AFTRS WHITE PAPERS

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Precipice: An AFTRS Applied Innovation Research Project

Authors: Kerinne Jenkins, Stephen Murphy and Penelope Thomas (2018)

AFTRS Australian Film Television and Radio School

Cinematic Radio: An Industry-Partnered Applied Research Project on the Potential of Binaural Storytelling Methods for Podcasting and Broadcast

Executive Summary

When the Australian Film Television and Radio School (AFTRS) sent a delegate to Radiodays Europe 2015, the report was that 'podcasting is booming'. From the global phenomena of Fresh Air, This American Life, Stuff You Should Know, Serial, Cabin Pressure and Welcome to Night Vale to independents such as Australia's own SleepTalker, millions of listeners were tuning in to a new world of audio entertainment – readily accessible, anytime, anywhere. The Applied Industry Research Unit of AFTRS set out to try and contribute to the space. However, true innovation is a tall order: to simply reproduce this brightly burning genre and generate a suite of podcasts would not position the School as a point of reference for innovation. In early collaboration, the significant idea to explore the potential of binaural recording technology for the project created the opportunity needed. A research strategy was designed to achieve three core innovative aspects: 1) to create an immersive fictional podcast; 2) to write specifically for binaural; and 3) to avoid using narration to tell the story. The result is *Precipice*, a 20-minute immersive podcast created by a team drawn from AFTRS and industry, which attracted partnerships with BBC Audio Research Division, WNYC Public Radio New York, Sydney Philharmonia Choirs and Barrett Casting. *Precipice* is being received globally as a form of cinematic radio (Vivid Sydney 2017; Radiodays Europe 2018). *Precipice is being received globally as a form of cinematic radio (vivid etc), and the full Precipice trilogy is to be launched as in-flight entertainment (Virgin Airlines).*

KEY FINDINGS

1. Delivering high production value in cinematic radio requires a combination of adapted filmmaking and dimensional sound design practices. Continuing to build a new descriptive framework for binaural production will establish it as a medium with its own storytelling form and language.
2. Achieving immersive audio storytelling without the use of narration is possible through encoded signifiers in dialogue, music and atmosphere.
3. The *Precipice* project presents a new technology-mediated experience in the all-audio space: where binaural is to radio and podcasting what virtual reality (VR) and augmented reality (AR) are to screen.

Image 1: *Precipice* studio installation designed by Andre Shannon and Jack Atherton (AFTRS, Vivid Sydney 2017)

1. Project Overview

In 2016, the Applied Industry Research Unit at the Australian Film Television and Radio School (AFTRS) commenced work on the School's second creative innovation project (the first being VR Noir, a VR narrative showcased at Vivid Sydney 2016). The idea was to explore binaural recording technology and create the pilot episode of a non-narrated fictional podcast series by experimenting with binaural recording methods and audio-narrative sound-mixing techniques and composition. To do this, the Unit designed a research strategy for a team of collaborators from AFTRS and Industry to apply an iterative methodology and evaluate established filmmaking practices for dimensional audio storytelling.

1.1 Aims

The project aims were to:

1. Establish a fictional realm that best supports a dimensional audio narrative;
2. Research and test the boundaries of binaural recording methods and compositional sound mixing;
3. Create a 20-minute, highly textured, non-narrated, 3D drama composition for earbud-headphone podcasting;
4. Share project outcomes with the public, industry and education (Vivid Sydney 2017, see Image 1).

1.2 Rationale

The project justifications were for:

- AFTRS to gain knowledge and have the opportunity to develop creative, technical and production methods for the podcasting industry.
- AFTRS to potentially achieve industry ‘firsts’ and produce a body of research for future use.
- AFTRS to produce a pilot episode to attract distribution partnership (Virgin Airlines).
- AFTRS to provide an opportunity for inclusive and wide-reaching collaboration and partnership (internal and external).
- AFTRS to use the intellectual property, in perpetuity, as a teaching resource, for marketing purposes, presentation at conferences and/or publication as research.
- A variety of artists and practitioners to collaborate on the project.
- