ignore them' and denial as 'it's too scary to think about' (Witte and Allen 2000 : 594), I approached the writing with the goal of transporting readers into stories in order that these types of responses be disarmed. As this was a practice as research project, detailed measurement of the ways the prototypes changed attitudes, or made people care, about species extinction was beyond the scope of the project. Instead, exploring ways to create narrative transportation by combining sound with text within a story incorporating difficult information about the issue became the research goal. Due to the fact that Gerrig's original ideas were based in the psychological processes involved in reading, and because aspects of Green and Brock's scale measure cognitive responses to texts, I chose to research in detail the way that narrative transportation worked within the mind

of readers. To do this, I used cognitive poetics[2] as a framework to study the psychological processes involved in reading. In particular, I studied Ronald Langacker's work on cognitive grammar (Langacker 2008) and applied this as a central analytical tool within the design process. Cognitive grammar allowed for the functions of specific aspects of language to be understood in sufficient detail to develop an approach to combining sound and text. To do this, I also read Zbikowski's (2017) work on the grammar of music and Chion's (1994) work on listening in the context of cinematic sound design. These theoretical ideas were combined and applied within an iterative creative process.

Research Approach

Three prototypes were built in total, with each design addressing questions of how to create engaging immersive experiences using language and sound.

These questions were:

- How can cognitive poetics be used to develop an understanding of the psychological processes involved in reading?
- How can this understanding be used to create a user-centred writing approach?
- How can knowledge of the psychological processes involved in reading be synthesised with sound design theory and practice to create narrative transportation?

[2] Cognitive poetics is the application of cognitive linguistics to the reading and analysis of literary texts.

Due to the practical necessity of synchronising sound and text, learning how to use Unity became increasingly integral to the writing process. This is in part due to the lack of out-of-the-box software pipelines available to writers wanting to use spatial sound – established tools for interactive writers such as Twine or Ink do not support spatial sound unless integrated with Unity, for example. Consequently, a bespoke development pipeline had to be established and a fourth research enquiry emerged:

- How can an increasing ability to use a bespoke development pipeline influence narrative design and writing decisions?

Though the latter is not a primary research question, I wanted to document the development of my coding skills in relation to designing the prototypes because this had a direct impact on what I made. There are many ways to make sound and text games, so by outlining my technical development, I aim to better contextualise the designs I pursued.

In line with Edmonds and Candy, in their paper *Approaches to Interactive Art Systems* (2004), this critical thesis documents this relationship with technology in a creative context.

> Our experience suggests that even today, with all the advances in software, the degree of programming and systems expertise is critical to having more artistic control over the developing process. Those artists who had such knowledge were in a position to make more interim decisions during the exploratory process that guided the next course of action. Those artists who depended on a technologist often felt uncertain as to how much control they might have to relinquish to achieve their goals. (Edmonds, Candy, Turner 2004: 116)

Methodology

This thesis adopts a practice-based research approach that regards the prototypes created for this PhD as practice-based experiments designed to answer 'a directed question about art and the practice of it' (Skains 2018: 86). In practical terms, this methodology required that I first set a research question that could only be answered through practice. I then conducted a literature review and began to create an original conceptual framework to guide the creative process. Due to the fact that I adopted an empirical approach to composition[3], my literature review covered cognitive poetics, human computer interaction, theories of narrative immersion, aural perception, multimodal cognition and sound.

To organise and orchestrate (Flower and Hayes 1981) my thinking, I kept sketch books of visual designs, kept a technical-based study log of the code I would need to write, designed and mixed sound, created spreadsheets that identified the interactive relationships between text and sound and wrote multiple drafts of Twine stories. During the later stages of development, I worked in Unity, referring to and adding to these logs and notes as I worked. As the prototypes developed, I conducted review of my own work, making my own assessments during early stages and subsequently seeking feedback from supervisors and friends when drafts of prototypes became stable and playable. I also analysed monomodal and multimodal texts using cognitive poetics and used the Narrative Transportation framework as a guide when creating each of the prototypes.

[3] It is beyond the scope of this thesis to explore the wider debate around cognitive approaches to composition, but a useful summary is provided by Charney in her 1996 paper 'Empiricism is not a dirty word.'

The creative process was naturally iterative and is best conceptualised in terms of the cognitive process model of composition (Flower and Hayes 1981), where thinking during composition is directed by goals and involves processes of organisation that allow sub-goals to emerge. Flower and Hayes (1981) refer to the compositional process as one where the writer draws on long term memory and experience when writing. In practice, I was required to draw upon my previous experience of both sound design and of writing. Composing multimodally in this way often resulted in very 'fragmented, unconnected, even contrary thoughts' (Flower and Hayes 1981: 372). Attempting to organise meaning across modalities, aside from the practical steps of note taking and drafting, involved me developing an aspect of my conceptual framework that informed which goals would be 'better accomplished with different representations' (Flower & Hayes1984: 129).

The organization of 'fragmented' and fleeting thoughts (Flower and Hayes 1981: 372) is of methodological interest to any writer assessing which modality expresses an idea more clearly than another, or where the two together might 'amplify' their meaning (Lemke 1998). Lemke outlines how separating out the function of language from the expressive function of other modalities offers a route to the composition of multimedia texts (Lemke 1998: 90). Whilst Lemke focuses on the combination of text and diagrammatic images, the methodology I adopted focuses on separating the cognitive grammatical function of language from the cognitive grammatical function of designed sound. This allowed me to create compositional sub-goals and conduct experiments to assess which modality could be used at which time and which types of combination could result in 'perceptual Gestalts' (Lemke 1998: 90).

To develop a compositional process for ‘multiplying meaning’ (Lemke 1998) and creating ‘perceptual Gestalts’ (Lemke 1998: 90), I developed a clear conceptual framework that place Langacker’s theories of cognitive grammar alongside Zbikowski’s musical grammar. Zbikowski (2017) concurs with Lemke’s observations that language is not always the best mode for expressing some meanings, noting that complex spatial relationships and dynamic emergences can be better expressed in other modalities (Lemke 1998: 90; Zbikowski 2017: 10 - 11).

In summary, I ensured that my conceptual framework addressed the grammatical function of both language and music and incorporated an understanding of the multimodal nature of perception and cognition (Barsalou 1999). I did this in order to think through how the two could be combined and to maintain focus on the mind of the reader. This allowed both for semantic and functional analysis of each modality as I worked, offering a route to serendipitous experimentation (Skains 2016) with both meaning making and functional organisation ((Lemke 1998: 87) in a multimodal creative process. I worked in this way to create user-centred writing informed by literature on the multimodal nature of cognition (Barsalou 1999).

Structure of the Thesis

The thesis is structured in two parts. The first sets out the theoretical concepts from cognitive poetics, musical grammar and film sound theory that were synthesised to develop an approach to the research process. The second documents how these theories were applied and further developed. Praxis – the application of a theory – is defined within creative research methodology as theory imbricated within practice (Nelson 2013: 37). Consequently, in addition to providing a narrative account of the practical

development of each of the three prototypes, part two documents the testing and development of the conceptual framework developed by this thesis.

In chapter one, details of the narrative transportation scale developed by Green and Brock are set out in order to document the role they played in framing the research approach. A brief overview of the literature on reading hypertext fiction follows. This is discussed within the context of narrative transportation and reader response studies to a wider variety of non-linear, multimodal digital texts.

Chapter two outlines the aspects of cognitive poetics used to understand the psychological processes involved in reading. This is done with reference to narrative transportation as identified by Gerrig (1998). An introduction to Langacker's framework of cognitive grammar (Langacker 2008) is set out.

In chapter three, the way that language simulates sensory experiences is described. In particular, the way that sound is simulated in literary texts is analysed through the application of cognitive poetics to passages from *The Odds Against Tomorrow* by Nathaniel Rich and *Annihilation* by Jeff VanderMeer. This is done to begin to set out the foundations of synthesising cognitive poetics with sound design theory and practice.

Chapter four sets out a working definition of sound as well as theoretical writings from the field of cinematic sound design and acoustic ecology-based sound design practice. Aspects of Zbikowski's (2017) framework of musical grammar are set out. Langacker's (2008) concept of viewing position within cognitive grammar is discussed for its impact on the process of adopting a cinematic sound design approach to the design process.

Finally, Chion's (1994) work on listening to cinematic audio is used to frame a discussion about auditory perception.

The introduction to part two opens with definitions of real world risk and speculative fiction as used within the context of this thesis. I also outline the full plot of the story underpinning the scenes in the prototypes.

Chapter six sets out the way the theories outlined in part one of the thesis were synthesised and applied to the design of the first prototype. Studies showing how language stimulates physical responses in readers are reviewed in order to contextualise decisions made in the writing. The ability of sound to influence spatial perception is explored in relation to the design of the audio in the prototype. A brief outline of the development of the software pipeline is given.

Chapter seven sets out the concepts from cognitive poetics that were applied iteratively through the research process of making prototype two. This is done to further document how an understanding of the psychological processes involved in reading was used within user-centred design. A critical reading of a literary game[4] that uses text and sound, *Loss of Grasp by* Serge Bouchardon and Vincent Volckaert[5] is included to illustrate the way that the application of cognitive poetics to reading a multimodal text helped solve design problems. The way that further design problems were ultimately solved by applying cognitive grammar to a reading of *My Boyfriend Came Home from*

[4] As defined by Astrid Ensslin in her book *Literary Gaming*, which features *Loss of Grasp*.
[5] Though four developers worked on the Angular version I accessed, Volckaert gets the author credit for the original Flash development.

the War by Olia Lialina is discussed. The way that increased knowledge of programming and interaction authoring influenced the design is set out.

Chapter eight documents the way that soundscape composition was foregrounded during the development of prototype three. Langacker's (2008) ideas are shown to have been synthesised with musical grammar and cinematic sound design theory and applied directly within a user-centred design. Specifically, Langacker's ideas are applied to readings of *Nantucket* by William Carlos Williams and *You Fit Into Me* by Margaret Atwood.

The thesis concludes by summarising the findings of the research and setting out the original contribution to knowledge made across the three lines of enquiry covered by this thesis. More than one contribution is identified; the prototypes themselves provide examples of an underexplored form of text game (one that combines spatial sound with text). Further contributions are made through the application of cognitive grammar to identify and solve user-centred design problems within multimodal text design[6]. Finally, a contribution to the field of narrative sound design is made by extending concepts of musical grammar and cinematic listening into the practice of working with acousmatic sound in language-led narrative contexts.

[6] This aspect of the research is due to be published within a book on Cognitive Grammar and Applied Stylistics.

Section One: Preparatory Research Undertaken to Establish a Design Approach

Chapter One

1.1 Reading as Simulation

As briefly set out in the introduction, narrative transportation is a concept developed by psychologist Richard Gerrig (Gerrig 1998). Within his work, he explores how reading causes a mental simulation that is more immediately experienced than events outside of the fictional world (Gerrig 1998: 93). This is due to the fact that non narrative information is insufficiently activated to enter consciousness within the experience of the narrative (Gerrig 1998: 173-174). As his interest lay in the persuasive nature of fictional narrative, Gerrig conducted studies of readers' responses to stories based on real-world historical events (i.e. where the outcome of the story was known and certain). He found that readers experienced uncertainty about the outcome of previously known events if particular phrases that introduced doubt were included (Gerrig 1998: 162-163). He called this phenomenon *anomalous suspense* (Gerrig 1998: 79, 157-176) and further explored how the emotions experienced by his readers could arise from the risk of a characters' goal being thwarted (or safety compromised) even when the real-world outcome was known to be positive. In Gerrig's model, risk in a narrative is experienced as a feeling which does not provoke a reactance response in the way that a real-world fear might. Instead, jeopardy in narratives that describe factual events engages the mind of the reader in an act of what Gerrig calls *anomalous replotting* (Gerrig, 1998: 176-179). Anomalous replotting occurs when recipients of a known story try to avert the course of action in their minds by actively thinking of ways to change the outcome (Gerrig 1998: 177). The cognitive processes involved in imagining outcomes within a story were hypothesised by Gerrig to involve the activation of the parts of the brain usually involved in planning (Gerrig 1998: 90). Gerrig's further

conclusion was that readers transported by narrative engage in replotting as they imagine fictional events and this replotting activates simulations in the mind of the reader (Gerrig 1998: 93). In this way, it can be seen how narratives can overcome reactance responses.

The way that readers simulate events depicted within a narrative is influenced by their knowledge of the type of event depicted in the story. This is due to the employment of schema of previous experiences within a simulation. Schema based on pre-existing knowledge leads to an increased ability for readers to imagine the narrative events and engage with them emotionally (Gerrig 1998: 40-41). An example given by Gerrig is a story of a woman at a cocktail party who feels unwell and thinks about leaving. Some readers were given an additional introductory section outlining how the woman had woken up that morning feeling sick and worrying that she was pregnant by her tutor. The readers provided with the introductory framing took a schema of 'unwanted pregnancy' forward into the reading of the cocktail party story and this resulted in the mental and emotional simulation cued by the story being more memorable than it was for those who did not use the schema within the reading (Gerrig 1998: 40-41). Gerrig concluded that that readers who bring greater knowledge of a subject or situation to a narrative imagine a greater range of possibilities. This leads to richer simulations and increased retention of the story contents (Gerrig 1998: 40-41). Gerrig sets this out as the basis for explaining why there are often multiple personal performances of the same text: each reader's simulation depends on the schema readers draw upon (Gerrig 1998: 41-47).

As I needed to create transportation across sound and text, I decided to develop a more detailed understanding of the psychological processes involved in reading. I wanted to

understand how schemas and prior knowledge are cued within language-led mental simulations in order to be able to identify how to cue them through sound. Consequently, the concepts of schema and their role in creating mental engagement with fictional events will be covered in more detail throughout this thesis. For now, however, I will set out the way that the narrative transportation scale (Green and Brock 2000) was developed to measure aspects of Gerrig's concepts. I do this because I used the scale as a blueprint and guide for the designs: in the absence of time to thoroughly play-test the pieces against the narrative transportation scale, I instead used it as a reference point for what I should be trying to achieve within the prototypes.

1.2 Aspects Measured by the Narrative Transportation Scale

Green and Brock (2000) hypothesised that the transportative effect of narrative identified by Gerrig (1998) could be used to overcome resistance to fact-based information, especially information that contradicted or undermined a belief. Consequently, they began to investigate the aspects of stories that achieved transportation and developed a questionnaire based on Gerrig's ideas (Brock and Green 2000: 702). The questionnaire was designed to measure the distance that readers felt from their real world surroundings, to collect data about the vividness of mental imagery created by the story, and to assess how readers felt affected by the story after finishing.

To quote from the questionnaire, the questions are:

1. While I was reading the narrative, I could easily picture the events in it taking place
2. While I was reading the narrative, activity going on in the room around me was on my mind
3. I could picture myself in the scene of the events described in the narrative
4. I was mentally involved in the narrative while reading it
5. After finishing the narrative, I found it easy to put it out of my mind
6. I wanted to learn how the narrative ended
7. The narrative affected me emotionally
8. I found myself thinking of ways that the narrative could have turned out differently
9. I found my mind wandering when reading the narrative
10. The events in the narrative are relevant to my everyday life
11. The events in the narrative have changed my life

(Green and Brock 2000: 704)

Supplementary questions related to specific characters or locations in the texts were added to these core questions, significantly all of which begin with the phrase:

- While reading the narrative, I had a vivid mental image of ….

These supplementary, story-specific questions were designed to record the way that readers created mental images of particular characters and settings (Green and Brock 2000: 704).

Results of Green and Brock's qualitative studies showed that an affinity for characters was linked to greater transportation and also confirmed that beliefs were changed by fictional texts. These conclusions have been supported in more recent empirical research based on their hypothesis. Morris et al (2019) ran three studies, with the first demonstrating that text-based stories about the environment were more likely to result in pro environmental behaviour than factually presented information (Morris et al 2019: 24). Another of their studies involved capturing body data from audience members as they were shown films about climate change (Morris et al 2019: 31- 32). Self-reported narrative transportation was also captured. An increased heart-rate was seen by the authors to indicate emotional arousal and to a long-term increase in attention paid to the threat of climate change (Morris et al 2019: 31- 32). The study links the increase in long-term attention to the way that the audience's emotional involvement in the story results in the encoding of the story in their memory. This link between emotion to attention is seen by Brock and Green as part of the convergent mental process that results in transportation (Green and Brock 2000: 703). Morris et al concluded that 'narratives framed as stories consistently outperformed factual narratives for encouraging action-taking in all audiences,' and suggested 'that this is because they more effectively trigger autonomic reactivity and emotional arousal' (Morris et al 2019: 32).

In conclusion, this research accepts the view that narrative transportation results in story-consistent beliefs and that beliefs can be changed no matter what real world values were brought to the reading (Green and Brock 2000: 707). However, the literature I reviewed accounted only for transportation caused by linear stories and this project required an approach that accounted for transportation within non-linear work. Consequently, I began to research the way that multimodal electronic work could be designed to maximise narrative transportation.

1.3 Structural Challenges of Interactive Texts in the Cognitive Domain

The experience of being transported is seen by Brock and Green as one of being absorbed or immersed in a narrative world (Green and Brock 2000: 703). I needed to account for the way that this absorption is impacted by interaction within the conceptual framework developed by my research. To do this, I conducted a review of literature that addressed the ways that hypertext[1] structure influences transportation.

Gerrig's (1998) formulation of narrative transportation as a journey is useful when discussing the structure of hypertexts because it positions navigation as being central to the experience: to go on a journey, you need to be orientated in a world. Where a physical book can be navigated by moving backwards or consulting the index or footnotes, hypertexts often conceal passages until user input reveals them: one cannot look ahead to see where the story is going or refer back to jog a memory when the thread of the story is dropped.

[1] An extensive overview of the theory and practice of creative works of hypertext is not covered by this thesis due to constraints of time and scope. As the hypertext authoring tool Twine was used throughout this research, it was felt sufficient to define hypertext as a text consisting of passages joined by links (Bell and Ensslin 2011: 1).

In their paper *Lost in Hyperspace*, Edwards and Hardman (1999: 90-105) set out the results of a study that examined the ways that spatial cognitive maps built by people to navigate physical space (of room, corridors, exteriors, roads etc.) were employed when navigating different hypertext structures. They took the view that a lack of navigational cues in some hypertexts – e.g. an index, mechanisms to provide visual feedback as to how far through a story the reader is – can mean the reader becomes disorientated, not least if aspects of the text are not accessible at certain times and the way to getting to these parts is concealed. Edwards and Hardman found that readers attempting to navigate such hyper-linked texts attempted to build cognitive models but instead of constructing a way through the narrative journey, ended up reporting that they 'felt lost'.

Charney (1994) writes about the way that non-linear writing can disrupt attention. As I found her work to be a succinct but useful way to understand the way that attention is linked to cognitive processes in reading, I will quote her here at some length.

> Cognitive theorists posit working memory to account for the fact that human beings can only attend to a small number of things at any one time, regardless of whether these are ideas recalled from prior knowledge or whether they constitute new information that has just been heard or seen or imagined. Further, the things that people attend to shift over time; as they recall other ideas or observe new things, items that had been in focal attention 'fade' or become 'displaced' or 'inactive'. The shifting of attention imposes a kind of linearity or seriality on thought processes: since we cannot think about everything at once, we have to

focus on a few things at a time in some order. (Charney 1994: 6-7)

Charney also sets out that readers of instruction documents delivered in hypertext formats do not know how to assess when they have read enough and often tend to stop before discovering crucial data. Participants in studies who read and carried out the instructions presented in traditional linear order were much more successful at completing the task described (Charney, Davida 1994: 20).

As my aspiration for this research project was to achieve narrative transportation through adaptation of hypertext structures, reviewing this literature established the need to focus carefully on the narrative and interface design of the prototypes. I decided to draw upon existing reader-response studies of digital works to inform my design approach. I will now set these out in order to demonstrate how the issues raised by Edwards, Harmen and Charney are manifested in the experiences of reading electronic literature, hypertexts and other text-heavy digital works.

1.4 Overview of Relevant Existing Reader-Response Studies

The first study I accessed was one seeking to interrogate the characteristics of successful interface design for hypertext. The reader study, conducted by Kim Gee (2001), used Bill Bly's 2002 hypertext novel *Descend* as its primary material. Participants in the study reported that the book was most enjoyable when read in the default (forward i.e. linear) mode. Furthermore, readers who read in a linear way were more able to recount the story afterwards than those who chose to navigate the text through links that changed the structure.

As a result of reading this review, some recommendations made by Gee were taken forward into the design process adopted in this project. These were:

- Use underlined links (as opposed to links only revealed when rolled over)
- Keep branching more or less linear with minimal asides
- Have a clear, single starting point

(Gee 2001: 14)

As Gee's study was based on a small sample, I felt that it was important to review the findings by referencing further reader-response studies, such as one developed by James Pope (Pope 2010). Pope used a wider variety of texts than Gee and chose texts authored in a wider variety of systems (the piece that Gee used, *Descend*, was written in the Eastgate systems hypertext authoring tool). A particular focus of Pope was – following Gee and Edwards/Hardman – the influence of interface design on readability, particularly the potential for an unfamiliar navigational structure to disrupt absorption[2] in the text. Pope found that pieces based on more familiar, web-based structures were more easily accessed than those built with less reference to user convention[3]. Furthermore, narrative structures that were not easy to follow or were overly experimental – when coupled with unfamiliar interfaces – caused confusion or disengagement. (Pope 2010: 82). Ultimately, Pope concludes that hypertexts need to reveal a story in a somewhat familiar format to be successful, saying 'a complete

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[2] Pope uses the word absorption in his study, drawing on the concept of flow, as developed by Csikszentmihalyi. Brock and Green deal with the issue of definitions between absorption, flow, and narrative transportation, saying; 'Transportation somewhat resembles flow, or optimal experience brought about by absorption in an activity and often marked by a deep sense of enjoyment' (Green, Brock, Kaufman 2004: 315).

[3] Hypertext transfer protocol (HTTP) is used by web browsers to link text and media passages, typically on web pages, and this is the most commonly encountered form of hypertext.

departure from such ordering parameters as “beginning, middle and end”, combined with the additional challenge of interactivity, may create an insurmountable barrier to reading pleasure’ (Pope 2010: 83).

Pope’s enquiry into the ways that digital texts could disrupt absorption and reduce identification with characters raised the need for user-facing design to be a feature of the research process. In particular, it highlighted the need to be cautious about prioritising experiments in narrative design over using formats that felt familiar and navigable. This set my overall design direction as one where the prototypes would be designed to be read in a largely linear way.

1.5 Chapter One Conclusion

I researched Gerrig’s (1998) work on the psychological processes involved in reading in order to understand the cognitive basis of narrative transportation. I decided that the narrative transportation scale (Green and Brock 2000) should be adopted for use as a guide during the making of the prototypes. Furthermore, after reviewing literature on hypertext design, I made a decision to focus on designing prototypes that would prioritise absorption in reading over experiments with structure and interface design.

However, in order to develop an approach to creating narrative transportation through braiding together text and sound, I needed a more detailed way of analysing the way that language cued mental simulations. I did not yet understand how a digital, text-based piece could incorporate sound *and* maintain absorption, given that sensory process (listening) would occur whilst reading. After reviewing the literature on narrative transportation, I chose cognitive poetics as the way that I would approach this task. The aspects of cognitive poetics that I adopted for use within this project are set out in the next chapter.

Chapter Two

2.1 The Influence of Cognitive Linguistics on the Project

I studied the psychological processes involved in reading through cognitive poetics. Cognitive poetics (also known as cognitive stylistics) is a discipline that applies ideas from cognitive linguistics to the reading, interpretation and analysis of texts. Cognitive linguistics is a field that regards language as a manifestation of the mind and assumes the position that there are generalisations common across all languages (Stockwell 2009: 3). These generalities lay in the way that language draws upon our other perceptual facilities, such as sight and touch. Language includes cognition, perception, memory, anticipation, speculative modelling, social relationships, meanings, and emotions (Stockwell 2015: 235). Drawing on these knowledge domains, readers engage in creative reconstruction and imaginative construction when reading literature. (Stockwell 2015: 235). Due to the fact that I studied the detail of these psychological processes through cognitive poetics, I will now outline the literature from the field that informed the development of the approach to writing and design I used in this research project.

2.2 Schemas and Reading

As previously set out in chapter one, a key aspect of Gerrig's (1998) theory is that the transportative effect of writing is achieved through efficient cognitive processes employed when reading (Gerrig 1998: 173). These cognitive processes draw on schema of pre-existing domains of knowledge, creating an expectation of events in a story running in a familiar way. Whilst Gerrig's work focussed on the employment of schema

at plot level, the concept reoccurs within the field of cognitive linguistics. Readers, when progressing through a passage, generate schemas drawn from domains of knowledge and contextualise a meaning through processes that reinforce, disrupt or introduce new schema as the passage progresses (Stockwell 2002: 79-87). Stockwell reiterates Gerrig's emphasis on the fact that one story can create multiple personal readings, saying 'schemas belong to people, not texts' (Stockwell 2002: 83). What Gerrig calls schema are also known within cognitive poetics as frames or scripts (Stockwell, 2002: 75-87).

The use of schema within a mental simulation of a story is linked to greater retention of information contained in the text (Gerrig 1998: 40-41). Margaret Mackey, in her 1997 paper *Good-enough reading: Momentum and Accuracy in the Reading of Complex Fiction*, surveyed readers to assess how much they formed vague mental images based on schema rather than taking in very detailed descriptions. She found that, in order to continue reading at a desirable pace and to maintain transportation into the world of the story, readers found that rather vague images were good enough. Ryan calls the phenomena of readers using schemas built on what they know *the principle of minimum departure* (Ryan 1980). After reading this literature, I began to understand that absorbed readers, when encountering descriptions of a world they do not know, will construct that world in terms of previously known events. In order that I could develop techniques to create speculative stories set in unknown worlds, I decided to research the way schema are processed within mental simulations in more detail. This led me to look at the aspects of cognitive linguistics that analysed how mental simulations are cued by language. Of particular interest was Fauconnier's (2012) model of mental spaces.

> Mental spaces are very partial assemblies constructed as we think and talk for purposes of local understanding and action. It has been hypothesized that at the neural level, mental spaces are sets of activated neuronal assemblies and that the connections between elements correspond to coactivation-bindings. On this view, mental spaces operate in working memory but are built up partly by activating structures available from long-term memory.
>
> (Fauconnier 2012: 351)

Though I did not aspire to delve further into the brain science underpinning this formulation of mental spaces, I felt the concept held promise for a research project that sought to braid text and sound to achieve narrative transportation by creating mental images across the two. I chose instead to look at research that could help me understand how the text I would write might activate aspects of pre-stored knowledge in the reader's mind. This led me to the work of Ronald Langacker.

2.3 An Introduction to Langacker's Cognitive Grammar

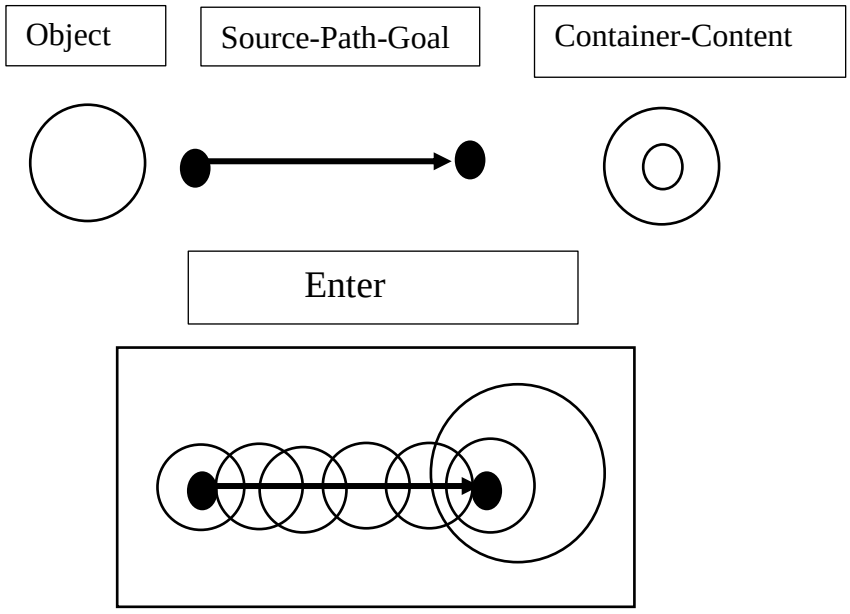
Cognitive grammar is a framework developed by Langacker (2008). I refer to aspects of this framework in further detail throughout this thesis. By way of introduction, building on Fauconnier's ideas, Langacker describes the physical foundations of mental spaces and sets out how these ideas manifest in practice. Langacker's work uses the term *image schema*[1] to express the way that pre-stored knowledge is activated through grammatical and linguistic choices.

[1] Examples of image schema are container, blockage, enablement, path, cycle, part-whole, full-empty, iteration, surface, balance, counterforce, attraction, link, near-far, merging, matching, contact, object, compulsion, restraint removal, mass-count, centre-periphery, scale, splitting, superimposition, process, and collection (Johnson 1987).

Langacker describes image schema as:

> Schematized patterns of activity abstracted from everyday bodily experience, especially pertaining to vision, space, motion, and force. Image schemas are seen as basic, 'preconceptual' structures that give rise to more elaborate and more abstract conceptions (or at least provide their skeletal organization) through combination and metaphorical projection.
>
> (Langacker 2008: 32)

Langacker uses an image to set out the way that the physical experience of moving towards a source, along a path and then reaching the goal is embodied in a grammatical phrase. What follows is a diagram Langacker uses to illustrate how the SOURCE->PATH->GOAL image schema might be used in practice. From his book, this is the imagistic representation of the word 'Enter'.



(from Langacker 2008: 33)

This diagram resonated with me. I saw in more detail the way language cues schemas within the mental simulations described in general terms by Gerrig (1998). By grasping how a single word ('Enter') draws upon multiple domains, including the physical and the visual, I understood how the image schema cued by 'Enter' draws upon our embodied experience of SOURCE->PATH->GOAL. As Gavins (2007) puts it; some of the most salient evidence for the link between mind and body 'can be found in the language we produce to express our position in the world and our relationships with the objects and entities around us. The area of language is known as deixis (from the Greek for 'showing' or 'pointing')' (Gavins 2007: 47). The way that language draws upon our physical experiences of relationships with objects and entities became the key to my understanding of how readers orientate themselves within mental spaces.

2.4 Deixis

Deixis is a psycholinguistic term that is associated with self-world orientation (Galbraith 1995: 21). The concept was originally developed by Karl Buhler, who disconnected the symbol of words such as I – here – now from the deictic (pointing) field and called the orientational axis *origio*. Galbraith contextualises the idea within the act of reading and navigating a text as follows:

> In his (Buhler's) model, the body-feeling representation […] (what psychologists would probably now call body schema), becomes loosened from its involvement with the HERE/NOW/I deictic coordinates of waking life […] and become available to translation into an environment we construct both conceptually and orientationally […] Buhler used the word loosened to indicate

> […] the normal subject never really forgets where he or she is in the physical world, but rather backgrounds this knowledge to allow for imaginative travel.
>
> (Galbraith 1995: 24)

2.5 Text Worlds

Text World Theory (Werth 1999; Gavins 2007) develops the idea of origio and deixis (our real-world relationship with objects) to refer to the reader's cognitive stance – or viewpoint - within a scene. It moves beyond Buhler's I-Here-Now into the identification of other forms of orientating and relational language including definite articles (bag, booth), pronouns (she, he, you), spatial adverbs (far away, there), temporal adverbs (later, sooner) and motion verbs (run, walk, slide). (Stockwell 2009: 128, 2002: 46 – 50; Gavins 2007: 36-38).

The way Text World Theory articulates the specific aspects of grammar that structure mental images of space based on real-world experiences was useful to me. It was key to developing a user-centred writing approach as it gave me an understanding of how to write scenes with the reader in mind. As Stockwell puts in in his article *The Texture of Authorial Intention*, 'Text World Theory models the rich world of a literary reading as a mental representation that is co-produced in the mind of the reader by an author's choices in providing textual patterns' (Stockwell 2016: 150). I found the way that Stockwell centres the writer's relationship with the reader when creating a mental simulation to be useful to this research. By aligning analytical tools used for reading with tools used to write, I could make a conceptual link that allowed for cognitive grammar and cognitive linguistics to be applied practically to the writing undertaken within this research project. I came to think of this as a process where tools from

cognitive poetics were used to analyse and conceptualize the way that the elements of my multimodal text might be structured in the mind of the reader. To develop this idea in a way that could be useful to other writers, I will now set out the aspects of Langacker's framework that foreground the relationship between the reader and writer of a text in more specific terms.

2.6 Cognitive Grammar and the Role of The Writer

In order to begin to discuss how writers might usefully apply cognitive grammar to multimodal text creation, a good place to start is Langacker's conceptualisation of *construal*. Construal is described by Langacker as 'an ability to perceive and portray the same situation in alternate ways' (Langacker 2008: 43). Nuttall (2018: 37) suggests that 'construal applies to all encounters with language, including that of a writer, who makes choices in coding his or her conceptualisation, and a reader, who conceives this meaning based on these linguistic cues'. To draw out this idea, Langacker further defines the construal relationship as 'the relationship between a speaker (or hearer) and a situation that he (sic) conceptualises and portrays, involving focal adjustments and imagery' (Langacker 1987: 487–88). In this definition, the construal relationship involves an individual speaker or hearer on the one hand, and a conceived situation on the other (Verhagen 2012: 59). Zwaan and Madden (2005) define construal as a mental simulation conveyed by an attentional frame, where words and grammar cue, activate and combine traces of experience (Zwaan and Madden 2005: 236-8). I found this definition useful as it not only reiterates that the writer must first conceptualise – or mentally simulate – a situation before turning to the task of coding it within their work,

but also foregrounds the idea that writing involves the design of a mental simulation that will be decoded by readers drawing on their own experiences. Langacker uses his conceptualisation of construal to describe with great precision the way that a scene builds in the mind as a sentence or phrase progresses and schema are modified by readers. I will set out the more complex and detailed terms used by Langacker next.

2.7 Construal As Visual Field

In order that I could use it to design sound-led text games, I decided that the conceptual framework developed through this research would involve synthesis of Langacker's work on cognitive grammar with theories of listening to cinematic sound design. One of the primary reasons for pursuing Langacker's ideas was the way his explanations of construal phenomena frequently employ visual metaphors, such as *focus* (Langacker 2008: 57) and *perspective* (Langacker 2008: 73), and the way that he presents conceptualizations as scenes that are seen from a *vantage point* (Langacker 2008: 76).

To further illustrate this, it is useful to set out Langacker's concepts of *vantage point* (Langacker 2008: 75) and *viewing arrangement* (Langacker 2008: 73). Vantage point, which can be thought of as the viewing position taken in a scene, is a central aspect of construal involving focus and *specificity* (Langacker 2008: 55). When an expression brings into focus a relationship (rather than a thing), the participants in the relationship are profiled by the reader and degrees of prominence are afforded to each, with the most prominent participant termed a *trajector* (Langacker 2008: 70-73). Other participants in the relationship – those given secondary focus – are called *landmarks* (Langacker 2008: 70-73). When using the preposition 'above', the trajector is conceived as higher than the landmark, whilst the opposite is true of 'below' (Langacker 2008: 71). Langacker says: 'One component of the viewing arrangement is a

presupposed vantage point […] Many expressions undeniably invoke a vantage point as part of their meaning (arguably, all expressions do). In one of their basic uses, for example, 'in front of' and 'behind' rely on vantage point to specify the trajector's location.' (Langacker 2008: 75-76).

Talmy (1983) refers to Langacker's concepts of trajector and landmark as being directly comparable to the idea of 'figure' and 'ground' (Talmy 1983: 232). This reference to Gestalt psychology helps describe how a moveable or moving object is perceived in a scene against a static, less attended to background. These ideas enabled me to think about the way that attention is paid to movement within a scene and the way that newly emerging elements become objects of focus.

In cognitive grammar, conceptualization is *dynamic* (Langacker 2008: 31) and unfolds through processing time as a *compositional path* (Langacker 2008: 61) is followed. This process involves *mental scanning* (Langacker 2008: 82) of symbolic components until the *composite* (Langacker 2008: 60) construction foregrounds particular elements over time (Langacker 2008: 60-65). In terms of how the dynamic scanning processes involved in conceptualization affect the composite construction, Langacker sets out how 'the specific course of development is a significant aspect of our mental experience' (Langacker 2008: 32). Choosing which word to use alters the view of two identical spatial relationships and influences the way that movement in an image is simulated in the mind of the reader. Langacker offers the following as an example: 'The hill gently rises from the bank of the river', as contrasted with 'The hill gently falls to the bank of the river', where the direction of mental scanning is directed upwards ('rises') or downwards ('falls') (Langacker 2008: 82). In Langacker's example, the hill does not move, but motion of the vantage point is simulated: the mental scanning processes involved in reconfiguring a mental space as new elements are

encountered alter the view of the scene. The particular phenomenon exemplified here is known as 'fictive motion' (Talmy 1983: 232), where motion is simulated through the figure in a scene being a moving or conceptually moveable object against the ground. Fictive motion occurs specifically when the object in the scene is not capable of movement itself.

In terms of how cognitive grammar enabled me to think about the multimodal nature of a reader's experience, I found it useful to refer to the work of Matlock (2004), who examined the way that fictive motion manifests itself in the mind of readers. Using an experimental design, Matlock concluded that sentences containing fictive motion, such as 'the fence runs along the coast', result in participants simulating movement as they read the words. Matlock says:

> Taken together, the research on mental simulation suggests that people (1) construct models that resemble physical space, (2) simulate objects and movement in these spatial models, and (3) simulate in a way that is to some extent analogous to perceiving physical movement.
>
> (Matlock 2004: 1391)

Overall, these concepts helped me understand how to produce a text so that the reader simulates physicality when construing a scene. Combined with the knowledge of the way that word choice can simulate fictive motion, I began to develop techniques to cue simulations rich in movement-based data that position readers visually within the world of the story. These techniques were applied in practice during the development of prototype one, and will be explored in further detail in part two of this thesis.

2.8 Coding Construal

Understanding how construal processes involve dynamic scanning and refocusing of attention enabled me to keep focus on how the player-reader would experience the pieces. This way of thinking led me to apply Langacker's ideas to the development of the software that would run the computer simulation. One aspect of programming computers is the need to break down problems into small parts that can be parsed and compiled as instructions. The detailed terminology developed by Langacker allowed me to break down the prototypes as I wrote. In this sense, by applying cognitive grammar, I could approach working with software. Working like this, I was able to create spreadsheets that set out events and user input as they connected to changes in the story presentation. This led to the creation of an author-led work flow, where I was able to understand how modifications made to both textual and sonic elements would be related through code.

2.9 Chapter Two Conclusion

In this chapter, I set out the core theories from cognitive linguistics that underpin the conceptual framework I applied during the research process. I explored the way readers construct deictic positions within mental models of scenes through Text World Theory, which sets out how grammatical choices effect these images. I gave an overview of the visual basis of terms used by Langacker to describe how we construe expressions and dynamically build composite meanings.

In order to illustrate how these theories were applied in practice, I will use the next chapter to set out readings of two pieces of literary speculative fiction. The goal of these readings is to illustrate how cognitive poetic techniques can be used to analyse how mental imagery is built and to show how I began to apply these techniques within

my research. As this research focuses on conceptualizing climate-changed worlds across sound and language, the texts I chose to read – *Annihilation* by Jeff VanderMeer and *The Odds Against Tomorrow* by Nathaniel Rich – both have environmental themes and are rich with sonic sensory data.

Chapter Three

3.1 Language and Multi-Sensory Simulation

An aspect of the approach I took to this research involved analysis of literary texts in order to understand how language simulated sound. Consequently, this chapter addresses the way that language in literature can evoke multi-sensory simulations. I do this in order to develop an approach to conceptualizing the ways that sound can be braided with language in a multimodal context.

An important starting point for this chapter is to establish the fact that language does not direct any input to the senses. This means that, when reading, sensory data must be simulated by the imagination (Ryan 2001: 11). By undertaking an analysis of how language simulates the senses, I learned how to break down texts into components. This ability came to be useful when designing work that would involve player-readers mentally simulating scenes generated by language whilst listening to soundscapes.

In order to develop this approach, I analysed two pieces of literary writing – *Annihilation* by Jeff VanderMeer and *The Odds Against Tomorrow* by Nathaniel Rich – using cognitive poetics. These are set out in the latter part of the chapter.

3.2 Cognitive Grammar and Sensory Simulation

Many of the terms used in this section are drawn from Langacker's (2008) work on cognitive grammar. He uses the visual field as the basis of many of his terms – for example vantage point, focus, prominence – but non-visual aspects of sensory perception are also involved in mental simulation (Langacker 2008: 55). Construal in cognitive grammar is dynamic and involves scanning of components to conceptualize a

composite mental image as a clause progresses (Langacker, 2008: 60-65). In this sense, conceptualization involves neurological activity that happens over time (Langacker 2008: 79). Langacker likens his formulation of dynamic conceptualization to the theory of Lawrence Barsalou (Langacker 2008: 79), where Barsalou (1999) articulates the way that mental simulations work to activate multisensory experiences. As Barsalou's work moves beyond visual perception and explores the wide range of perceptual experiences involved in simulations, a brief overview of his ideas follows.

3.3 Perceptual Symbol Systems

Langacker likens the dynamicity of conceptualization (the way that meaning builds as we process a text) to the theory of mental simulation set out by Barsalou (Langacker 2008: 79; Barsalou 1999). The connection between Langacker's framework and Barsalou's work on perceptual symbol systems (Barsalou 1999) can be understood in terms of Langacker's definition of construal phenomena (such as profiling, focusing and vantage point) as applying to conceptions in any domain (Langacker 2008: 79), where a domain is defined as 'any sort of perceptual experience' (Langacker 1986: 4). Barsalou (1999) uses the term *perceptual symbols* to describe the neural states that underlie perception. Perceptual symbols are dynamic, compositional and stored with associative patterns of neurons and are multi modal, operating on any aspect of a perceived experience, from touch to visual to auditory (Barsalou, 1999: 585). Barsalou's framework sets out the way that mental simulations work by describing how the brain activates configurations of neurons to represent the properties of perceived events and

entities (Barsalou 1999: 582). These configurations are organized in frames[1], defined by Barsalou as integrated systems of perceptual symbols used to construct specific simulations of a category (Barsalou 1999: 583-4). In this sense, frames are dynamic.

> Simulation is the re-enactment of perceptual, motor, and introspective states acquired during experience with the world, body, and mind. As an experience occurs (e.g. easing into a chair), the brain captures states across the modalities and integrates them with a multimodal representation stored in memory (e.g. how a chair looks and feels, the action of sitting, introspections of comfort and relaxation). Later, when knowledge is needed to represent a category (e.g. chair), multimodal representations captured during experiences with its instances are reactivated to simulate how the brain represented perception, action, and introspection associated with it.
>
> (Barsalou 2008: 616-617)

Having established Barsalou's principle that mental simulation involves all types of perceptual experience, I should now like to proceed to setting out two readings of texts that show how language can cue sensory data.

I selected the first passage, from VanderMeer's *Annihilation*, specifically to illustrate how dynamic construal involves the allocation of attention to trajectors (Langacker 2008: 70-73). As scanning occurs during reading, elements are profiled and selected for attention (Langacker 2008: 107, 111). As previously discussed in chapter 2.7, when an expression brings into focus a relationship (rather than a thing), the

[1] The term 'frame' is used interchangeably with Langacker's term 'domain' within the literature on cognitive linguistics (e.g. Croft, Cruse 2004: 17) and both refer to 'a coherent region of human knowledge' (Croft, Cruse 2004: 14)

participants in the relationship are profiled by the reader and degrees of prominence are afforded to each. The most prominent participant is termed a trajector (Langacker 2008: 70-73). Other participants in the relationship – those given secondary focus – are called landmarks (Langacker 2008: 70-73). Following Barsalou, simulation is multimodal and patterns of neurons associated with a trajector's profile will be activated across all aspects of the reader's perceptual experience as the simulation cued by the text unfolds in time.

3.4 A Cognitive Poetic Reading of *Annihilation* by Jeff VanderMeer

Annihilation is the first of a trilogy that explores Area X, an area of green and strange space that has encroached on a coastal area of America and has become the subject of numerous scientific missions. Those who attempt the missions either do not return or die in the months after returning. This passage is taken from a part of the story where a biologist, who is struggling to make sense of Area X, perceives a presence there that makes her fear for her life. The passage has been chosen because it is set in an alien environment, necessitating the writer to construct a simulation without reference to stored experiences of that place; VanderMeer cannot simply write 'the sound of Area X' to provoke a simulation. Furthermore, the environment is rendered largely through reference to auditory experiences. As it opens, we find the protagonist listening to something she believes is pursuing her through the reeds on her journey back to base.

> The dragging sounds had intensified, almost equal to the moaning. A thick musk clung to the air […] Now the darkness was so complete I could only see a few feet ahead of me, the flashlight revealing little or nothing. I felt as if I were moving

> through an encircling tunnel. The moaning still grew louder, but I could not determine its direction […] There came the moaning again, as close as I'd ever heard it, but now mixed with a loud thrashing sound. I stopped and stood on tiptoe to shine my flashlight over the reeds to my left in time to see a great disrupting wave of motion ahead at a right angle to the trail, and closing fast. A dislocation of reeds, a fast smashing that made them fall as if machine-thrashed. The thing was trying to outflank me […] I could feel the rasping clack of the reeds beneath its tread, and there was a kind of expectant tone to its moaning now that sickened me with the urgency of its seeking.
>
> (VanderMeer 2014: 141-2*)*

This passage establishes the deictic position of the protagonist within the landscape by referring to visual experience, specifically the experience of trying to see through fog at night with a torch. This is done through the phrase 'A thick musk clung to the air…Now the darkness was so complete I could only see a few feet ahead of me, the flashlight revealing little or nothing.' The use of the preposition 'ahead' draws on a SOURCE -> PATH -> GOAL image schema and demonstrates how physical experience can be drawn upon to create a vantage point within a scene.

In terms of sound, by writing 'I could feel the rasping clack of the reeds beneath its tread', VanderMeer references the sense of being touched to embody an external force. He focuses this further by choosing consonant-charged words ('rasp' and 'clack') to profile the sharpness of the threat, which is scanned last in the sentence as being one that is 'closing fast.' The construction of the phrase 'I felt as if I were moving through an encircling tunnel' is effective due to the protagonist being positioned as a trajector before the word order foregrounds the moving tunnel. By using the preposition

‘through’ and then placing ‘encircling tunnel’ last in the sentence, scanning processes applied during the construal process modify the point of view as being surrounded, looking around and ahead. The use of ‘encircling’ is particularly effective as it focuses on oscillating movement and oscillation is what causes sound (due to disturbance in the air causing sound waves). The scene is punctuated by the words ‘thrashing’, ‘dislocation’, ‘disrupting’ and ‘smashing’, all of which are embodied experiences that evoke physical forces and the consequential sound of impact and movement. Furthermore, this passage makes direct reference to our stored simulations of physical ‘dragging sounds’ and evokes a machine – perhaps a combine harvester – to offer a concrete image of the source of this. In terms of establishing the deictic centre of the protagonist in relation to the sound source, the disorientating nature of the experience being simulated is drawn through use of the phrases ‘I could not determine its direction’ and ‘There came the moaning again, as close as I’d ever heard it’. Once this machine is evoked, along with movement (‘machine thrashed’), the bringing to attention of ‘the rasping clack of the reeds beneath its tread’ focuses the machine as being closer (due to the prominence of the tread in the image) than it was previously, whilst offering a more precise rendering of the sound it makes (‘rasping clack’). This creates a sense of encroaching danger.

Through this reading, I explore the way that the sound of an environment can be rendered through a linguistically cued simulation of dynamic forces. However, it is important in the context of this chapter to see that the simulations are effective but possibly too dense: in a multimodal context, there may be a need to make room for sensory input without breaking the effect of the simulation generated through reading. Imagine this scene with spatial sound: the machine can be perceived as moving closer, the thrashing can be heard. Time would not need to be spent in the text simulating this

sensory data by the writer, it would be spent instead in the sound studio or the digital development environment. The timing of the display of the words would be organised and programmed to be displayed in shorter segments and synchronised with the sound. This would alter the way that the writer would direct attention and the selection of elements for specific profiling.

My reading of *Annihilation* highlights the way that attention is allocated though language and the way that multi-sensory data is simulated through words. It also highlights how Langacker's core concept of image schema manifests in literature, demonstrating in practice the way that language is grounded in physical experiences. To move the discussion on, it is now useful to look at other concepts from cognitive poetics that I used as tools to read and understand the way that rich sensory simulations can be built through the use of metaphors. To explore this further, I will give an overview definition of conceptual metaphor before setting out a reading of *The Odds Against Tomorrow* by Nathaniel Rich.

3.5 Conceptual Metaphor

As previously discussed in chapter 2.3, Langacker's definition of image schema is that they are 'schematized patterns of activity abstracted from everyday bodily experience […] that give rise to more elaborate and more abstract conceptions […] through combination and metaphorical projection' (Langacker 2008: 32). By way of illustration of such a metaphorical projection, 'narrative as journey' is an example of a conceptual metaphor, where the source domain (journey) of a physical experience is mapped onto the target domain (narrative) (Lakoff and Johnson 1980). A further example of conceptual metaphors grounded in physical experience is the way that we talk about life

being on the up as being healthy or good and of it being down as bad (Lakoff and Johnson 1980: 16). Though metaphors related to major orientations (in-out, centre-peripheral) tend to be general across all cultures, some metaphors tend to be reliant on cultural contexts for their meaning, such as 'time is money' (Lakoff and Johnson 1980: 9, 34). Metaphors can also be ontological, for example those metaphors where the physical object is further specified as being a person, as in 'this fact argues against the standard theories' (Lakoff and Johnson 1980: 33). Personification is said by Lakoff and Johnson to be 'a general category that covers a very wide range of metaphors, each picking out different aspects of a person or ways of looking at a person' (Lakoff and Johnson 1980: 34).

In terms of the ways that metaphors can engage readers in mental simulations, I found it relevant to look at the findings of Lacey et al (2012), who demonstrated empirically that conceptual metaphors trigger somatosensory activity, where somatosensory relates to bodily sensations. Their particular study builds focussed on the way that textural metaphors ('she was going through a rough patch', 'it was smooth sailing' or 'it was a sticky situation') activated texture-selective somatosensory cortex (Lacey et al 2012: 423). Empirical evidence also suggests that use of embodied metaphors that use the source domain of taste (e.g. 'she looked at him sweetly'), creates stronger cognitive engagement than literal counterparts ('she looked at him kindly'). This is due to their being grounded in sensorimotor and perceptual representations (Citron and Goldberg 2014). Citreon and Goldberg also point out that novel metaphorical expressions have been found to require more cognitive resources than either literal metaphors or conventional metaphors (Citron and Goldberg 2014: 2586). These studies hold clues for writers as to how to engage readers through use of metaphor. To further develop this idea, I now offer a reading of *The Odds Against*

Tomorrow, where Nathaniel Rich makes use of many metaphors to simulate a deluge. This will show how the techniques used by VanderMeer in *Annihiliation* can be combined and augmented with the use of conceptual metaphor. I do this not to make any judgement of one writer over the other – I admire both of these passages greatly – but to offer further demonstration of the concepts developed in this chapter.

3.6 A Cognitive Poetic Reading of *The Odds Against Tomorrow* by Nathaniel Rich

The Odds Against Tomorrow by Nathaniel Rich (2013) is set amongst the days and weeks following the (fictional when he wrote it) flooding of New York City. The protagonist of the book is Mitchell Zukor, a mathematician turned successful risk forecaster making big money working for corporate clients predicting events, specifically a flood. The passage selected describes the moment the rain first begins to fall and Zukor is amongst the Manhattan crowds.

> A great curtain of rain drew across the Great Lawn. Mitchell could hear it before it was upon them, a vociferous lashing of dried leaves and baked soil. Angry fist-sized droplets detonated on the ground in front of them, and a sagging, wounded belly of the cloud passed over their heads. It was like walking under a waterfall or into a car wash. The rain pelted like hurled stones. The force was staggering. The people around him, raising their hands over their heads, laughed at its comical, bullying strength. They were like children being tossed around by a half-playful and half malicious older brother.
>
> (Rich 2013: 117)

This excerpt demonstrates the manifestation of the concepts of vantage point and trajectors (Langacker 2008), conceptual and personification metaphors (Lakoff and Johnson 1980) and fictive motion (Talmy 1983) in writing practice. To understand in detail the way that these concepts can be observed in practice, I found it useful to examine the way that the sentence construction and sequence move the vantage point of the reader around the scene. The opening ('A great curtain of rain drew across the Great Lawn.') creates movement within a visual image that foregrounds the dynamism of the rain event by using the phrase 'drew across' to position the rain as a the prominent trajector moving over the ground of the great lawn. By following this up with the use of a trajector to simulate movement (in the phrase 'a sagging, wounded belly of the cloud passed over their heads'), the vantage point and deictic centre of the protagonist is shifted into the centre of the image, beneath the sky. The choice of the word 'belly' to describe and profile the cloud not only reinforces the vantage point of being below the sky but also brings the environmental phenomena that is a weather system close to the body of the reader. The use of 'belly' to describe the cloud also demonstrates the use of embodied metaphor to centre the reader in a physical experience. This embodiment of environmental phenomena is increased through the choice of adjective used to describe the force of the rain ('staggering' in 'The rain pelted like hurled stones. The force was staggering'). The drawing of attention directly to a bodily sensation within forceful water (by using 'walking under a waterfall or into a car wash') evokes the physicality of the protagonist at the same time as enforcing the power of the rain. By engaging the somatosensory system in a simulation of the stored experiences of being in rushing water, this physicality is further compounded. Rich's use of 'fist-sized' as a metaphor to describe the rain further engages the body, simulating the experience of a thumping impact on the skin of the reader.

Beyond this physicality and movement of vantage point, the excerpt introduces how the sensing of sound is simulated in language. Consider the following sentence again: 'Mitchell could hear (the rain) before it was upon them, a vociferous lashing of dried leaves and baked soil'. The sound is evoked by switching attention to a visual cue: dry leaves being lashed. This image is used to evoke memories of the sound of rain smashing against dried leaves. After cuing this auditory data, the use of 'hurled stones' enforces a dynamic of force and volume into the simulation of lashing rain on leaves. For something to be hurled, there must be a person (or other living entity) doing the hurling. In effect, Rich is personifying the rain as an angry, attacking force. This 'force was staggering', and so the physical experience of this type of movement is added to the simulation by cueing the somatosensory system of the reader. By choosing to draw attention to the embodied physical memories of defending our faces against blows (by using the trajector of arms raising over the landmark of the head) and then referencing the experience of being thrown around by a sibling or bully, Rich has successfully simulated the experience of this extreme weather event as being one of assault. Of interest to this thesis, however, is that he has only managed to do this by returning all readerly attention back to their body and, thus, to the human. Personification of weather may create an effective simulation, but in the context of this project, the way that language is limited in its ability to represent and articulate natural phenomena outside of our prior (human) experience offered me a way to think about how sound could be used within the designs. By using sound recordings of nature, and of weather, I could bring the sound of species and weather events not yet experienced by the readers into the prototypes. Beginning to understand the limits of language in the context of writing about the Anthropocene opened up an approach to the sonic elements of the designs.

3.7 Chapter Three Conclusion

In this chapter, I set out the role of schema and frames within multisensory mental simulation, particularly in terms of how attention is allocated and how dynamic conceptualization can engage the body of the reader. Through applying specific tools from cognitive poetics to readings of literary texts, I was able to analyse how the sound of an environment can be rendered through language. These readings led to me understanding that the environment can be rendered in an embodied way through use of metaphors that encourage personification of phenomena such as rain. The readings also opened up my thinking about how sound could communicate weather and species that lay beyond experience.

In the context of multimodal writing, however, I realised that simply adopting an approach to writing that sought to emulate the techniques used within the writing analysed here would not work. The language-only simulations are effective but dense: there is a need in multimodal texts to 'make room' for sensory input without breaking the effect of the simulation generated through reading. I began to ask if a simulation could maintain its coherence when cued by sound and text. The research process that explored this question will continued to be developed in the next chapter, which focuses on the development of my approach to sound design.

Chapter Four

4.1 Moving Towards Sound Design

In the previous chapter, I applied cognitive poetics to two readings of literary texts. In particular, I used cognitive poetics to explore how language can cue a simulation of perceptual experience, including auditory experience. However, whilst literary writing can cue and recall a simulation of, for example, the sound of rain on dried leaves (Rich 2003: 117), the dynamic nature of construal (Langacker 2008) means such simulations are momentary: we seem to 'glimpse' the sounds in the previous chapter's readings of Nathaniel Rich and Jeff VanderMeer. In this sense, I came to understand the nature of how words cue experiential traces of auditory perception (Zwaan and Madden 2005: 224; Barsalou 1999) in practice. However, in order to braid sound and text to cue mental simulations, and to move past analysis of monomodal literary work, I needed to augment my conceptual framework in order to conceptualize the impact of sensory input on mental simulations. Furthermore, I needed to develop an ability to sequence sound and language coherently within a mental simulation.

To do this, I began to imagine how listening to sensory input could be balanced with the momentum of mental imagery generated through reading. Through study of cognitive poetics, I understood that construal and conceptualization involves activation of knowledge stored in many domains but, to incorporate sound, I needed to understand how we process auditory cues. Due to there being a lack of pre-existing framework for braiding sound with language to cue such simulations, I had to construct my own. To do this, I began to synthesise concepts from musical grammar with linguistic grammar and with theories of auditory perception in cinema. I tested and applied the conceptual

approach through practice. The theoretical aspects of sound that I incorporated into my approach will be set out in this chapter. However, before proceeding to do this, I will first establish a working definition of sound as it is applied through this research.

4.2 A Working Definition of Sound and Music

In the context of this project, sound does *not* include instrumental music. Neither does it include dialogue in the sense that dialogue might be used in a radio play or a fictional podcast. I made the decision to minimise the amount of spoken dialogue and narration in the piece in order that the emphasis of the research stayed on the combination of silent reading and listening to (non-human) sounds. As the thesis references Lawrence Zbikowski's *Foundations of Musical Grammar* as a framework for thinking in the domain of sound, the apparent contradiction of the previous statement that sound does not include instrumental music should be clarified.

Music in the context of this project means, in the main, musique concrète. Musique concrète is a type of soundscape composed from recorded sound and is created through techniques such as editing, looping, time-stretch/compression and layering (Schaeffer 2012). Reliant on the manipulation of recordings, it was developed with the advent of tape and is categorised as part of the field of electro-acoustic music.[1] It is also influential in the field of film sound design.[2] Tape (and digital recording) enables a type of sound practice that separates source from sound object, which Schaeffer defined as acousmatic sound: sound that you hear but never see the source of. Significantly for a

[1] For more information on Musique Concrète see http://120years.net/the-grm-group-and-rtf-electronic-music-studio-pierre-schaeffer-jacques-poullin-france-1951/

[2] Film sound designer Walter Murch talks about the influence of musique concrète on the field of cinematic sound design in this interview on YouTube: https://www.youtube.com/watch?v=Lm48OzyLnU8.

discussion on multimodal texts, film sound scholar Michel Chion (1994) used acousmatic as a term to mean the off-screen sound sources that can be heard when viewing frames of a film (Chion 1994: 40). Conversely, sound synchronised with image is defined as *de-acousmatized* (Chion 1994: 130). These ideas came to be usefully applicable to the design of multimodal text when synthesised with Langacker's concepts of vantage point in linguistically rendered imagery.

4.3 Acoustic Ecology

This research is grounded in a wider field know as acoustic ecology The origins of acoustic ecology lay in the world soundscape project, a project initiated by R. Murray Schafer in the late 1960s. Schafer regarding the acoustic aspects of the world as 'a huge musical composition unfolding around us ceaselessly' (Schafer 1994: 205). Schafer identified soundscapes as comprising of keynotes (sounds generated by geographic location that set the tone of a soundscape, including animal vocalisations), signals (foregrounded sounds, with Schaffer particularly highlighting sounds designed by humans to attract attention) and soundmarks (a sound that is unique in a community or area) (Schafer 1994: 9-10). He further argues that any soundmarks identified as being significant by communities deserve to be protected. (Schafer 1994: 10). He situates sound pollution (which he terms 'mechanical jabber') in terms of its detriment to health (Schafer 1994: 184, 202).

Schafer advocates for sound recording to be used within soundscape composition in order to retrieve 'a significant aural culture.' (Schafer 1994: 206). Of the approach to acoustic ecology developed by Schafer, Truax says; 'the soundscape model most typically describes a balanced, two-way relationship between the listener and the environment'(Truax 1998). A sound recordist adopting a recording-based

compositional approach would typically engage in listening during a soundwalk, a concept of Schafer's further developed by Hildegard Westerkamp (1988), who describes this process as the 'balance between listening and soundmaking, impression and expression' (Truax 1998: Westerkamp 1998).

An early advocate of an open and democratic approach to soundscape making, Hildegard Westerkamp developed her walking-based soundscape composition method by making pieces for radio, using narration within the recording to describe the context of the landscape. This narration brought the audience's attention to cause of the sounds being listened to (Lane and Carlyle 2013: 112). This addition of contextual information is seen by Westerkamp as 'an essential part of any work done in acoustic ecology' (Westerkamp in Lane and Carlyle 2013: 116), with the contextual information placing 'the listener and recording into some sort of relationship' in order to make clear what the message of the work is (Westerkamp in Lane and Carlyle 2013: 116). In addition to recording, Westerkamp also applies digital processing within her soundscape design (Lane and Carlyle 2013: 115).

The practice of selecting, processing and editing sound recordings to create narrative arcs and cinematic imagery is deeply embedded within the methodology I adopt throughout this thesis. By placing my recordings into a narrative structure, I was able to contextualise them and create a clear relationship between the listener and the recordings. In prototype three, I included vocal narration that describe the source of the sounds being heard by the player-reader. In this way, I adapt Westerkamp's techniques of using vocal description to situate the listener in some kind of relationship with field recordings within an interactive media format.

This thesis further applies the recording-led, soundwalk-based methodology of acoustic ecology throughout prototype three. To make the prototype, I attended a field

recording trip with Chris Watson, a prominent wildlife sound recordist. On the trip, I took part on soundwalks with Chris, identifying which sounds I would capture and present before making the recordings. In terms of the overlap with definitions of musique concrete, Watson refers to his process as one where he edits and time compresses his field recordings into a 'filmic narrative' (Watson 2020). Watson has released edited and time-compressed collections of his recordings, for example *Weather Report* (Watson 2003), often organising an album around geographic locations, named clearly to add a context to the recordings.

An additional way that this thesis directly applies Schafer's ideas of acoustic ecology is by drawing upon the way that the soundscape project engages with the nature of human relationships with the sounds of other species. Schafer highlights studies that have classified the calls of birds, insects, marine life and land mammals and that attempt to code the meaning of these calls in written language (Schafer 1994: 33-38). Schafer says; 'In onomatopoeic vocabulary, man (sic) unites himself with the soundscape around him. […] But the soundscape is too complex for human speech to duplicate' (Schafer 1994: 42). I applied these ideas in practice throughout the design of prototype two, where I used animal behaviour studies and edited associated recordings of whale and Blue Jay calls to create soundscapes within a listening-led game that explores the ways that noise pollution impacts on a species ability to survive.

4.4 Sound and Space

A particular focus of this research was the ability of sound to develop our mental imagining of the space outside of our own bodies. I found the thinking of Denis Smalley, who says, 'sounds in general, and source-bonded sounds in particular, carry their space with them – they are space-bearers' (Smalley 2007: 38), useful. Source-

bonding is defined by Smalley as our natural tendency to relate sounds to supposed sources and to each other if they appear to have shared origins (Smalley 1991: 110). In this way, Smalley expresses the way that certain sounds cue a process of imagining a source.

The ability of sound to render space is due to how it travels in waves. These waves collide with surfaces and with objects encountered on the path from source to listener. These collisions can reflect or delay waves travelling from the sound source. Waves from the same source can hit our ears at slightly different times. Open exteriors tend to have fewer surfaces and so fewer such reflections (Rumsey 2005: 5). Sound recordings capture reflections (or lack of reflections) along with the original source. In film sound design practice, use of artificially rendered reverberation to add reflections is a common way to bond sounds to a simulated space.

My main intention for differentiating between formal instrumental music and more experimental practice is due to the fact that formal music expresses human experience through instruments designed by humans for that purpose. As electro-acoustic composer Barry Truax says, instrumental 'music frequently functions as a surrogate environment that interposes itself between us and the external world, imposing a relationship instead of expressing it' (Truax 1992: 374). I wanted to create a soundtrack that expressed aspects of the landscape, not impose a barrier between it and the player-reader. By working with musique concrète, I hoped to make a clear distinction between the human communicative systems that are language and instrumental music and the sound of the environment itself.

In line with the thinking developed through the readings of Nathaniel Rich and Jeff VanderMeer in chapter 3.5 and 3.7, I began to separate out the function of sound and language within the mental simulations that I was beginning to conceptualise. By

using a recording-based medium like musique concrète, I could use sound to create a sensory experience of elements beyond the prior experience of player-readers. Language might have to reference a similar prior human experience to create environmental simulation, but use of environmental sound offered a way to escape this limitation.

4.5 Musical Grammar

A key aspect of the methodological approach I adopted within this research was the synthesis of an analysis of musical grammar with Langacker's formulation of cognitive grammar. The framework of musical grammar to which I primarily referred was *Foundations of Musical Grammar* (Zbikowski 2017). In this work, Zbikowski adopts Langacker's work on cognitive grammar to the structure and meaning of music. Music, and by extension musique concrète, is explored for its ability to represent dynamic phenomena through its structure, in contrast to the grammatical functions employed in language to direct attention (Zbikowski 2017: 6, 9). Zbikowski suggests that music has an analogous, rather than symbolic, function and uses the term 'sonic analog' to define this. Sonic analogs are based on form-function pairs representing emotions, gestures and dance (Zbikowski 2017: 1). As an example of what he means by the term sonic analog, Zbikowski describes a motif (or 'token') that involves two notes, the first higher than the second and with no accent on the second, commonly used in music to refer to a sigh. This is an example of a sonic analog, with the analogical reference being made to the dropping of shoulders involved in the physical act of sighing. He further argues that music provides sonic analogs for dynamic processes, such as weather or movement (Zbikowski 2017: 9-10). One sound can stand in for another, and the capacity of humans for such analogous interpretation 'makes possible a form of reference quite

different from that employed by language, one that is uniquely explored by music' (Zbikowski 2017: 4). Zbikowski sets out how musical grammar differs from the grammar of verbal language.

> Symbolic tokens are very useful for picking out objects and events, and characterizing relationships between them. Analogical tokens are less useful in this regard but very good at representing complex spatial relationships and summoning dynamic processes that unfold over time.
>
> (Zbikowski 2017: 10)

Zbikowski further asserts that because music – and by extension musique concrète – makes fewer demands on interpretation whilst symbolising dynamic processes, it has an ability to serve as a sonic analog for the dynamic of our emotions (Zbikowski 2017: 11). By referencing emotions and movement directly, sound has the potential to bring these types of dynamic spaces into a multimodal text with more immediacy than language can.

4.6 Cognitive Grammar and Vantage Point: Conceptual Access to a Sound Design Approach

In terms of synthesising Zbikowski's ideas and Langacker's framework, the idea that language picks out objects or events and characterizes the relationship between them whilst music conveys complex spatial relationships and dynamic forces (Zbikowski 2017: 10 - 11) was a useful concept. It allowed for a conceptualization of the way that one (language) differs from the other (music), and of how a soundtrack can perform a particular function within a text-heavy multimodal simulation. Furthermore, the idea

that sounds convey space and provoke an imagining of their possible source (Smalley 2007, 1991) also highlighted the perceptual processes involved in listening to certain types of auditory stimuli. I saw that, if acousmatic sound is sound that has a source that is off-screen (Chion 1994: 40), and listening to such sounds provokes a process of imagining this source, then sound cues aspects of a mental simulation in a way that differs from language: it is processed via perception prior to being incorporated into a simulated scene. Furthermore, as linguistically based construal involves the adoption of a vantage point during the dynamic structuring of mental images (Langacker 2008: 76), I began to understand the task of braiding sound with language in terms of cinema. This is because cinematic sound design practice has to take auditory processing into account and must also synchronise sound meaningfully with images.

To begin to illustrate this approach in more detail, it is useful to set out Langacker's concepts of vantage point and viewing arrangements once again. Though this idea has been covered in earlier parts of the thesis (see chapter 2.7), the use of visual terms such as *focus* (Langacker 2008: 57) and *perspective* (Langacker 2008: 73), when read alongside theory describing ways of listening to sounds and imagining their sources, allowed me to make a conceptual connection with sound in cinema. This connection lay in Langacker's use of visual terms to describe mental images cued by language. Once the connection had been made, I began to formulate a practice-based experiment: what happens if mental images cued by language are likened to cinematic images and then augmented by cinematic sound design? To pursue this idea, I would like to look at the visual terms used by Langacker again:

> One component of the viewing arrangement is a presupposed vantage point […] Many expressions undeniably invoke a vantage point as part of their meaning

> (arguably, all expressions do). In one of their basic uses, for example, 'in front of' and 'behind' rely on vantage point to specify the trajector's location.
>
> (Langacker 2008: 76)

This use of visual terms by Langacker allowed me to synthesise cognitive grammar with musical grammar: this was particularly useful for thinking about work that combines sound and text. In the example above, Langacker sets out the function of language in visual terms and supports Zbikowski's analysis that language points out objects and entities and specifies the relationship between them. Zbikowski also says that sound communicates dynamic force with more immediacy than language can (Zbikowski 2017: 10 - 11). This sets a clear distinction between the way language cues spatial, visually simulated imagery and how sound cues non-visual force and imagination of sound sources. This opens up clear roles for sound and text within the design of a coherent mental simulation. In terms of my adopting a cinematic sound design approach, co-dependency between auditory and visual information is a material aspect of any cinematic work (Chion 1994). I came to understand the visual terms used within cognitive grammar in the context of film sound design, where the work consistently involves synchronising soundtracks with cuts, frames and close-ups, and where decisions are made as to which off-screen sounds and ambient, background sounds best spatially and semantically augment the images. For example, I found that point of view in cinema (normally set by the position of the camera in a film) could be conceptually mapped to the idea of vantage point found in cognitive grammar. As vantage point is part of construal, and construal in Langacker's framework involves scanning, the identification of prominent elements and the profiling of the focus of attention (Langacker 2008: 60-65), I came to understand the process of designing

multimodally across text and sound as one that requires an ability to conceptualise a text in terms of a 'hybrid' mode of construal. This mode of construal requires an ability to conceptualize a simulation that combines sensory input with reading. On one hand, there are the mental images cued through reading a text, and on the other there are the perceptual processes involved in listening to and imagining the sources of sounds.

4.7 The Nature of Listening in Cinematic Theory

To advance this idea, I would like to build a more detailed conceptual framework for understanding the way that sound can provoke a process of imagination as to its source. Chion's (1994) ideas enable a conceptualisation of the perceptual processes involved in listening. Whilst Chion's work is centred around cinematic sound, thinking of the visual images to which he refers as being somewhat similar to the images dynamically framed within mental simulation (Barsalou 2008) enables an application of his ideas to the creation of texts that combine language with sound.

To begin this discussion, it is first useful to set out some terms. Chion (1994: 40, 60) uses the term 'acousmatic' (an idea first developed by Pierre Schaeffer) to describe offscreen sound sources that are not seen within the viewing frame of a film. Chion goes on to assert that sounds that are off-screen will require a mode of listening that differs from one used to perceive sounds that give substance to an on-screen (i.e. seen) object. When perceiving a sound whose source is unseen, Chion sets out that viewers employ a mode of listening he calls 'reduced listening' (Chion 1994: 29-33; Schaeffer 2012). Reduced listening is the type of perceptual state involved in listening to sound detached from image, where attention is paid to the traits of a sound itself rather than to the aspects of a sound reinforced by simultaneous sight of its cause. Reduced listening might mean that the inherent qualities of a sound are prominent, along with perception

of its emotional resonance (Chion 1994: 31). Two other modes of listening categorised by Chion are ‘coded’ or ‘semantic’ listening and ‘causal’ listening (Chion 1994: 25-35).

Causal listening occurs when the cause of a sound is visible. When listening to a sound caused by an object within the viewing frame, the sound can provide supplementary information about the object. Consider being told or shown that a door is being closed: the sound of it closing would convey additional information as to the weight of the door, the material it is made of and the force with which it was closed. Spatial information about the scene would also be conveyed through causal listening if reverberation is added to this sound, setting out the wider context of the room that the door is in. Causal listening is often exercised in tandem with reduced listening by seasoned auditors, such as film sound designers (Chion 1994: 32). Finally, the mode of listening that Chion calls ‘coded’ or ‘semantic’ is engaged most commonly when instrumental music or speech occurs, as there is a need to comprehend its structure or meaning.

By categorising these modes of listening, Chion makes it possible to understand that altering the relationship between audio and vision causes shifts in the perceptive and cognitive processes engaged by the listener. Some of these processes pertain to semantic perception and some refer to spatial perception. In terms of drawing parallels between Langacker’s formulation of construal and cinematic sound design practice, Chion further describes how semantic perception of scenes is influenced by the prominence of sounds and by the way their spatial qualities adjust the perspective taken on the scene. Prominence and perspective are just some of the (visually derived) words used by Langacker to describe the dynamic imagery involved in mental simulations. Reading Chion showed me that sound can also influence the semantic and subjective position taken within a scene. As such, I would like to draw these ideas out further next.

4.8 Point of Audition

Chion's term for the listener position/perspective taken on a scene is *point of audition* (Chion 1994: 89-90). Chion sets out his ideas about point of audition by way of reference to point of view. Chion says:

> Cinematic point of view can refer to two different things, not always related:
>
> 1. The place from which I the spectator see; from what spatial location the scene is presented – from above, from below, from the ceiling, from inside a refrigerator. This is the strictly spatial designation of the term.
> 2. Which character in the story is (apparently) seeing what I see. This is the subjective designation.
>
> […]
>
> […] Now by comparison, let us examine the notion of point of audition. This too can have two meanings, not necessarily related:
>
> 1. A spatial sense: from where do I hear, from what point in the space represented on the screen or on the soundtrack?
> 2. A subjective sense: which character, at a given moment of the story, is (apparently) hearing what I hear?
>
> (Chion 1994: 89 - 90)

To clarify these ideas, it is useful to refer to some examples. Consider being shown that a nearby door is closing, but synchronised with sound that is very dull or completely

absent. Changing the sound to a dull thud in this way, or even removing it entirely, could be used to evoke a perceptual state of understanding that the scene is being heard from the point of view of a protagonist who is disconnected from their surroundings. When the audience sees a character on screen speaking into a phone but hears the voice coming through from the other end of the phone, the sound is subjective because the sound design focuses on what the character hears rather than what would actually be heard if the viewer was standing where the camera is (Chion 1994: 91-92). In this way, sound can be seen to have the ability to set the perspective taken on a scene.

4.9 Conclusions on Sound

In this thesis, I attempt to synthesise knowledge of the psychological processes involved in reading with sound design theory and practice in order to create narrative transportation. Reading Zbikowski (2017) allowed me to understand how language functions differently to sound, specifically the way that language is used to frame attention on objects and entities whereas music (and musique concrète) can immediately convey dynamic forces outside of our experience. In terms of further synthesising an understanding of the psychological processes involved in reading with sound, I found that reading about the nature of listening in cinema highlighted the way that auditory perception influences the position taken by an audience within a scene. I wove this notion of 'subjective sense of audition' (Chion 1994) in with Langacker's visually-framed concepts of construal. Construal (Langacker 2008) is a psycholinguistic concept exploring how we frame attention as we dynamically conceptualise situations. I used some of the visual terms used by Langacker to describe construal – perspective, focus and prominence - to understand Chion's work on how sound guides attention within scenes. This 'hybrid' mode of thinking about construal allowed me to begin to

formulate designs that could braid sound with text to create an absorbing, coherent experience.

A feature of texts that achieve narrative transportation is that they generate strong mental imagery of place, offer readers an ability to picture events and enable readers to have a strong sense of their own position within a scene (Brock and Green 2000: 704). In pursuit of achieving these effects across the prototypes, I chose to study the aspects of Chion's work that focussed not only on perception of space, but also on the subjective nature of auditory perception and on the ways that different types of sound cue types of listening (causal, reduced or coded). Understanding that sound can guide attention to prominent aspects of a scene and also influence the player-reader's auditory perception of a situation offered me a way to approach the task of strengthening the player-reader's sense of their own position spatially and semantically within scenes.

Though these ideas synthesised conceptually, it was only through practice-based research experiments that their use within a creative design process could be assessed. Consequently, the praxis documented in the second part of this thesis can be seen as a record of a developing conceptual framework as much as a record of the research process itself.

Part Two: Praxis. Documentation of Practice as Research Processes

Chapter Five

5.1 A Working Definition of Speculative Fiction

The wider question focusing this research project is how difficult information can be incorporated into speculative fiction. As such, it is helpful to establish a working definition of the term speculative fiction and to outline the real-world nature of the difficult information incorporated into these prototypes. To begin this process, I will quote from the Oxford Research Encyclopaedia, specifically an entry in the speculative fiction section written by Marek Ozeiwicz.

> The term 'speculative fiction' has three historically located meanings: a subgenre of science fiction that deals with human rather than technological problems, a genre distinct from and opposite to science fiction in its exclusive focus on possible futures, and a super category for all genres that deliberately depart from imitating 'consensus reality' of everyday experience.
>
> (Ozeiwicz 2017)

It is beyond the scope of this thesis to discuss at length the genre of speculative fiction, aside from noting that the two works featured in chapter three (*Annihilation* and *The Odds Against Tomorrow*) were chosen for a very detailed reading due to their belonging to the genre. The themes of the failure, or unintended consequences, of science – including data science in Rich's work – and of belief or faith in scientific solutions is a theme of both of these works and one I took forward into my story. The reason for this decision is related to a view of science expressed in the context of risk within the work of Ulrich Beck (1986). This is set out next.

5.2 A Working Definition of Real World Risk

In *Risk Society: Towards a New Modernity*, social scientist Ulrich Beck states: 'In advanced modernity, the social production of wealth is systematically accompanied by the social production of risks' (Beck 1992: 19). The book outlines his theory of reflexive modernisation. Beck does not view modernisation as a sometimes difficult process that will ultimately balance the distribution of wealth generated through industrialisation, but instead formulates that science and technology produce new risks and consequent, reflexive, science-based responses in an attempt to manage these risks. The relevance of Beck's ideas to this thesis is his link between the risk produced through reflexive modernity and environmental destruction. Furthermore, Beck is also interested in the invisibility of this risk and our inability to articulate its existence.

> Intentionally or not, through accident or catastrophes, in war or peace, a large group of the population faces devastation and destruction today, for which language and the powers of our imagination fail us, for which we lack any moral or medical category. We are concerned with the absolute and unlimited NOT, which threatens us here […] the unimaginable…the unthinkable.
>
> (Beck 1992: 52)

Beck felt that modern novels have the general ability to express the invisible aspects of risk within reflexive modern societies by creating protagonists who make their own destiny within a structure of uncertainty (Beck 2009: 4-7). It was this idea that I took forward into the plot developed for the story underpinning the three prototypes. In particular, I wanted to create characters fighting an invisible threat. This fitted

thematically with the idea of risk in a modern scientific technological society and practically with my goal of using sound. An emphasis was placed in hearing invisible aspects of the landscape and on hearing invisible scientific experiments within the nature reserve.

5.3 Overview of the Plot Underpinning the Prototypes

The protagonist addressed as 'you' in the prototypes is Helen, a twenty-something go-getter with a rich, well-connected uncle (Richard) who recently disappeared under a cloud of trumped-up corruption charges. The charges were brought by Richard's former colleagues within the tech corporation who run and own a massive network of cities. Helen works in the city where the corporation's media conglomerate is based. She works as an editor at the nature channel and is having an affair with her boss (Simone), who is an old friend of Richard's.

Simone has been receiving messages telling her of irregularities at one of the channel's nature reserves and the nature channel itself has been repeatedly hacked. These hacks involve disturbing images of environmental degradation being cut into the channel's usual output of pristine landscapes and beautiful wildlife. A drive was delivered by the hacker network to Simone, demanding she face the realities of the places in which her nature-based content is generated. The hackers say that Richard has joined their movement and that terrible things are happening, accusing Simone's channel of censoring the reality of climate collapse. Simone and Helen decide to visit the reserve to see things for themselves but they do this unofficially, under the guise of a work trip.

The night before the trip, the hackers get in touch to say that the elements of the corporation that ousted Richard are now coming to arrest Simone for corruption. Helen

steals the drive in an attempt to protect her lover and takes the flight to the reserve, hoping Simone joins her. Simone does not turn up for the flight. This is where prototype one opens. The prototype recounts Helen arriving at the reserve and having to take the stolen drive through security without the benefit of Simone's protection. She receives a mysterious note with the extinction rebellion logo printed on it as she turns on her audio tour guide and receives mandatory vaccinations through her corporation-issued wearable.

Prototype two opens with Helen in her hotel room on the reserve, unable to understand how the stolen drive was not intercepted at security. When she turns it on, she finds she is being contacted by the hackers. They ask her to verify her identity and then to use her proximity to the reserve to undertake some surveillance for them. They are able to bypass the security intercept around the reserve because she is on site. She is told there is a science campus on the reserve and that their experimentation is killing the wildlife and causing distress. She is asked to listen to a microphone network that the hackers have accessed to help them locate the position of the anomalous sounds being sensed by blue jays. If Helen can find evidence in real time, this evidence can be used to prevent the corporation's science campus from continuing with its destructive experiments. Helen is given letters from Simone and Richard in reward for her work and Helen begins to realise they had been planning this together without telling her.

The prototype ends with Helen finding a note pushed under the door to her hotel room with an access code to the CCTV and surveillance control centre on the reserve. She realises that her next mission is to enter the centre and follow the next set of instructions.

Prototype three opens with Helen already having accessed the control area and, having followed instructions given to her by the hackers. They are now communicating with her through the computer-operated the equipment used to monitor the reserve. She is asked to input live commands as the hackers guide her towards cached videos left by activists working on the reserve. She follows instructions and activates microphones that will record evidence to be used against the corporation and science institution.

Eventually, the hackers feed through a live camera, and this camera is showing an activist waiting for his cue. He has been made aware that she is on a mission inside the reserve and is waiting to show her and the hackers the location of final evidence: an illegal dumping ground over the border from the reserve where chemicals are being slipped into the water supply. With this capture of evidence complete, Helen is told by the hackers to pretend to enjoy the reserve and act as though she knows nothing. They then erase the drive and any evidence of their presence within the reserve's surveillance system.

5.4 Note on the Use of the Extinction Rebellion Logo

When I started this project, Extinction Rebellion were just starting out and I featured their logo from the beginning of my research. By the end of the project, it began to seem that I was responding to their rise in profile, rather than having researched the type of movements seeking to articulate extinction risk to the wider population. Whilst being ahead of trend is usually a good place for a writer to be, I have extremely mixed feelings about predicting this particular trajectory.

5.5 A Note on The Structure of the Chapters Documenting Prototype Development

In order that the practice documented in this section can be understood in terms of answering the research questions, each prototype will be documented in this thesis across four inter-related, distinct areas:

1) The application of cognitive poetics to the identification and solving of design problems

2) Examples of texts or sound works that influenced the piece

3) The way in which the prototypes developed in line with improving technical skills

4) The application of sound theory to the development of a practice that braids sound and text to create narrative transportation

Chapter Six. Reflective Documentation of the Design of Prototype One

6.1 Introduction

Prototype one was developed in the first eighteen months of the research process. Consequently, this chapter documents how I first applied an emerging understanding of cognitive poetics to the structuring of a multimodal text. I approached the design of the prototype by setting out a specific set of research enquiries. The nature of these enquiries was led by the narrative transportation scale. As this prototype marks the first step taken towards an exploration how narrative transportation can be created within interactive texts, I also researched the psychological processes involved in immersion in electronic media. Furthermore, as I needed to assemble a custom development pipeline in order to create the piece, I developed a technical approach to the braiding of text and sound and the way this influenced the work is also documented.

6.2 Using the Narrative Transportation Scale to Define a Focus

In order to refine the scope of the design enquiries, I selected particular aspects of the narrative transportation scale for use as a guide (Green and Brock 2000).

These aspects were:

1. While I was reading the narrative, I could easily picture the events in it taking place

3. I could picture myself in the scene of the events described in the narrative

4. I was mentally involved in the narrative while reading it

(Green and Brock 2000: 704)

Question one foregrounds the importance of the way events and entities are positioned in scenes and question three highlights how strengthening the subjective position adopted by readers within these scenes increases narrative transportation. I wanted to explore these two ideas in practice as they related to the concepts of deixis within Text World Theory[1]. I selected question four ('I was mentally involved in the narrative whilst reading it') in order to open up a specific creative enquiry: how can sound represent the emotional and introspective inner life of a protagonist in a text that uses second person address? In addition to these priorities, I used the supplementary question in part two of the transportation scale ('While reading the narrative, I had a vivid mental image of… *a location or a character'*) as an additional guide for the design process. This aspect of the scale was developed by Green and Brock in order to measure the impact of strong mental imagery on narrative transportation.

6.3 Narrative Transportation in Interactive Texts

In order to use Brock and Green's scale to lead the direction of the design enquiries, I needed to find a way of translating its core principles for application within the design of electronic interactive texts. I found a similar concept to narrative transportation within studies of immersion in electronic media. This concept was *presence* [2]. Presence

[1] See page 26 for more detail on Text World Theory.

[2] Green and Brock themselves deal with the issue of synonyms for transportation saying, 'Transportation somewhat resembles flow, or optimal experience brought about by absorption in an activity and often marked by a deep sense of enjoyment' (Green, Brock, Kaufman: 315).

is understood by Schubert et al (2001) as a feeling of 'being there' within an electronic experience (Schubert et al 2001: 266). Presence is seen as being built through two cognitive processes: the creation of a spatio-functional mental model and the allocation of attention (Schubert et al 2001: 269). This literature gave me an insight into the way that sound might contribute to a reader developing a sense of 'being there' because I saw how a spatio-functional mental model could be co-constructed across reading and listening. Furthermore, the way that allocating attention is seen as key to building a sense of 'being there' (remembering that narrative transportation involves readers being easily able to picture their own position in a scene) gave me a very specific way to think when approaching a user-centred writing approach.

In terms of approaching the task of interaction design, a mirroring idea to Schubert et al's (2001) definition of presence is Ryan's (2001) formulation of *spatio-temporal immersion* in electronic narrative. Ryan defines spatio-temporal immersion as being achieved when the distance between the narratee and the narrated events reaches near zero (Ryan 2001: 130). This locates the player-reader in space and time and was also useful to me when translating the principles of narrative transportation into the electronic domain. The way I applied this in practice is documented in further detail in the part of this chapter that deals with user interface design.

In summary, I began to think of narrative transportation as spatio-temporal immersion and presence. Thinking across disciplines in this way gave me a wider conceptual framework to use when approaching the designs.

6.4 Application of Cognitive Poetics to Create a User-Centred Writing Approach

I wanted the creative enquiries developed through this prototype to focus on the ways that braiding text and sound could build mental models of spatial aspects of scenes and could create an embodied, subjective position within scenes. I first began to pursue these creative enquiries by selecting specific areas of cognitive poetics that held promise for developing my user-centered writing and design process.

The key areas of cognitive poetics I took forward into the creative enquiry were[3]:

1. How Text Worlds are constructed in the mind of readers, specifically how readers adopt a position in relation to other objects and entities in a space (summed up in the concept of deixis)

2. The physical and embodied basis of language

3. How blueprints and scripts are cued by words, specifically prototypical images and situations

Items one and two on this list are related to the structuring of space and strengthening the player-reader's ability to picture themselves in a scene. Item two is also related to language and introspection, which I found relevant to an enquiry into how to create mental involvement with a character. I chose item three as a focus because Gerrig (1994) sees prototypical schema cued by words as being key aspect of transportation. I

[3] All of the concepts summarised here are explored in greater detail in chapter two.

will first deal with the way I pursued items one and two in practice first before proceeding to set out how I applied the concept of prototypical imagery in more detail.

6.5 Deixis and Images of Events and Entities in Space

In terms of writing with a focus on creating strong mental images of space, I applied an understanding of the psychological processes involved in reading to the writing by choosing language that draws attention to the position of objects within scenes. Text World Theory (Gavins 2007; Werth 1999) draws on the way our real-world experience of our relationships to other objects (deixis) is cued by particular aspects of language. It also highlights the way that orientation in a text is experienced from the point of view of the reader. This was a 'breakthrough' concept for me and was a key part of my thinking as I wrote: I could easily synthesise the idea of presence (being there) in an electronic experience with the idea of placing the player-reader in the centre of a set of objects and entities described in text.

On a practical level, this involved me applying my understanding that prepositions such as 'beyond' and 'behind' have a key role to play in the structuring of mental models. I wrote scenes with the deliberate intention of setting up spaces and began to think of myself in the middle of these spaces as I chose the words to describe it. In this sense, I imagined the player-reader's position in relation to other objects at all times. For example, in the scene just after the protagonist has descended from the plane, pressing the 'look' button releases aspects of a description of the forecourt. The words 'Looking up, you can see tree canopies sprawled over the skyline beyond,' and 'a high stone wall surrounds the security forecourt' are displayed. I chose the word 'sprawled'

as it draws on physical experience and personifies the trees. I knew from reading Rich[4] (2013) that personification metaphors are an effective way to simulate non-human natural entities. I chose ‘surround’ as, drawing on Langacker, I knew this would cue an embodied recall of being enclosed in a space. Pressing ‘look’ again adds the text ‘The only way out is through arrivals to the right’. This was a deliberate attempt to construct a spatial model of the forecourt in the mind of the reader. I prioritised descriptions of positions of objects in relation to the protagonist’s position (e.g. through the use of ‘beyond’, ‘to your right’, and ‘in the centre’) throughout the writing of the rest of the prototype: the ‘look’ button mechanic was used to deliberately draw attention to the act of ‘viewing’ surroundings in subsequent scenes.

6.6 Adding Sound: Creating Presence and Spatio-Temporal Immersion

The way that a mental model could be built across text and sound became clearer in my mind once I had structured the spatial aspects through language. By focussing on acousmatic (unseen) sound’s ability to stimulate the imagination and recall of space (Smalley 2007), I established a specific research goal: exploring sound’s contribution to a mental model constructed through preposition-led textual description. I began to see how words could be a framework that could be braided with additional spatial information inherent in sound. Remembering that the second aspect of presence (Schubert et al 2001: 269) within electronic experiences involves allocation of attention, the way that auditory perception could be accounted for within the design of the text came to be understood by thinking in terms of Chion’s (1994) concepts of reduced and

[4] See pages 43-45.

causal listening[5]. In particular, I thought about how the quality of a sound stimulates an emotional response and can cause a process of imagining the source.

I came to understand Chion and Smalley's ideas in terms of how auditory attention would be called upon whilst reading. This led me to leave spaces in words by displaying descriptions of space in blocks revealed in response to user input. In addition, I decided to add sound that was not described directly in text to experiment with how people's tendency to imagine an acousmatic (unseen) sound's source in absence of visual reinforcement would impact immersion (Smalley 1991; Chion 1994; Schaeffer 2012).

The way this experimentation manifests within the prototype can be illustrated by returning to the scene described above, where the protagonist is looking around the arrivals forecourt. I added sound to these sparse descriptions (e.g. to 'Looking up, you can see tree canopies sprawled over the skyline beyond') in order to augment the text with sound to build mental imagery of the scene. Consequently, when the player-reader presses the 'look' button and words show descriptions of tree canopies, a bird in flight is heard. I designed the sound to convey specific spatial information – the bird crosses the stereo field and is recorded from a mid-distance perspective. This stereo sound is placed high in the vertical plane within the audio engine, to create some sense of height in relation to the player-reader's position. I did this to experiment with how sound could reinforce the mental images of tree canopies and simulate an embodied action, namely moving the head to look up at the sky. By rotating the soundscape and tracking the sound 'around the forecourt' whilst placing sound in positions described by text (e.g. I placed a clanking flag where the door is described as being), I hoped to call on the player-reader's experience of their real-world position and enable them to 'picture

[5] Chion's formulation of listening is covered on pages 57-60

themselves' in the scene. As the birds cry and the wind builds, these conceptually moving objects ('trajectors' (Langacker 2008)) were placed in the soundtrack in order that attention was drawn to them, so as to increase a sense of 'being there' and allocate attention. In this way, I also explored how a simulation of being amongst a landscape full of wildlife can be cued with much more immediacy through a designed soundscape than is possible through language.

In terms of how sound could further work to allocate attention, I also experimented with how the timing of sound in relation to the descriptions of scenes could stimulate the imagination. In places, acousmatic (unseen) sound plays before the text appears to describe the sound source. An example of this in the prototype is the scene set in the arrivals hall where the protagonist has just entered the security area and looks around. Resonant, short percussive sounds can be heard but the player-reader is not told what is causing them. Only when a 'look' button is pressed does the detail of the woman in the booth get revealed. The player-reader is never told she is typing – this aspect of the scene is imagined through causal listening (Chion 1994).[6] By approaching the sound design in this way, I hoped that the cognitive processes used to build a mental model of the scene could be fired by causing the player-reader to wonder what the cause of a sound might be.

6.7 Creating Presence Through Embodied Language

By focusing on the ways that the reader's point of view in a scene is simulated from experiences of positioning in the real world, I began to strengthen my ability to create other types of embodied presence through language. I read empirical studies showing

[6] Chion's formulation of listening is covered at length in chapter four section eight..

how language can activate both somatosensory (relating to sensations in the body) and sensorimotor (relating to movement in the body) responses with readers (Fischer and Zwaan 2008; Aziz-Zadeh and Damasio 2008; Goldberg 2014). I learned, for example, that reading the verb ‘kick’ activates the leg (Aziz-Zadeh and Damasio 2008: 35). Taken together, these studies offer empirical support to Gerrig’s formulation of narrative transportation involving a performance (Gerrig, 1998: 18) and this enabled me to understand how the physicality of such performances can be coded through word choice. In terms of spatio-temporal immersion, where Ryan (2001) says that the space between the narratee and narrated events should be near zero, I wanted to experiment with how bringing the body of the player-reader closer to the body of the protagonist could contribute to transportation.

To experiment with how I could create the effects described in these studies, I wrote passages that attempted to activate physical sensations in the body of the player-reader. Specific examples include, ‘She reaches into the drawer beneath the counter, pulling out an object that she now slides through the glass’, and ‘the back of the device is cool and the weight feels expensive in your hand’. By increasing the use of verbs (‘reaches’, ‘slides’, ‘pulling’) I wanted to cue physical simulations of these actions within the body of the player-reader. By using prepositions (‘through’, ‘beneath’) I experimented with to create a spatial mental model within which the action sequence occurs. By referring to sensory information (‘feels cool’, ‘weight’), I wanted to draw attention back to the body of the protagonist by cueing sensory information. The use of metaphor (‘feels expensive’) was intended to return attention back to the protagonist’s point of view and express the way she thinks. I began to use this technique throughout the prototype, including the opening scene where the protagonist is on the plane. The

sexual undertone of the story is conveyed through the choice of words in the passage ‘the leather is soft against your thighs’. I supported this embodied sexuality through designing the sound of a rising, revving plane engine activated when the link is clicked on ‘it’s right you should be rewarded [[in this way]]’. In this way, I made a conscious attempt to create a sense of ‘being there’ physically in the text world through word choices that sought to apply activate sensorimotor responses within the body of the reader and by use of sound that simulated and represented dynamic forces.

6.8 Specific Experiments Braiding Text and Sound: Speech.

In the scene where the protagonist must empty her bag and present her credentials to the female security guard, I conducted a specific experiment with speech and dialogue. This decision was made after I read research into the way that reading speech activates sensorimotor responses in the body. Of particular significance were the findings of Yao et al (2011) that reading direct address speech (i.e. ‘I need to look in your bag’, rather than ‘The woman says she wants to look in your bag’), activates the same brain activity as hearing it said. In summary, a written text featuring direct address speech activates the auditory domain and cues a mental simulation of the speaker’s voice in the reader’s head. This made me wonder about how to deal with dialogue-based scenes when working with sound and text. I experimented with the best way to deal with direct address speech by writing the dialogue-heavy scene and then looking at how to render it: through reading or through listening. This was done with the intention of assessing how the experience of going through the security process (conversing with the woman in the booth) could most effectively be rendered in the mind.

To pursue this line of enquiry, I recorded the woman’s lines (using an actor) and implemented it in the sound track (i.e. the player-reader heard her speak as the scene

progressed). The dialogue featured direct address (i.e. ‘I need to look in your bag’ rather ‘the woman says she wants to look in the bag’). However, once I had implemented the recordings within the scene and played it, I made a judgement that listening to the lines whilst reading had the effect of breaking immersion. I reverted to writing the dialogue into the text instead. The effect of writing her lines was more immersive as it kept her voice anchored within the mental simulation cued by the rest of the reading, with timings kept fluid. Due to the fact that I wanted to show that the protagonist’s state of mind had been affected by the drugs she had taken, I experimented further by having the player-reader hear just one line (the woman saying, ‘Don’t take enhancers here, this place is weird enough already’), and synchronised this with text referring to how hearing the voice was strange. I did this to create doubt as to if the protagonist was experiencing an auditory hallucination or not. In other words, I was able to use the sound to enhance the illusion that player-reader is inside the character’s head in order to strengthen the braid between her and the player-reader.

6.9 Specific Experiments Braiding Text and Sound: Character Development, Subjective Point of Audition and ‘Picturing Myself in the Scene’

As set out in the introduction to how the narrative transportation scale was used to steer the design of this prototype, I decided that I wanted to experiment specifically with braiding text and sound to portray the inner life of a protagonist. Specifically, I wanted to explore how sound could do this within the context of a story that uses second person direct address (i.e. by referencing ‘you’ throughout the piece). In this sense, the example scene given above, I was not only experimenting with dialogue and immersion but also with portraying the protagonist’s state of mind.

Throughout the second part of the prototype, her state of mind is shown to deteriorate as her introspective state grows more disorientated. By including introspection as part of the perception of an experience (Barsalou 2008: 618), and including emotion as an aspect of introspection (Barsalou 1999: 585), Barsalou's framework enabled me to approach sound as a way to represent the interior life of the character within a simulation. In the part of the prototype where the protagonist speaks with the security woman, I increasingly used sound to portray emotions. The sound also became increasingly abstract rather than deliberately spatial or linked to a source outside the body of the protagonist. Slight shifts in the mix are used to suggest that her subjective point of audition (Chion 1994) is shifting as she moves around the space and tries to get out of the security area. I did this by creating and mixing very subtle shifts in the atmospheric sound as her position shifts.

By way of specific example, I foregrounded the sound of a crackling heating system as the protagonist gets closer to the man guarding the door as she attempts to avoid security protocol. This is not referenced in text and so is perceived through reduced and causal listening. As she is sent back, the atmosphere changes again and a strange, distorted sound of a walkie-talkie plays. I did this to suggest she is worried that the security man has radioed his boss about her. Increasingly, I used whispers and subtle bangs and crashes in the atmosphere as she speaks with the female security staff. I created this acousmatic soundscape to be perceived subjectively by the player-reader i.e. to provoke a state of mind within them that might portray the confusion felt by the protagonist. Finally, as she moves on from security, I designed the exit doors to sound loud and explosive as they are finally activated and her escape is possible. I did this to convey the emotion of releasing tension. As she enters the corridor, the atmospheric

sound is pulsing with electricity. Again, I did this to convey the emotion (nervous excitement) she feels on her release from the passport control area.

In this way, I experimented with sound as a way to place the player-reader closer to the body of a protagonist in order that the player-reader might 'picture themselves' within the scene from a very intimate perspective. Other ways that I attempted to create a dynamic, evolving picture of who the character is was through keeping close to her point of view within the text and link design. This is set out next.

6.10 Prototypes, Blueprints and Speculative Fiction

The third area of narrative transportation I explored through this design was mental involvement and the use of prototypical images and schemas of situations. The mental images generated most easily in the mind when a category is mentioned are called *prototypes* by Langacker. The term prototype is specifically used to describe the most prominent central *physical* image cued by a word (Langacker 2008: 31). This idea of prototypicality also extends to situations, where blueprints and schema are employed within mental simulations of similar situations (Gerrig 1998: 40 - 41; Gavins 2007: 3). These ideas were applied across the writing of the whole prototype, from general setting to the detail of her point of view. I shall take each of these in turn.

In terms of writing speculative fiction that incorporated difficult information, I was mindful that I needed to write a beginning to the story that helped the player-reader construct a world by making it one that they could picture easily. Rather than immediately creating a world that was so strange that I risked disrupting absorption by making people have to 'stop to think', I created an opening that could call on schema and prototypes of familiar physical objects. In this fundamental way, I applied knowledge of the psychological processes involved in reading to user-centred writing

by deliberately opening the story with cues that would cause a simulation of a familiar situation: a young business woman on a flight to a nature reserve. A leather seat (indicating first or business class travel). An arrivals hall at an airport. A security guard. It was only as the story progressed that I began to disrupt these prototypes. The way I approached this disruption of prototypes to create a sense of a world that is not all as it seems is intrinsically linked with the technical design of the hypertext and with my ability to code. Consequently, in order to meaningfully set out how I applied knowledge of prototypes and schema of situations within the writing, it is first necessary to first set out how this approach was influenced by the technical design of the piece.

6.11 Link-Based Work: Technical Pipeline

When I began this research, I knew how to use Twine to write rather basic, linked-based digital stories and could implement limited functional tracking of variables. However, in order to incorporate spatial sound, I had to learn how to use Twine in a way that could interface with Unity. This led me to discover a plugin called Cradle (Terre 2016). Cradle turns Twine stories into C# story scripts that can then be run in Unity. It is a developer's tool, rather than one aimed at writers, and necessitated an understanding of event-based programming patterns. I learned how to use it through study of the source code of a game authored using Cradle and Unity (*Snoozing* D.A Terre: 2016). Following additional study of the documentation, and further study of events in Unity, I was able to understand how to invoke sounds as Twine passages were entered and exited and so the pipeline was finally at least functional. Alongside studying Twine's more advanced functionality, I began to look specifically for examples of Twine games that maintained immersion and that – ideally – used sound to support and develop this immersion.

6.12 Early Drafts, Centering Choice

When researching games made with Twine, I found choice-based narratives to be common. In-line with this established genre convention[7], I originally pursued a strategy of writing that involved making choices. Some of these choices were created through offering different dialogue options and some of them were about taking different actions and changing the course of events. For example, in an early draft, the player-reader had the choice to try to bypass security by walking up and flirting with the male security guard. Another draft involved the player-reader accruing points for bad behaviour and eventually not being allowed in to the nature reserve if there were too many of these marks against the protagonist. My own readings of these drafts led me to the assessment that the choices were breaking immersion in the story: stopping to read questions broke absorption in the story as answers were considered. In order to refine my approach, I widened my search for link-based games that succeeded in building a story world and that centered character development over rule-based play.

6.13 The Influence of Porpentine

In pursuit of a way to develop writing that was character-led, I began to look for examples of hypertext that maintained player-readers' attention by centring a protagonist's point of view. This led me to the work of Porpentine. Porpentine is a prominent independent game developer whose hypertext work has been shown in galleries in addition to being downloadable or playable in a browser.

[7] Even a very quick internet search of Twine games delivers countless examples of games and interactive fiction featuring choice-based links. High profile examples are The Writer Will Do Something by Mathew S. Burns and Depression Quest by Zoe Quinn.

Porpentine's Twine games attracted my attention in a way that other choice-based games did not. This was largely due to the way that clicking links incrementally reveals a world from the protagonist's point of view. In many of the games, backstory is revealed slowly through details of things characters remember or noticed in rooms and situations. In the early Porpentine Twine game *Howling Dogs* (2012), the protagonist wakes up in some kind of institution. Links from the starting scene allow the world to be explored from the protagonist's point of view. For example, the following passage occurs near the start of the game (words surrounded by [[these brackets]] are links).

> A room of dark metal. Fluorescent lights embedded in the ceiling.
>
> The [[activity room]] is in the north wall. The [[lavatory]] entrance, west, next to the [[trash disposal]] and the [[nutrient dispensers.]] The [[sanity room]] is in the east wall.
>
> Her [[photograph]] is pinned to the side of your bunk. A red LCD reads 367 a few inches over.
>
> A wrapper sticks to the floor.
>
> (Porpentine 2012)

The use of the phrase ‘nutrient dispensers’ to describe a vending machine allows for an insight into both the clinical nature of the room and also the protagonist’s functional relationship with food. Clicking on the link leads to a passage that reads ‘Preserving rations is vital for mission success’. This potentially provokes a question in the mind of the reader as to what the mission is. After eating food, the player-reader returns to the starting scene. Clicking on the link [[photograph]] leads to the following passage of text: ‘Every day you think of the ways this photo could have been improved’. This provoked the type of mental involvement described within the narrative transportation scale in my mind as I asked myself what was going on and who the character was.

After playing several of Porpentine’s games, I developed a huge admiration for the way that links were designed to drip-feed aspects of the story world. The process through which these worlds are built is described by Porpentine as *terraforming*. Terraforming is a word used to describe the approach taken to ‘constructing worlds, contrary to this one,’ (Telematic Gallery Website 2019). Porpentine’s world in *Howling Dogs* is recognizable as an institution – pictures of loved ones are present in a fairly clinical room – but this feeling of being somewhere familiar soon disappears when discovering that the machines that dispense nutrients are rationed due to the needs of a mission. Consequently, I felt that this writing approach held promise for my speculative fiction project.

6.14 How Using Cognitive Grammar to Read Porpentine Influenced the Hypertext Design of the Prototype

Whilst looking at the layout of the images and titles of Porpentine’s games on Itch.Io, I began to understand how the entirety of Porpentine’s work builds this parallel world through novel combinations of phrases and words. In this sense, terraforming – building

parallel worlds – involves words from everyday use being reframed within unusual combinations which has the effect of building parallel meanings to everyday concepts.

By way of specific example, one of the games on Porpentine's Itch.Io's title page is called *Psycho Nymph Exile*. It struck me that this was an unusual image but one that I understood straight away. I began to analyse why I found myself so mentally involved through applying cognitive grammar to Porpentine's work.

Within Langacker's formulation of construal, dynamicity pertains to how a conceptualization develops and unfolds through processing time (Langacker 2008: 79). Read through the lens of Langacker, it was seen that 'terraforming' was a process that occurred when prototypical images (e.g. of 'psycho' and then 'nymph') became modified over time (e.g. by 'exile'). In this sense, Langacker's work on construal explained Porpentine's practice of terraforming as one of constantly modifying the pictures that first come to mind. Through grasping this concept, I came to understand terraforming in Porpentine's work as a process of building alternative meanings through the subversion and modification of prototypical images and modified schema of situations.

6.15 Prototypes, Schema and Links Designed to Create Mental Involvement

As discussed above, Langacker's ideas enabled me to understand that the engaging quality of Porpentine's work is caused by the modification of prototypical images. Barsalou's (1999)[8] framework offered an insight into the way that the cognitive process involved in this modification could also involve the processing of mental images provoked through causal and reduced listening to acousmatic sound. This insight was

[8] Barsalou's work is covered in greater detail on pages 36-38.

possible due to Barsalou setting out that patterns of neurons can be reactivated by various *bottom up* sources (Barsalou 1999: 589). Barsalou describes how bottom up (sound or text) information overrides top down (stored) frames and neural states and this triggers new cognitive processes. This began to give me an insight into how I could design links that constantly modified mental images – including mental images caused by sound – when clicked.

As an example of how this way of thinking influenced my work, my writing and design approach to the prototype increasingly featured in-line links designed to modify the situation portrayed in a scene. I did this both through adding or altering words and through adding or dynamically mixing sounds. Though the additions and alterations are minimal in terms of departing from the mental image previously built of a scene, they were intended to be enough to cause the type of engagement described by Barsalou. By way of specific example, in the scene where the protagonist approaches the security women for the first time, a description of her bag is shown ('the bag is leather and expensive and stuffed with [[essential]] items'). Clicking on the word 'essential' causes 'essential' to change to 'illegal' just when the protagonist has no option but to proceed through security. I did this both create a sense of tension as to what is about to happen and to engage the reader in a process of learning that this character is not as she seems.

I have highlighted this particular link as it also demonstrates how I used sound to foreground her state of mind at the moment the illegality of the contents of the bag is discovered. Shortly after clicking the [[essential]] link and being confronted with the illegal contents, the sound of the conveyer belt stopping is foregrounded, and silence descends. In this sense, the silence is used to modify the player-reader's simulation of the protagonist's introspective state by foregrounding a moment where she realises that everything has stopped and is waiting for her to put her bag through. By using a loud

alarm sound to punctuate the start of this sequence, and then following this by mixing out all other sounds in the environment, the sound was used to indicate a subjective point of view, one where she felt that all eyes were on her and nothing else in the room mattered. This was intended to simulate a moment of anticipation, nerves and self-consciousness within the player-reader that could be understood as being experienced by the protagonist.

6.16 Hypertext Games and Spatio-Temporal Immersion

The way I designed links to create mental involvement with the protagonist was also an attempt to make the most of my limited ability to code. Ryan asserts that some types of click-based hypertext can sacrifice immersion for interaction and that the effort of interaction does not always feel worth it. In her view 'interactivity can only be reconciled with immersion if the user's input counts as participation and as action in the fictional world' (Ryan 1999: 130). I had to find a way to design interaction that could count as participation with the few skills that I had.

In response to Ryan's ideas, I attempted to braid interaction into the meaning and action of the story. The most obvious examples of this experiment are the scenes where pressing buttons with the word 'look' written on them unlocks text spatially placed on the screen i.e. in response to clicking 'look', the player 'sees' what the protagonist is looking at.

The way that I eventually designed the links to dynamically progress the conceptualized situation was another way that I attempted to create interaction that resulted in participation in the action. The technical design of the prototype also incorporated links that activated sounds in an attempt to create a sense of action

progressing as they are clicked. The stopping of the conveyer belt described above is one example, but others are; clicking links in the sequence where the protagonist has to give her bag over causes sounds of bags and movement to play, and pressing door buttons causes the sounds of doors opening to play and the atmospheres of the room to change accordingly. In actual fact, because of the way the piece is designed in Unity, in the background, every link makes an avatar move off-screen. A whole other invisible part of this game exists where an avatar moves in a 3D sound world in response to clicks as this is how I used links to create the dynamic sound mix and to place sound sources in space.

My goal for the dynamic 3D sound mix was that it would create spatio-temporal immersion by incorporating spatial sound into the piece. It was only possible to do this because I studied Unity and Wwise alongside writing the story. In this way, the development of more advanced software skills was symbiotically influenced by the goal I had for structuring a digital story that could support the implementation of my sound design concepts.

This point about technical ability is relevant to documentation of this research because the software pipeline I eventually put together to make the prototypes evolved both from creative goals but also from technical limitations: I was new to coding, and this meant that I had to make the most of the link-based format. The dominance of indie games made using Twine can perhaps be attributed to the ease of use of the tool by people like me who want to write a narrative game but who lack advanced programming skills.[9]

[9] Examples of the many such games made using Twine can be found on Itch.io.

6.17 Conclusion

By selecting four items from the narrative transportation scale and using them to guide the direction of the creative enquiries undertaken through this research, I was able to formulate distinct areas to examine the way sound and text could be braided together. By combining the narrative transportation scale with definitions of presence and spatio-temporal immersion in electronic texts, these creative enquiries became contextualised within theory of immersion. This meant I was able to apply an understanding of the cognitive processes involved in building presence alongside the application of an understanding of the psychological processes involved in reading. In practice, I discovered that by using sparse, preposition-led descriptions revealed in response to clicks, I could combine descriptive language of place with a soundscape rich in spatial information.

By applying knowledge of the embodied basis of language, I chose words related to touch and other senses in an attempt to keep the player-reader feeling close to the body of the protagonist. In this way, an understanding of cognitive poetics was used to lead a creative enquiry into how to create a strong physical presence within scenes. Furthermore, by understanding how presence is built through building mental models of space and allocating attention, I saw that sound could be used to build images of surroundings as they related to this embodied position.

When it came to hypertext design and spatio-temporal immersion, I learned that a more successful approach than my initial choice-based design could be found through using links to refresh and disrupt prototypical images and schema. Through the application of cognitive grammar to readings of Porpentine's text games, I was able to

develop a style of writing that deliberately attempted to stimulate mental engagement with the text. In practice, this meant that I began to use both text and sound to dynamically modify the player-reader's picture of the protagonist and the story world as links were clicked.

Finally, whilst the limitations of my coding ability meant that it was difficult for me to achieve full spatio-temporal immersion in the way Ryan describes, I found that using her definition of immersion gave me a technical goal. This made me work hard to create a 3D soundscape that changed in response to clicks and to move past using choice-based links as my primary or only mode of input.

Chapter Seven. Reflective Documentation of the Design of Prototype Two

7.1 Introduction

I made this prototype in the second year of the research project and my goal was to create a work that moved beyond the reading-led, linear format of prototype one. Consequently, this chapter documents the process of formulating an approach to creating narrative transportation through the use of more 'game-like' modes of play than those found in the first piece.

I wanted to introduce interaction mechanics that moved beyond clicking links and buttons to refresh text or reveal descriptions. This was because I wanted to explore more fully Ryan's ideas of spatio-temporal immersion by attempting to create elements within the prototype that allowed player-readers to 'participate in the action' (Ryan 1999: 130). I took this to mean that the game should not directly ask the player-reader to make choices that were intended to alter the direction of the plot. Consequently, I conducted research into game mechanics that did not use this type of 'up front' branching narrative technique and that could help me move past the mostly linear, link-based format used in prototype one.

In terms of applying an understanding of the psychological processes involved in reading to develop a user-centred writing approach, the prototype was guided conceptually by a particular aspect of Langacker's theory of cognitive grammar, that of *viewing arrangement*. I chose to focus on this concept as I wanted to assess how its application within practice could benefit my sound design process.

7.2 Aspects of the Narrative Transportation Scale Used to Lead the Design

Green and Brock use immersion as a synonymous term for narrative transportation (Green and Brock 2000: 702). Consequently, I began to see Ryan's formulation of spatio-temporal immersion (Ryan 2001) as being interchangeable with the concept of narrative transportation. This enabled me to work in a way that synthesised Ryan's ideas about interactivity and immersion with Brock and Green's (2000) work on narrative transportation.

In order to formulate some parameters for the creative enquiries undertaken through the making of this prototype, I chose aspects of the transportation scale as a guide that I had not used when making prototype one. The aspects were question seven ('This narrative affected me emotionally'), and question eleven ('The events in this narrative have changed my life') (Green and Brock 2000: 704).

In terms of question seven, Gerrig's (1998) original formulation of transportation posits that the more a reader is able to bring their own schema of a situation to a narrative, the more they become emotionally engaged in that narrative. His example is one where a story about a sports match is far more engaging to somebody who plays that sport or knows it very well than somebody with no knowledge of what is at stake or how the game is played (Gerrig 1998: 41). Bringing pre-known schema based on prior experiences increases the emotional aspect of transportation and results in a memorable mental simulation (Gerrig 1998: 40-41). I chose the emotional aspect of the transportation scale because I wanted to experiment with how sound could create emotions within an immersive narrative, especially sounds of other species and natural

landscapes. I chose question eleven of the transportation scale ('this narrative changed my life') in order to maintain a focus on incorporating difficult information within the narrative. The issue of noise pollution negatively the ability of animals to feed and communicate was one that I discovered whilst researching the story[1] and I wanted to somehow bring this into the prototype. Whereas I didn't think I would *literally* change somebody's life by focussing on this issue, I took the view that successfully transmitting new information about species vocalisation and behaviour had potential to alter a person's view of that species and of their need for non-noise polluted environments.

7.3 A Long Process of Development: Early Failures

In order to create a vehicle for listening and learning about animals, I decided early on that quiz-like elements would be a design feature of the prototype. I wanted to ensure that player-readers had to listen to animal calls attentively enough to identify them later. However, the attempt to shift into thinking about the way that player input could count as participation in the action whilst writing a story involving listening to animals was difficult. An early version of the prototype attempted to break up the story with a mechanic that turned the cursor into a camera-shaped 'viewfinder.' When hot spots were located and clicked on the screen, graphically-designed text describing parts of the hotel suite appeared as the sound of a camera taking a photograph played.

I asked my supervisors to play-test this early version and they fed back that I had created an experience that confused them. They reported that their attention was being pulled from story to task and there was no gestalt to the experience or sense that taking

[1] For example, see http://news.bbc.co.uk/earth/hi/earth_news/newsid_8305000/8305320.stm 'Noise Pollution Threatens Animals' BBC website article.

pictures was particularly important. The game mechanic I was experimenting with did not cause immersion but simply broke contact between the player-reader and the protagonist when they took on the task of ‘photographing’ the room. Breaking up the immersion of a linear text with interactions beyond clicks (to progress a passage) was turning out to be extremely difficult to manage.

Through the second round of the development process, my coding and Unity skills expanded to include animation. I also developed the ability to dynamically alter variables sent to the sound engine. As a result, I was able to experiment more proactively with listening-led mechanics. For example, I created animated buttons to provoke the user into moving the mouse. Moving the mouse changed the settings of the sound engine and altered the sample being played. The samples played were of electronic scanners and radio signals and the intention was that player-readers would discover the sub-text of the narrative: that the protagonist was being electronically tracked by the security services on the resort because she had made a phone call on the plane in prototype one. However, in testing with supervisors and with my partner, I found that this strategy failed to engage these players with the audio and, thus, with the linked story. Instead, they reported that the sound was ‘in the background or ‘didn’t seem important’ when compared to the bright moving buttons. So I faced another failure: this time one that had taken a long time to code and implement. A process of reflection and rescoping of the research needed to take place.

7.4 Using Cognitive Grammar to Analyse Feedback

To do this, I went back to Langacker’s (2008) core concept of construal and attempted to use cognitive poetics to understand the psychological processes involved in reading this type of text. In Langacker’s formulation, dynamic construal – simulating a scene in

the mind as elements of a clause or phrase are encountered – involves the building of composite meaning over time. As scanning occurs, elements are profiled and selected for attention (Langacker 2008: 107, 111) with the most prominent participant being termed a trajector (Langacker 2008: 70-73). Thinking in this way, it became obvious that coloured moving buttons on a black screen would count as trajectors, and could certainly be understood to attract attention. Langacker's ideas explained in a useful way exactly why the sound was being profiled as being 'unimportant': the expression created by graphic, linguistics and sonic elements was impossible to conceptualize coherently due to the way I had designed the relationship between these elements. My attempt to construct a conceptualization from these disparate items did not work because a composite meaning did not emerge.

I began to understood that the early design did not construct the mental model I had intended because I had mismanaged attention. I saw that the question in the mind of the player-reader was more likely to be 'what does the button do and can I click it?' rather than 'what does the sound in the background mean?' Although these seem obvious points, the benefit of the using cognitive grammar was that I began to grasp an understanding of the detail of how multimodal design can create coherent mental simulations. Specifically, I saw how it was necessary to maintain semantic coherence across interactive elements, narrative sound design and story development in order that these elements could be construed dynamically without confusion setting in. In this sense, by providing a tool with which to keep an eye on the cognitive processes taking place inside the mind of the user, cognitive grammar enabled me to continually evolve my approach to the design of the piece. However, despite being able to parse the feedback I was getting from early players in terms of attention allocation, I still didn't

have a prototype that succeeded in braiding together text and sound with increased mechanics of interaction after nearly three months of work.

7.5 Refining the Research Strategy

Although I had analysed the problem, I did not have an easy answer. I needed to adopt a radically different approach and find new combinations of conceptual tools. I drew these tools from three domains:

1. Game design theory
2. Particular aspects of cognitive grammar that had the potential to aid a design that foregrounding listening without detaching the player from the story
3. The study of other interactive narratives employing sound and text

I also set out to study programmatic user interface development in Unity and deepen my understanding of the responsive properties of the Wwise audio engine at code level.

In order to summarise the development process, I will now take these domains in turn, outlining how they were applied during the phase of work that brought the prototype to completion.

7.6 How Further Study of Game Design Theory Helped

To move the prototype towards the goal of increased immersion through participation in the action, I referred to *The Art of Game Design* by Jesse Schell (2015), particularly his writing on feedback loops in design. Schell sees feedback as a way to show the user ‘quite clearly that what they have done makes a real difference’ and that ‘experiences

without feedback are frustrating and confusing' (Schell 2015: 263). In particular, I began to focus on designing clear feedback to the player-reader that the state of the game had changed as a direct result of their input. This meant that I needed a responsive interface that communicated to the player the result of their input. Furthermore, in line with Schell's' list of game mechanics (Schell 2015: 157-185), I decided to use timers, develop some rules and ensure there was a way to lose and that this was communicated through displaying points. Furthermore, as this was a research enquiry into how to allow player-readers to participate in the action of the story, I decided that playing the game would involve some tasks

It was after thinking about the ideas of Schell that the 'game within a game' idea I eventually used in the prototype came to mind. In previous versions of the prototype, the drive containing the quiz game was not foregrounded, it was simply something in the bag that had just been taken through security into the resort. I decided the program on the drive would ask the protagonist sound-based questions about her past, score the answers, tell her the mission, and – crucially – put the player-reader through some listening tests to check they were able to concentrate. This design meant that the player-reader was taking the protagonist's role on very directly and this opened up interesting possibilities for narrative development. Furthermore, I was able to write all of the quiz logic and scoring in Twine, meaning that this aspect of the design could be developed and balanced within a relatively agile environment.

Whilst this centring of the quiz and the drive set the project on a surer footing, I had still not found a way to create an emotional aspect to the piece and this was a goal of the prototype's design. I wanted to find a way to use the environmental sounds of animals and seascapes to create an emotive tone to the piece. I specifically wanted to do this by

stimulating memories or images within the mind of the player-reader through this auditory input. Furthermore, narrative-wise, I still hadn't managed to balance developing the character's story with the mechanical experience of playing a sound identification quiz: the rich sound content of the quiz had the potential to lead the player-reader to be focussed on themselves rather than on the protagonist's situation. At this point, I turned back to cognitive grammatical concepts in order to re-write the story around the quiz.

7.7 How Cognitive Grammar Was Applied to Manage Immersion

The central problem – at this stage of development – was how to address the issue of balancing the player's own self-awareness ('I am playing a quiz game'), with the need to maintain transportation into the character's emotions and narrative journey ('Helen has a backstory and she is nervous about this drive', 'these sounds of the sea provoke memories of happy times'). A concept within Langacker's (2008) framework that proved to be useful when thinking through this problem was that of *viewing arrangement* (Langacker 2008: 74). Given that this idea gave me a tool that eventually helped solved many of my narrative design problems, it is useful here to set out the concept of viewing arrangement in more detail.

> If conceptualization (metaphorically) is the viewing of a scene, perspective is the viewing arrangement, the most obvious aspect of which is the vantage point assumed […] A viewing arrangement is the overall relationship between the 'viewers' and the situation being 'viewed'.
>
> Langacker (2008: 74)

Langacker further defines the *viewer* and the *viewed* as the *subject* and *object* of perception (Langacker 2008: 77). In visual terms, the perceiving subject is the viewer, who lacks self-awareness of the mentally constructed perspective from which they look out at the object. They are instead totally involved in apprehending the object, which is clearly delineated (Langacker 2008: 261). Langacker sets out *subjective construal* as being characteristic of the subject's role as 'an offstage locus of perceptual experience that is not itself perceived' within the object of conceptualization (Langacker 2008: 77). In simple terms, subjective construal is characteristic of being engrossed in a scene that does not involve the viewer. All attention is on the scene, as it tends to be when watching a gripping film, and the viewer's consciousness of their own mental processes is minimal. Langacker's ideas were useful because they describe how grammatical choices can explicitly position the conceptualizer within the scene, rather than them staying outside of it. The extreme example of this use of grammar is to put the conceptualizer onstage as the focus of attention by use of first and second person pronouns ('I', 'you', 'we', and their variants), the use of which mean the reader is profiled, explicitly mentioned, and *objectively construed* within the object of conceptualization (Langacker 2008: 78).

I felt this concept to be pertinent to my work because Langacker refers to the way the second person address places the reader within the object of conceptualization. In this sense, I saw how the player-reader of my quiz game was being asked to picture themselves in the story. Walker-Rettberg (2002: 41) argues that the use of the second person address in digital texts 'can make you feel included; you feel seen by the text'. But if 'you' are included, and you feel 'seen' by the text, the question arises as to how

‘you’ can continue to inhabit the character and continue to be subjectively absorbed by the story. Thinking in this way led me to understand that there is a particular quality to text-based, interactive multimodal work that needs to be managed when using the second person address. By understanding that the locus of the player-reader’s consciousness is lacking self-awareness when totally involved in a story (Langacker 2008: 261), I saw that the challenge of writing for a format that deliberately draws attention towards the mouse in the reader’s hand and asks them to take on the role of a character is linked to the management of the player-reader’s self-awareness.

Applying this idea to early drafts of the prototype made me see how playing the quiz made me ‘fall out’ of the story world and into my own world of subjective listening. I also saw that I was ignoring the story: my locus of consciousness was aware of myself when I answered the questions, and so was not absorbed in the narrative. In terms of Ryan’s idea of spatio-temporal immersion (Ryan 1999: 130), where Ryan asserts that maximal immersion occurs when the space between the narratee and the narrated events is near zero, I was failing.

I began to analyse how I might use Langacker’s ideas to solve my problem. I re-read Walker-Rettberg (2002), who likens being asked to interact with a text in order to progress it as being asked to take a turn as the narrator (as opposed to being the narratee) (Walker-Rettberg 2002: 36-37). Taking these ideas together, I saw that the result of a text asking the reader to interact with it is that it draws attention to the fact that they are reading and clicking over apprehending the object of conceptualization (i.e. the story).

I began to use this analysis to understand how to maintain attention on the story through braiding text and sound. I applied Chion’s (1994) formulation of how causal

and coded listening[2] modes switch attention to help me with this. I saw that if a player-reader is listening to a sound that they must consciously process – such as within a quiz game asking them to recall where they have heard a seascape before – then the potential for them to lose contact with the story world and instead enter their own memory or become attentive to their processes of auditory perception is high.

I first began to test these ideas through applying them to the reading of multimodal texts that used a significant amount of sound.

7.8 Learning from Other Texts – *Motions* by Heather Smith, Roger Dean and Will Luers (2014)

One of these pieces was *Motions* (Dean, Smith, Luers, 2013), a work of electronic literature that is progressed through pressing a key to turn a page and that features sound, kinetic typography and split-frames of textual graphic design. By applying the conceptual framework developed and described above, I identified tensions within this piece that I was able to comprehend as being caused by an imbalance in the viewing arrangement the reader was asked to adopt when construing the text. The position of my locus of consciousness was not kept inside the story, and I felt myself become, instead, more conscious of my position outside of it. This tension was caused by musical aspects becoming more prominent as the piece progressed and the fact that this threw the textual elements out of the attentional frame. Whilst I have every admiration for the piece, and its message about people trafficking has stayed with me, later sections of the sound track – an improvised, jumpy, vocal-led musical piece – begin to compete with the written text.

[2] See page 52-55 more information on Chion's modes of listening

I found as a reader of *Motions* that these later passages (featuring vocal music) caused me to switch my consciousness to the task of parsing the sound (it is very unusual music and hard to decode) which threw me outside the situation conveyed through the text. Whilst I am a narrative sound designer, and so particularly attuned to the way that audio relates to a story world, I didn't think this was the reason for my attention to switch away from the textual elements. The soundtrack is vocally 'busy', and rhythm of the piece is uneven. It was difficult to decode[3] in terms of the what it meant within the world of the story and it caused me to stop engaging with the written words. By thinking in terms of Langacker's ideas, I was able to learn from this piece the way that demands on cognitive processing can cause conflicts between two rich modalities, which was useful when writing a sound-text piece. I saw how sometimes sound would need to be calmer in order to support the emotional sub-text of a story told through text. However, *Motions* is very music-led, and I needed to find a piece that combined text with sound that did not feature instrumental score in the same way. This piece was *Loss of Grasp* by Serge Bouchardon and Vincent Volckaert.

7.9 A Cognitive Poetic Reading of *Loss of Grasp* by Serge Bouchardon and Vincent Volckaert[4] (2010)

Loss of Grasp is a piece of work that is designed to be read and navigated by clicking and moving a mouse on a computer screen. In this multimodal piece, sound and text are entwined with interaction design. The work is separated into chapters and tells the story of a man who feels like he is having a breakdown.

[3] Using Chion's formulation, this would be seen as coded listening.
[4] Though four developers worked on the Angular version I accessed, Volckaert gets the author credit for the original Flash development.

Chapter one begins with the display of a single line written in white in the centre of a black screen. The text reads 'All my life I believed I had infinite prospects before me'. Rolling over the text with the mouse causes a series of moving, incomprehensible symbols to animate before revealing further single lines describing the protagonist's youthful optimism. Eventually, the reader must click (rather than roll) on a line to progress the story. Clicking causes a short bright sound and produces bright circles on the screen. More clicking produces more bubbles and bright sounds. The latter, to use Zbikowski's[5] (2017) term, is a musical motif that acts as a sonic analog for the sentiment of the narrator described in the written text (of youthful optimism and playfulness). As the reader continues to click, the production of the bright circles becomes increasingly unruly, their size and position difficult to predict, with the sounds becoming increasingly discordant and erratic, beginning to overlap as the text describes the feeling of a loss of control setting in. This sequence ends with the music playing haphazardly as bright circles move and the phrase 'How can I have a grasp on what happens to me?' is displayed. I found it useful here to see the moving items and colours against the black background as trajectors: the simulation of 'life moving on in time' is cued multimodally and in response to the reader's input. In terms of shared grammar between music and language, I saw the sound as punctuating a word-led simulation of an introspective state with tokens of emotions in music I perceived subjectively as I took the story in.

In the next chapter of *Loss of Grasp*, the scene opens with the ambient sound of a restaurant or bar. This ambient sound carries the spatial characteristics of a restaurant full of conversational diners: it communicates the space from which the narrator is telling the story by engaging readers in auditory perception of the scene. The text

[5] See page 48 for more detail on Zbikowski's work on musical grammar.

describes being dumbstruck over dinner and further words set out questions line by line at the top of the screen. Clicking questions on the screen plays the sound of a man's voice asking the questions, for example 'Do you want a drink?', in a tone that suggests awkwardness. As this awkward voice is heard, the words setting out the questions also change to nonsensical versions. The sound can be construed as being part of the same conceptualization as the written questions: he is lost for words and listening self-consciously to his own voice as he speaks. Eventually, a large question mark appears. Clicking on this question mark produces a coloured shape line by line on the right hand side of the screen. Moving the mouse over this shape causes more questions to appear, developing a piece of typographic art as the reader 'paints' on the screen by moving the mouse. Eventually, a photograph of the narrator's wife (made of coloured, typed questions) emerges out of the dark on the right of the screen, as though from the crowd in the restaurant to which the reader is still listening: his questions have led to knowing her, or at least building an impression.

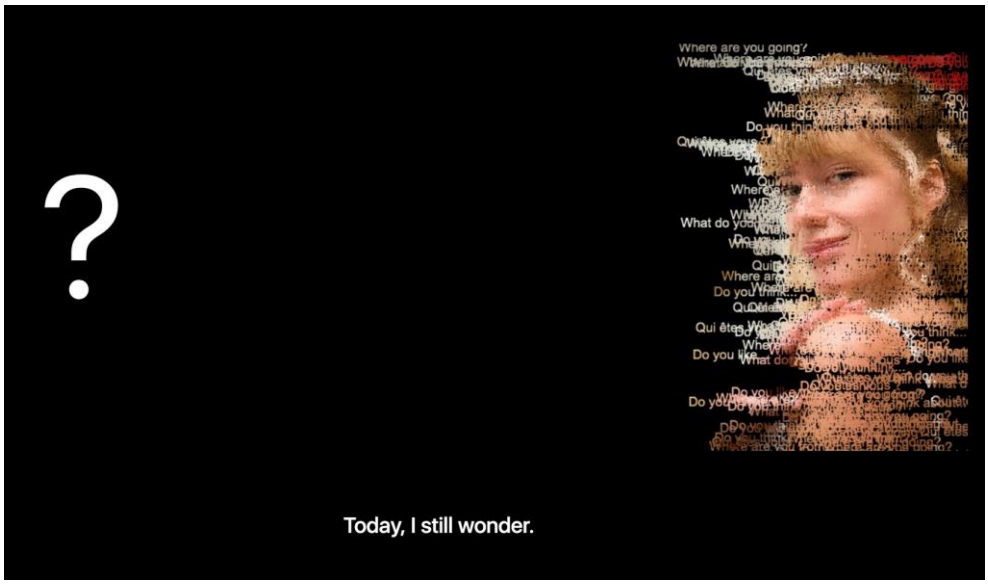


Figure 7.1. Chapter Two of *Loss of Grasp*: Meeting in the Restaurant (screenshot used with author's permission).

The final section of *Loss of Grasp*, when read using cognitive grammar, helped me to develop an understanding of how sound can be used to create emotions in a player-reader that fit with those experienced by the protagonist. The section that ends the piece features an almost empty black screen. The only other content is the titles and credits. A soundscape plays an atmosphere of sparsely distributed birds, music and wind mixed with reverberation so that the sound is perceived as playing from a source far away, perhaps at the end of a dark tunnel. By way of the spatial information contained in the mix, the sound situates the deictic centre, or vantage point, of the reader: the viewing position within the scene is one that is far away from where happier-sounding music plays. Essentially, the design of this multimodal text uses sound to enable the mind and emotions of the reader to stand in for the mind and emotions of the protagonist.

7.10 Braiding Text and Sound: How These Readings Influenced the Sound Design

In terms of applying these readings to solve the problem I had with balancing my quiz-game with narrative development, Walker-Rettberg's idea that 'you' are a vacuum waiting to be filled by a multimodal text (Walker Rettberg 2002: 37) proved helpful. I began to see that if the reader is playing / performing a character who has their own story-consistent emotions, and the reader is empty and able to be filled with emotions, then I could actively manage the sound in order that their emotions maintain a connection to a character's emotional arc. If I designed a sound to provoke an emotion or memory with the player-reader, then this should be an emotion or memory that could be clearly understood as belonging to the character.

Using Zbikowski's formulation that sound can create emotion and dynamic forces much more immediately than words can (Zbikowski 2017: 10), I realised that I could harness this emotional potential of sound if I used text to direct the player-reader's attention back to what the sound means to the protagonist, not to them. To use Langacker's terms, I needed to move the player-reader's locus of consciousness back towards the object of conceptualization (i.e. the metal simulation of the story). In essence, through applying these ideas to the reading of *Loss of Grasp*, I saw that the player-readers self-awareness of mental processes involved in listening, and their subjective emotions, had to be made story consistent. If the player-reader is experiencing an emotion or has a subjective response to the sound, then this should be understood as being felt by the character. I began to refine the sound design in the prototype so that, in addition to the animal sounds in the quiz, I used the tone and texture of the sea, weather and ambience to try to create an emotional, memory-based part of the story. I then wrote extra questions asking 'you', the player-reader, about 'your' past, (which of course is the protagonist's past). These questions were accompanied by spatially rich recordings of whales breathing by a boat and by sounds of wind that I had chosen for their particular tone (I used reduced listening[6] to decide that they sounded 'cold' and 'lonely'). I cued these to play alongside parts of the story that asked the character where she had heard these sounds before. My own readings of these drafts led me to conclude that this approach to braiding sound and text had begun to make the piece more coherent. However, most of the story was still told in one text box and I still felt that most of my mechanics still revolved around making choices. I set out to increase participation in action and to improve the user-interface of the prototype in order to try to reach my goal of creating spatio-temporal immersion.

[6] See pages 57-58

7.11 Coding, Creating and Increasing Possibilities

One of the most striking features of *Loss of Grasp* is the mechanics employed in the interaction design: instant feedback (e.g. moving graphics) gives the player-reader cues that the story is responding to their input. Following the path that I had set for the prototype – to give more feedback to indicate to the player-reader when they have interacted with the game – I took the decision to learn how to code elements of the sound and graphic engine that could respond to user input beyond the links in the Twine quiz game. I learned how to pass values into certain dynamic properties of the audio authoring tool and I also developed an ability to code colours and counters so that they changed in real time and in response to mouse movement.

Studying these things helped me to understand Schell's (2015) assertion that feedback is a way to show the user 'quite clearly that what they have done makes a real difference' within the context of user interface design. If I could design numbers that changed as the player-reader moves a slider, and the sound is audibly altered, then this would feel like participation in the action of the story and increase the potential of my game to create spatio-temporal immersion (Ryan 1994). Furthermore, through the study of code, I was able to conceptualise, implement and iterate quickly, affording me a power over the creative design process that had been impossible at the beginning. I added the two timer-based games centred around listening for the blue jays and recording the anomaly.

However, I still had a problem: the drive interface was nice, the sound was woven into the story that the hackers were telling through the drive, but it seemed that adding all of the user interface coding and extra play-centred elements had somehow made the protagonist's backstory start to drag. Compared to the excitement and

immediacy of the responsive drive, with its flashing panels and requests for input, the text telling of the protagonist's connection to her past, to her missing Uncle and her missing lover, felt faded and unimportant. The user interface improvements had caused the disconnect between the player-reader and the character to worsen. This meant that the protagonist – who had been front and centre of the story in the first piece – once again felt absent.

I needed to find a way to place her story within the context of the tasks being performed by the player-reader rather than leave it where it was, in the background behind the sound and lights. Whilst I had written in a story about the protagonist's memories of being at sea and listening to whales, and this had initially improved the connection between the player-reader's subjective sense of their emotional response to the sound and to her, this was no longer working. There was too much text and too much information: I had put all of the backstory within the same text box as the one used to display the quiz. My own assessment told me that nobody would read it, and that I was not managing to frame and allocate attention in a way that felt coherent and connected.

7.12 Finally Reconciling the Story with the Game: Graphic Design in My Boyfriend Came Back From the War (Olia Lialina 1996)

Though it does not feature sound, the hypertext work *My Boyfriend Came Back from the War* (Olia Lialina 1996) provided inspiration that helped me solve the problem of telling a character-led story alongside a scored, quiz-type game.

Lialina's work is introduced on the Net Art Anthology as one that relays an evocative, cinematic narrative and that she uses hypertext to interrogate the organisation of memory (Rhizome website). The piece commences with one link on a black screen ('My boyfriend came back from the war. After dinner, they left us alone'). Clicking this single line link results in a split screen – a picture of a window at the top, and the actor playing the boyfriend at the bottom. Clicking the boyfriend splits the screen down the middle in half, the frame on the left containing him, the frame on the right displaying a close up of the girlfriend of the title. Clicking her picture splits the screen into three, the lovers divided by a central column containing two text links ('Where are you' and 'I can't see you'). Both of these links lead to another single line ('Forget it'). On either side of this exchange, the two actors faces remain static, though one of them flickers (it is not possible to interact with these pictures at this point). Further clicking of 'Forget it' results in further splits in this central text column so that it becomes subdivided into increasingly small, nested boxes. As the reader clicks these multiplying boxes, the conversation fragments before finally settling, box by box, to black. At the close of the piece, there are seventeen separate frames on the screen, all empty apart from the column containing the boyfriend, who remains impossible to interact with.

The graphic design of this piece inspired me: it gave me the idea of separating Helen's memories from the quiz-led story told on the drive by using boxes set to the side of the drive. This provided a solution to the problem of too much backstory being told by the text on the drive. By (graphically) framing Helen's internal thoughts separately from the quiz questions, I created a way to make clearer the way that the sounds remind her of something. This again helped address the potential problem of the player-reader not connecting their own emotional response to listening to the character's

response to the sounds. I applied this framing device throughout the rest of the prototype in an attempt to balance narrative development, participation in action, and sound-led emotion.

7.13 Conclusion

In this prototype, I set out to experiment with how to create narrative transportation using game mechanics such as timers, rules and scoring feedback. I did this in order to experiment with how to create spatio-temporal immersion whilst engaging player-readers with listening and learning about animal communication. Alongside this, I attempted to continue telling the story begun in prototype one, and to centre the same protagonist. The goal of maintaining immersion in a character-led story world whilst introducing game mechanics was particularly challenging to achieve, especially given that I also needed to allocate attention towards the perception and sensing of sounds. Developing the ability to code more responsive interfaces enabled me to implement more game mechanics but did not solve problems with a disconnect between the narrative and the quiz game or the listening tasks.

In terms of applying cognitive poetics and the psychological processes involved in reading to user-centred design, I took a very specific aspect of Langacker's work on cognitive grammar – viewing arrangement – and applied it readings of texts featuring text and sound. This application of cognitive grammar allowed for me to focus on the ways that a player-reader's attention or locus of consciousness could be moved and managed with sound. In terms of user-centred design, I applied Langacker's ideas to a reading of *Loss of Grasp* (Bouchardon, Volckaert 2010). Reading this piece in this way also enabled me to understand why I was experiencing problems balancing storytelling with an increase in game mechanics. I began to understand how to approach braiding

sound and text in a way that would potentially increase narrative transportation by creating an emotional connection to the character through sound.

Another reading (of *Motions)* (Dean and Smith 2014) illustrated to me the way that sound and music concrete that is too rich or grammatically complex can cause a player-reader to adopt a mode of causal and coded listening that results in a disconnect between a soundtrack and the story told in the text. This led me to use sounds that were quite ambient in sequences where the protagonist's story and memories where to be foregrounded over listening. This sound design approach was strengthened by using graphic design to frame the protagonist's thoughts and memories outside of the quiz game being played on the drive.

End Note on The Creative Process Behind the Animal Sounds

The audio of whales and blue jays in the piece are the result of a great deal of editing, layering, enhancing and binaural filtering of archive recordings. For example, some of the orcas were recorded by a marine monitoring station in Canada who publish their sounds online as part of their educational work[7], and the blue jays in the main came from the Macaulay online library[8]. These field recordings vary in quality – many are from hydrophones or recorded by amateurs – and what you hear are composites of elements taken from hundreds of samples. To clarify, much as I wanted to, I could not put the player under the sea surrounded by whales, as I simply did not have the elements (close up calls, separate microphones for each whale, close perspectives, lack of noise on the recording etc. etc.) that this approach would need. The factual elements of the

[7] Ocean Network Canada's Sound Cloud Page can be found here https://soundcloud.com/oceannetworkscanada
[8] I obtained a researcher's license at https://www.macaulaylibrary.org

text that accompanies these designs are drawn from papers written by animal behaviourists and the sound edits were made in accordance with information set out in these written studies. In this sense, the blue jay and orca soundscapes are unique compositions.

Chapter Eight. Reflective Documentation of the Design of Prototype Three

8.1 Introduction

I had wanted to work with 3D text from the very early stages of the project, but it was only during the later stages of the research that I could conceptualize a design in the level of detail required to make it. This increase in my conceptual ability was partly the result of my developing framework of praxis[1], and partly the result of my increased skills with Unity/Wwise. I found that an ability to conceive the prototype's software design offered a fluidity within the creative process that had been unavailable earlier in the research process.

In terms of the question of how to incorporate of difficult information into a narrative game, this chapter documents a process of writing a story about activists trying to save a polluted landscape. I wanted to tell this story by synchronising language with environmental sound and so decided to adopt a creative process led by field recording. This recording-led process is documented in detail as it differs significantly from the sound design of the other prototypes, where I made heavy use of library sounds.

[1] Praxis – the application of a theory – is defined within creative research methodology as theory imbricated within practice (Nelson 2013: 37).

8.2 Aspects of Narrative Transportation Used to Guide Development

In terms of narrative transportation, the decision to centre the story of a degrading environment created a specific challenge: how to make a landscape-based story engaging whilst delivering difficult information. From my research, I understood that if I wanted the piece to have any chance of changing people's views on the risk associated with reflexive modernity (Beck 1992), any plot or action within the narrative had to be written in a way that created an emotional connection with the woodland and animals. This is because research told me that if the mental simulation cued by the prototype was to be memorable enough to change behaviour, I needed player-readers to be emotionally absorbed in the experience I created. (Gerrig 1998: 40-41; Morris et al 2019).

Strong mental imagery is one of the aspects measured by the narrative transportation scale, as is the degree to which readers can picture themselves within a scene (Green and Brock 2000). By using cognitive poetics to understand the psychological processes involved in reading – particularly the fact that schema and prototypical imagery is a key aspect of mental simulations (Gerrig 1998; Langacker 2008) – I was able to understand the particular challenge of using language to create absorbing mental images of nature. I wanted to create memorable work that foregrounded the natural world as far as possible, but Mackey (1997) found that readers tended to employ 'rather vague' images when reading complex fiction. If readers tend to visualise 'a tree' or 'a leaf' when reading with momentum, I had to write differently if I wanted to immerse people in a rich mental simulation of a woodland. This thinking led to me reducing the number of words I used and avoiding complex descriptive sentences. In this way, I attempted to create strong mental images of nature. However, although vivid images of locations are aspects of the narrative transportation scale,

results of Green and Brock's qualitative studies ultimately showed that affinity for characters is linked to greater transportation (Green and Brock 2000: 704).

I decided that writing a character into the story was a strong strategy. I designed the prototype to centre an activist, and created an interaction mechanic focussed on helping her and discovering her story. By doing this, I was able to strengthen the potential to develop an affinity between the player-reader and the character. I also decided that the activist character should speak her story, rather than leaving notes to be read. Putting her voice in the piece, amongst the sound of the landscape she is trying to protect, was a deliberate attempt to reduce barriers to connecting with her and to maximising narrative transportation. However, I chose not to feature any recorded interactive dialogue after my discovery in prototype one that this mechanic tended to break immersion.

Once I had made the decision that I would include a character, I was able to develop an approach to braiding sound and text in order to create immersion in a landscape. I decided to write in a way that used language to build 'pictures in the mind' and to pace the mental simulation cued by words so that there was space for a rich soundtrack to be incorporated within this mental imagery. This required a particular methodological approach: I wanted to experiment with how sound could be designed to increase immersion in a natural landscape by cueing aspects of visual imagery that was only suggested or sparsely constructed through text.

Beyond mental imagery, I also wanted to create a soundtrack that had an emotional resonance and that supported the personal subtext of the activist character's story. In this way, I hoped to explore how sound field recording and manipulation could add an emotive resonance to the piece. I felt that this approach would help strengthen

the prototype's potential to absorb readers within the story of the landscape as one aspect of transportation is being emotionally effected (Green and Brock 2000: 704).

8.3 Reading in 3D: Interaction Design for Narrative Transportation

As stated in the introduction to this chapter, my goal was to create a prototype containing 3D text. To begin this task, it was necessary for me to conceptualise a mechanic that could enable player-readers to read this text in 3D space. To do this, I returned to the literature on digital narrative and user interfaces, in particular the work of Aarseth (1997), who uses the term *cybertext* to refer to the type of work I wanted to make.

The tension between absorption in reading and operation of a text is conceptualised by Aarseth (1997) as an effort-reward dynamic, where the 'non-trivial effort' involved in negotiating cybertexts needs to be balanced with a response from the text (Aarseth 1997: 1). Aarseth's formulation that a computer is integral to a cybertext's meaning was useful to me when I was designing this prototype. He says: 'just as a film is useless without a projector and a screen, so a (cyber)text must consist of a material medium as well as a collection of words. The machine [...] is not complete without a third party, the (human) operator' (Aarseth 1997: 21).

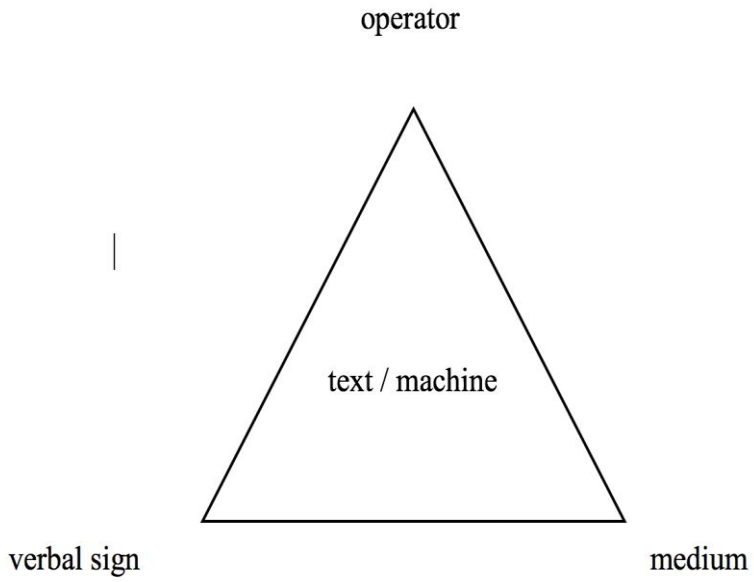


Figure 8.1. Aarseth's Textual Machine (adapted from Aaresth 1997: 21)

As a result of my thinking in the way formulated by Aarseth, I decided on the way that the user interface of the prototype would integrate into the story: the player-reader would take on the role of Helen (the protagonist in prototypes one and two), and this role would be task-based and centre around operating environmental monitoring equipment on the fictional nature reserve. I took this decision because it positions the player-reader as a participant in the story and, in line with Ryan's assertion that immersion can only be reconciled with interaction if interaction counts as participation (Ryan 1999: 130), also minimised the threat to transportation posed by an interface design that was not conceived as being part of the storyworld.

In further pursuit of a design strategy that balanced 3D reading with interaction, it was useful to refer back to Pope's (2010) conclusions from his reader-response studies that 'interactivity should enhance, and not impede, reading absorption' (Pope 2010: 8).

As the prototype aspired to create a reading experience whilst immersing the player-reader in a 3D spatial soundscape, I wanted to minimise text and link-based interaction. I chose instead to use a mechanic that moved the position and focus of the descriptions and sound in response to keystrokes made by the player-reader. I felt this mode of input could help maintain a more traditional narrative flow that stayed closer to the experience of literary reading than one afforded by clicking links. Furthermore, the operator mechanic gave player-readers a chance to navigate the environment central to the story without the danger of them 'falling off the edge' of a simulated 3D world. This is due to the fact that the fictional equipment operated in the prototype has a fixed range of movement and focus, minimising free movement that might otherwise have meant player-readers getting lost in empty space as they looked for words to read.

8.4 Reading and 3D Text Presentation: Inspiration Taken from Other Works

Though the interaction mechanic provided me with a way to implement the 3D aspects of the prototype, creating text to be read in this navigable environment provided a new challenge. The conceptual framework developed by the research had, up until this point, only dealt with text presented in 2D. On commencing writing, I found that I had a limited ability to conceptualize how to construct text that would be presented spatially and that could support the interface design of the prototype. I began to seek out examples of 3D work for inspiration.

This research led me to the literary installation work undertaken at Brown University, particularly the work *Screen* (Wardrip-Fruin, Mclain, Greenlee et al: 2003). The piece features 3D projection that places language in physical space, with readers entering a 'cave' and interacting through hand movement with text. According to

Wardrip-Fruin (2009) '*Screen*…combines familiar game mechanics with virtual reality technology to create an experience of bodily interaction with text…the uncanny experience of touching words create an experience that doesn't settle easily into usual ways of thinking about gameplay or virtual reality' (Wardrip-Fruin 2009: 373). I found how the piece places text in 3D space, specifically the way the text moves past and around the reader, to be an inspirational design concept. However, though the 3D presentation of language created a strong impression on me, *Screen* was not designed to prioritise narrative transportation. Instead, Wardrip-Fruin classifies the piece as a 'textual instrument' (Wardrip-Fruin 2009: 366), where words are 'knocked-back' by player-readers, causing a sound to play, audibly marking the collision. Furthermore, as the experience progresses, the blocked text on the walls of the cave becomes increasingly fragmented and placed in random locations (Wardrip-Fruin 2009: 376). Wardrip-Fruin describes the experience as one where 'Interactors […] oscillate between reading and playing – with the objects of both coming faster and coming apart – until both experiences can no longer be sustained and the piece ends' (Wardrip-Fruin 2009: 377).

Wardrip-Fruin does not state that immersion in a narrative or character is his primary concern. It seems instead that the goal of the piece was to encourage play with words and to experiment with a particular form of digital writing that could take advantage of the 3D cave format. Furthermore, though sound is used to indicate collision (on hitting a word), and text is read out when the words have collapsed to the point of graphic illegibility, the piece does not feature a soundscape designed to support a narrative. Though I admired *Screen*, the mechanic of 'catching' moving language did not seem to offer much promise for a project seeking to use 3D space to create narrative transportation through reading and listening. Consequently, the piece was influential

only so far as its rendering of text in space afforded the development of a broad design concept.

When looking at other work made at Brown University, I discovered a prototypical piece by John Cayley, *Lens* (2006). In this short piece, the word 'lens' is displayed in large letters on the three surfaces of the VR cave. As the reader stands in front of these letters, they can use a controller to zoom them. Doing so results in the word moving forward and growing in size until the reader 'moves through' the word. In Cayley's words, 'surfaces that were "in front" now form surfaces for other texts. They may even become other "spaces" within which writing drifts. Letters both delineate and redefine spatial relationships' (Cayley: 2006). *Lens* is illustrated in figure 8.2 below.

[image redacted from this digitised version due to potential copyright issues]

Figure 8.2. Screenshot of Cayley's presentation of the work *Lens* (Cayley 2018).

Figure 8.2 visualises the spatial, typographic and interactive nature of *Lens*, thereby illustrating the form of the piece. The writing contained in the figure can be seen to make direct reference to itself and the 3D 'lens' format (for example, both writer and reader are set out as perceiving 'glory' within each other, and the word 'lens' appears numerous times on the screen). In this sense, the theme of the text is the design of the text itself (exemplified in the phrase 'the letter is a threshold'), and this design element is featured more prominently in the writing than any sense of story. Cayley prototypes his concept but does not offer an example of how this concept could be used by writers seeking to transport readers into narrative worlds. I wanted to explore this further.

I applied Cayley's design concept by synthesising it with the machine operator mechanic used in the prototype. The framing of his textual presentation as a 'lens' moving through surfaces prompted me to begin writing fragments of descriptions that would be read in layers. I began to think of how text could build mental images as player-readers moved through words and beyond surfaces into the depths of the landscape featured in the story.

I identified a goal of writing fragments of visual information that could build composite, dynamic images in the mind of the player-reader as they moved the 'lens' through the words. I wanted this imagery to build and move in a cinematic way, as though the images were being zoomed and the reader was being drawn through the imagery. This approach required me to develop new writing techniques. I developed the technique ultimately used in this prototype by using cognitive grammar (Langacker 2008) to analyse the way sparse texts succeeded in creating distilled, conceptually moving mental images. Specifically, I applied cognitive grammar to the reading of poetry.

8.5 How Cognitive Grammar Was Applied Within a User-Centred Writing Approach

Langacker's visually-based conceptualization of the way words cue and simulate scenes in the mind of readers enabled me to think cinematically. This was particularly useful when I approached the task of writing visual imagery I intended to augment with dynamically mixed environmental sound. In particular, in terms of applying the psychological processes involved in reading within a user-centred writing approach, I began to try to imagine how the dynamic, moving nature of cinematic images could be produced through language presented in 3D. This led me to focus on writing techniques that could create fictive motion.

Fictive motion (Talmy 1983) is a phenomenon that describes the simulation of an object's movement in a scene when the object is not actually moving (such as in the phrase 'the road runs along the coast'). In this example, the fictive motion is simulated in the mind of the reader, because the road is not running, but rather the movement is from the reader's point of view and is comprised of multisensory recall of moving along rivers and coasts (Matlock 2004). This aspect of cognitive grammar helped me think more clearly about the cinematic quality of mental images simulated through reading: this simulated fictive motion could potentially replicate the effects of a moving camera shot. This consequently led me to attempt to construct a dynamic and shifting point of view that could be synchronised with a subjective point of audition cued through sound (Chion 1994).

My attempt at to create a type of 'cinema in the mind' through writing was enabled in part by Stockwell (2009), whose application of cognitive grammar to poetry gave me a way to turn this way of 'thinking cinematically' into an actual technique.

Stockwell uses the word ‘zoom’ to describe how grammatical choices frame attention and dynamically generate prominent items through the process of construal (Stockwell 2009: 31). This conceptual mapping of linguistic construal (building images in the mind) to the occurrence of ‘zooms’ in the visual domain enabled me to make the ‘surveillance equipment’ mechanic work. I began to construct passages of writing with the goal of them ‘being zoomed’ in mind. By knowing that the piece would reveal increasingly close-up images, I chose to write concise, detailed and granular clauses: I knew that the user would zoom on the user interface and that the system would respond by altering the scope of the mentally simulated visual imagery.

The goal of creating a visual sense of nature through a ‘zoom’ mechanic led me to being influenced by the distilled nature of poetry. I applied cognitive grammar to readings of poems in order to analyse the way that they cued dynamic profiling of prominent elements and how this resulted in ‘camera-like’ fictive motion. I did this to attempt to learn techniques useful to creating cinematic, landscape-based writing. Specifically, I read *Nantucket* by Carlos Williams (1934). This poem was very influential in the research process as I used it to explore in detail how spatial and deictic elements are rendered in text. Reading it closely helped me develop techniques to generate images that contained simulated movement and that zoomed into details.

Nantucket

Flowers through the window
Lavender and yellow

Changed by white curtains –
Smell of cleanliness –

Sunshine of late afternoon –

On the glass tray

a glass pitcher, the tumbler

turned down, by which

a key is lying – And the

immaculate white bed

In this poem, the use of the preposition ‘through’ in the first line establishes the deictic centre of the reader as one moving through the scene and out into the flowers beyond. The way that objects are subsequently picked out from the interior foreground and background creates a sense of pulling back into the room and noticing the contents. This effect is generated through the scanning processes involved in construal of the scene, where the picture in the head of the reader is built dynamically as the text produces items of prominence in turn and reprofiles the frame of attention. A useful example here is how the view through the window of flowers is pulled back into the room by the line ‘Changed by white curtains’, which brings the reader’s deictic centre in close proximity to the curtains, before sensory data rendered in the immediately following line (‘Smell of cleanliness’) shifts the reader’s deictic centre so close to the window that the curtain can be smelt. From this position, elements are picked out for profiling and are zoomed into the attentional frame.

An example of this technique is:

> Sunshine of late afternoon –
>
> On the glass tray
>
> a glass pitcher, the tumbler
>
> turned down, by which
>
> […]

The text is sparse and offers an amount of descriptive detail that is just enough to render each item in turn. What was most useful in terms of developing a writing technique for this project was the way that the line structure and the use of capitalisation and punctuation break up the movement of imagery in a way that simulates a ‘jump cut’ in the images. This setting apart of phrases to indicate movement of gaze was influential on the way I broke up the text in the prototype into small phrases that were presented piece by piece over time. To illustrate how this manifested in practice, there follows a sequence from the prototype:

> A cluster of taller trees stand apart from the others. They are thin and white, mottled but alive. Their bark is detaching in thin ribbons, ringed around the trunk in scrolls like exfoliating folds of skin.
>
> At their feet are piles of what took like shavings.

[[Zoom Forwards]]

Paper-like bark lies scattered wide amongst gnarled roots twisting deep down into the ground.

[[Zoom Forwards]]

The bark amongst which the woman placed her item is home to small patches of mushrooms. They grow from its surface. They reach through the cracks between the sheaves, thin brown stems supporting bloody hoods.

[[Zoom Forwards]]

Amongst this mess of red, brown and white, a small white piece of pristine bark is laid flat, weighted down with a small stone and pinned in with twigs.

A set of numbers and bars are printed upon its surface, tiny but clear in thick black ink.

I wrote these phrases with the express goal of experimenting with ways that altering the scope of the image through a zoom mechanic could drive a dynamic, visually-led mental simulation. The occasional use of simile (‘bark…like folds of exfoliating skin’) helped to warm up the text, with the embodied reference to skin enabling a physical connection with the landscape. As the physical design of the text and zoom mechanic came together in Unity, I began to realise that reading prepositions (‘down’, ‘into’) combined with description of detail (‘gnarled’, ‘bloody hoods’)

simulated a fictive motion that, when combined with the physical moves made back and forth through layers of text, created a scanning process in the mind that was very rich. Furthermore, in terms of my pursuing conceptually moving, ‘cinematic’ mental images within the Unity implementation, it became apparent to me that the way I had used body-based metaphors within distilled visual images opened up opportunities for the sound design: I began to conceptualize a design where the movement of the camera and corresponding changes in the scope of the mental simulation altered the point of audition represented within the audio mix. I pursued this concept in order to see if I could strengthen the embodied sense of presence felt by the player-reader (of ‘being in the wood’) by simultaneously shifting the sound to simulate a point of audition as the text changed the scope of the images. I made specific choices of sound and mix (for example, removing high frequencies and bird song as the wood is entered more deeply) in order to explore if linking dynamic mixing with ‘zooms’ through layers of text could create a sense of ‘being there’ through implying that the point of audition was moving with the mental imagery. The way I developed these sound design ideas will be discussed more fully in section 8.7.

In terms of researching how language could create rich mental imagery and work with sound to create presence, I looked at other distilled forms of poetry that successfully generated images and cued embodied multisensory simulations rich in fictive motion. I chose a poem I had always admired – Margaret Atwood’s *You Fit Into Me* (1971) – and re-read it to see how dynamic construal processes might be contributing to its effect.

You Fit Into Me

you fit into me

like a hook into an eye

a fish hook

an open eye

As with Nantucket, the preposition ('into') in the first line creates movement. Following that up with 'me' creates an image of two pieces fitting together seen from the point of view of the reader ('me'). The immediate subversion of a domestic image (hook and eye is a sewing technique) with the image of the fish hook and punctured eye causes rapid reprofiling of this image. As these images are built and refreshed, the reader must engage with cognitively processing them. The composite meaning of the poem and specificity of the mental image only emerges as you get to the last words ('open eye'). The processing of the final image involves a fast shift from a prototypical image schema (Langacker 2008) of domesticity to one of violence. This shift finally reveals the meaning of the poem (the work is part of Atwood's collection *Power Politics*).

Reading this poem increased my grasp of the ways that the dynamic scanning involved in construal result not only in moving imagery but also drives the focus of meaning. This informed my own approach to the generation of the story. A specific example of how I applied approach is the way the meaning of the sight of the bird ('life', 'nesting') is reprofiled in the sound of creaks and termites, revealing that the tree

is diseased and will soon not be able to provide food for the bird. A further example of working with sound and text to cause reprofiling of a perceived situation is the decision to create an image of deer running through the forest that is immediately reprofiled as being caused by the sound of danger under the surface of their grazing ground. To change the tone of the scene from positive ('deer running beautifully free') to sinister ('anomaly in the landscape'), I designed the sound to include the cries of the Jackdaws, which are quite jarring in tone. This is the type of technique I would use in cinematic sound design to shift the meaning of a scene towards a darker place than the images alone would generate.

8.6 Braiding Text and Sound to Create Immersion

As I wanted to compose a soundtrack that expressed aspects of the landscape that could not be described in words, I focussed on researching sound's unique capacity to reveal things that cannot be seen. This led to thinking about how sound reveals interiority. Ong (1982) sets out this idea in a useful way and so it is featured here.

> (one of the characteristics of sound) […] is its unique relationship […] to interiority [...] This relationship is important because of the interiority of human consciousness and of human communication itself […] Sight isolates, sound incorporates. Whereas sight situates the observer outside what he (sic) views, at a distance, sound pours into the hearer [...] I am at the center of my auditory world, which envelopes me, establishing me at a kind of core of sensation and existence.
>
> (Ong 88: 71-72)

In terms of researching the question of how to braid text and sound to create narrative transportation, specifically in terms of how best to create an emotional connection (or 'core sensation') with a landscape, I found Ong's idea of interiority useful. To articulate exactly how I was able to apply his ideas within my sound design approach, it is useful to briefly explore how the writing I had created helped situate the player-reader's point of audition within what Ong calls the 'centre of an auditory world' (Ong 88: 71-72).

I initially created text that would reflect the impassive nature of the 'surveillance equipment' mechanic and 'lens' concept and had envisaged that the sound would work with this in a cinematic way. In other words, I was working on the basis that a 'lens' would observe from a detached perspective and these visual descriptions would provide adequate frameworks for the audio. In line with this approach, I originally minimised subjectivity within the descriptions and images I was writing. However, my own assessment told me that early attempts to use literal descriptions (e.g. the tree is white, bark is breaking away from the trunk because this tree sheds layers as it grows) were not engaging and 'faded' into the background when synchronised with sound. I deduced that this was because the language was leading to me adopting a point of audition that was as detached and far removed from the landscape as the descriptions were.

Much more successful were the embodied metaphors ('exfoliating skin') and embodied schema ('twisting', 'grow' 'bloody') I eventually used. In this way, I found that to create a compelling mental simulation of landscape through language braided with environmental sound, I had to personify trees and mushrooms. Using personified metaphors and embodied language helped me create the types of 'core sensations' described by Ong. I also found that creating an embodied sense of presence amongst the trees led to a perception of listening from that position. In this way I saw how I could braid text with sound to create an emotional effect: by bringing the body of the player-

reader inside the mental simulation of the wood, it was possible to approach the sound design in a way that attempted to create 'core sensations' multimodally. This led to me taking a fresh perspective on the process of selecting and mixing sounds to use.

8.7 Selecting and Recording the Final Sounds

In keeping with my decision to adopt a recording-led approach to the sound, I put myself out in the field. I selected a trip to the Cairngorms in Scotland led by wildlife recordist/soundscape artist Chris Watson and sound artist/microphone maker Jez Riley French. I chose to attend this particular trip in part because French specialises in making and recording with contact microphones: I wanted to apply his technique of recording metal, trees, insects, buildings, pond life and electrical pulses to this work.

The timing of the trip meant that when it was taken, I had written some of the textual descriptions of the wood but had not finalised the technical details of how the sound would render the environment. It was necessary for me to envisage how the sound would be designed, played and programmed into the story scripts during the recording week. This put sound design at the heart of the writing process in a way unique to this prototype. For example, the idea of beetles[2] in the dying tree emerged when Chris Watson explained that the place to find them was inside weakened and sick bark. We recorded some ant hills and the 'termites' in the rotting tree were inspired by this. As the recordings I made of the anthills were not of sufficient quality for me to use, the termite sound is actually a recording of grass beating in the wind that I made

[2] The recordings in the prototype of beetles in wood are the only sounds not recorded by me. They were recorded by David Dunn, an acoustic ecologist and composer who spent years developing microphones and recording beetles.

because I realised its tone and texture could make a useful contribution to the feel of the soundscape.

Furthermore, in terms of how the recording process was led by fledging story ideas, though the idea of an activist discovering pipes under the surface of the nature reserve had begun to emerge, it was not a very developed idea. By approaching the story of the pipes from a sound design point of view (creating a material feel for the pipes is a design challenge in itself), I found myself recording metal fences and structures with contact microphones. This process led to me writing the part of the story that centred the activist having buried microphones to record the fictional pipes underneath the fictional nature reserve. The story idea developed during the week until the recordings of metal I was making began to form the foundation of the soundtrack. Furthermore, in line with the goal of creating emotional content for the piece through sound, I decided to represent the chemicals within the pipes as a 'dark force'. This led me to look for particular tones and moods to record. For example, in terms of the metallic quality of the pipes, I recorded fences and metal structures out in the landscape as they moved in wind and rain. I searched out grass beating against metal because I wanted the rapid, relentless percussive element to contribute to the feeling of velocity. I used hydrophones (below the surface) along with omni mics (above the surface) to get recordings of water the could be used to create the movement of the chemicals within the pipes. These recordings were layered, edited and turned into the soundscape that is incrementally built when the microphones revealing the pipes are activated in the game. In terms of the other aspects of the soundscape, I had set the piece in a forest, so I visited and recorded three. These ranged from the sparse woodland surrounding the bank of a narrow river near Glenshee (the field and bridge in the story were drawn from this location, and all the Oyster Catchers were recorded there, as was the birdsong that

opens the piece). The second forest was The Caledonian Forest, and it was in here that the tree creaks were recorded. Finally, we went to the Balmoral Estate, where the running stags were sighted.

During these recording sessions, I referred back to the language I had used to describe trees and wood, working towards creating space by imagining how the recordings I was making would blend with the writing. In addition to using stereo microphones to capture atmospheres (of winds, swaying trees, water and choruses of birds), I also used contact microphones to record the landscape from a different perspective. Contact microphones – unlike the microphones used to record air-borne vibrations – transduce movement in structures into sound and can therefore access the interiority of solid entities such as trees and buildings. These recordings have a different texture to the air-borne atmospheres. An example of such sounds in the prototype are the close creaking and the granular, effervescent "termites" used within the beetle recording task. These differently-textured, close recordings of the interiority of objects were made to give me material with which to 'zoom' the sound and achieve a granularity in the auditory images that matched the language.

In terms of the atmospheric recordings, I made decisions as to what tones to record based on pursuit of the mood I wanted to underscore the writing. As I knew that the destination of the recording was a 3D audio engine, I adopted a strategy of recording elements that could later be structured across separately-spaced, mono ambient sound objects. Consequently, I recorded very empty atmospheres to form the tonal and spatial bed of the work. These atmospheres – due to the prototype being made in a game engine – had to be looped and mixed across real time parameter controllers that changed volume, proximity and position of the sound sources as the camera/listener moves through space.

In terms of storytelling through the sound, the use of two different locations (moor and wood) meant I could give the prototype a sense of movement across a large nature reserve without having to communicate this through lengthy bits of writing. Using sound to create a sense of moving between locations also afforded an economy to the storytelling: it tells the reader that the reserve is large and its influence spreads into neighboring land. Locations were chosen for their mood and tone as much as their content. For example, the Oyster Catchers featured in the last part of the prototype, were recorded over multiple trips to a river on an open moor at night fall. I liked the tone and the quiet of the location. In addition, Oyster Catchers are migratory water birds, and this fitted the story of the activist's monitoring activities.

One aspect of the sound in this prototype that differs to the others is that I worked with a foley artist who performed the birds and the bodies of the activist. This happened in the post production phase, where I was able to send videos of the kinetic text to the foley artist and have her create sounds recorded to specifications as to the proximity to the camera of the described events (e.g. of birds nesting). In these very practical senses, the creation of this prototype applied cinematic sound design workflows to the creation of an electronic, literary game.

8.8 Conclusion

When making this prototype, I sought to create narrative transportation by making a 3D reading experience accompanied by an immersive soundscape. I chose to focus the story on the degradation of a natural environment and the effects of this on species extinction. In order to increase narrative transportation, I featured the story of an activist attempting to save the landscape.

Due to the goal of working in 3D, I expanded the conceptual framework developed by this research to encompass writing that could create strong mental imagery when read in fragments. This led me to research poetry and find examples of work that created a clearly framed attentional ‘zoom’ through fictive motion. The approach I took to the soundscape design was compositional in nature and sounds were chosen for their potential to create an emotional connection with both the character and the landscape.

Researching Cayley and Wardrip-Fruin’s 3D work led to me conceptualizing a design that involved reading through moving the ‘focus’ of surveillance equipment. This combination of interface design, ‘zoom’ mechanics and text that reprofiled the scope of mental images offered me an opportunity to take a cinematic approach to the design. In practice, ‘zooms’ in text were accompanied by dynamically mixed environmental sound. I discovered that the most successful approach to braiding text and sound within an environmentally-based narrative involved use of personification metaphors because they cue embodied schema. The particular reason this worked in the prototype is because the strongly embodied schema establishes an intimate point of audition within scenes.

Despite the complexity of the piece, it was made more quickly than both of the other prototypes. This was due to the maturity of the conceptual framework and the fact that my creative approach was informed and supported by the two years I had spent studying and using Unity and Wwise.

Chapter Nine. Thesis Conclusion

9.1 Introduction

The primary research question addressed by this thesis is how cognitive poetics can be applied to the design of sound-led text games which incorporate difficult information. This question was chosen when I discovered that there was no pre-existing conceptual or design frameworks for braiding sound with language in games. As I applied cognitive poetics to readings and analysis of texts, more detailed research questions about how listening could be combined with reading in interactive texts emerged. Pursuing these questions resulted in insights that I used to address design problems and to produce three prototypes. These prototypes serve as examples of approaches to combining text and sound to create narrative transportation in games. Throughout this conclusion, I provide detail on the outputs from the research in order to establish my original contributions to knowledge.

9.2 Development of an Applied Conceptual Framework

In order to conceptualize how sound could be braided with text to create narrative transportation, I had to develop an ability to imagine how listening would impact on reading. Applying cognitive grammar to analyse and conceptualize scenes from the point of view of the player-reader opened up a space for me to fuse ideas about mental simulations cued by language with ideas about auditory perception within cinema.

By using cognitive poetics and cognitive grammar to isolate functions of language, and by adopting a framework of musical grammar and cinematic audio to isolate

functions of sound, I developed techniques to cue coherent simulations across the two modalities. I applied cognitive poetics in order to analyse and understand specific aspects of textual design structures, and have synthesised this analysis with theories of auditory attention in cinema. This approach is documented in terms of both theory and practice. Consequently, this thesis demonstrates in detail how a range of design problems were formulated and addressed using cognitive poetics fused with sound design theory. As such, one original contribution to knowledge made by this research lies in the development of a novel conceptual framework for formulating creative enquiries, undertaking analytical readings and solving user-centred narrative design problems associated with sound-led text games.

9.3 Braiding Sound and Text to Create Non-Visual Immersion

The particular contribution to practice-based knowledge made by this research is my formulation of how language can situate a player-reader within a mentally simulated scene and how sound can be designed to allow for listening-led immersion to co-exist with reading. Consequently, this thesis documents a process of applying knowledge of the embodied nature of language in order to formulate a novel approach to sound design. In particular, this thesis documents in detail two main insights in the field of narrative sound design in text-led games. Firstly, in terms of immersion, by focussing on how language cues mental simulations of space and causes embodied responses within the player-reader, I developed a practice where I could design sound to augment mental images cued by text. This resulted in the formulation of a novel approach to the creation of multimodal mental simulations.

Secondly, by extending concepts of musical grammar and cinematic listening into the practice of interactive writing, I was able to design sound to reinforce a

subjective point of audition within mentally simulated scenes. This approach ensures that player-readers, even when experiencing their own response to sounds, maintain a connection with the emotional arc of a character. Consequently, I have demonstrated how acousmatic sound can be used to subjectively and emotionally connect player-readers with protagonists in language-led narrative contexts.

The way I braid sound and language to create multimodal mental models and to set a subjective position within a scene is the most important creative technique I developed. This aspect of my research is where my original contribution to multimodal text design practice primarily resides.

9.4 Knowledge Contained Within the Finished Prototypes

Seeking to incorporate difficult information within games featuring text and dynamically mixed, spatial sound put the research into somewhat unchartered territory. In addition to the lack of pre-existing conceptual frameworks that could be used in this research, it was very difficult to find examples of work that did *exactly* what I wanted to do. Instead, in order to conduct the research, I had to identify elements from established games or other forms of artistic expression that I thought could be brought together to achieve my creative goals.

In this sense, the knowledge I developed through this process is, ultimately, displayed within the prototypes. Consequently, the prototypes created through this research are intended to make a contribution to the genre of text-based narrative games by offering examples to others who may come after me. Now there are three more text games in the world that use spatial sound in a cinematic way. It is my claim that the original knowledge contained in the prototypes is design, writing and sound related and

that this knowledge can be communicated with or without the accompanying contextual thesis. The benefit of reading the thesis along with playing the prototypes is that researchers who come after me can apply and expand the conceptual framework within their own work. As I hope others find it useful in solving their own design problems, my intention is to publish highlights from this contextual work along with the prototypes at a future date.

9.5 Additional Possible Future Research Directions

I feel lucky that, very early in the process of researching climate change communication, I came across George Lakoff's work on the role of language within the crisis. For me, this thesis is ultimately a response to his call for people to understand how brains work in order to incrementally build new frames for thinking about climate change (Lakoff 2010). Studying the nature of mental simulations has led me to believe that all people struggle to understand and conceptualize phenomena outside of their experience. Researching sound from an environmental perspective has led me to believe that allocating attention to sensing and listening will reveal to us aspects of the natural world we cannot see or articulate.

The fact that cognitive poetics is based on neural theory of thought and language (Lakoff 2012) gives me hope that, within interactive narrative design, I can use my newly-developed understanding of the limits of language and the potential of sound to try to change the mental frameworks we use for thinking about the environment. If a game can be a device to create an experience (Sicart 2013), then I hope I have illustrated how sound-led text games can create experiences that let us think outside of our real-world existence and access information about the non-human world.

Sound has a unique ability to bring space and environmental phenomena into the psyche of listeners. It reveals what is under the surface. I believe that collaborations between sound designers, writers, acoustic ecologists and animal behaviourists can place unseen, difficult and complex information into narrative frameworks that can be understood by non-specialists. Consequently, I intend to continue exploring the potential of sound-led text games to allow people to experience what species extinction in their own world might look like.

I intend to work with mixed reality and sensor-driven, physical games that combine language with sound. I suspect that I will continue to struggle to balance the kinetic energy of play with the need to absorb people in a narrative experience and that the design approach developed in this thesis may need to be modified and extended to improve how I do this. As I want to further explore live performance and non-visual immersion, I will also need to develop research approaches that allow for the incorporation of physical interaction into my work.

The theme of all of my future narrative-driven research will, in one way or another, be species extinction. We need new frames that address what I believe is one the most difficult beliefs to shift: that science has solved the problem of our own vulnerability as a species within nature. Trying to shift this ideological frame is, I believe, the biggest challenge of the climate change crisis.

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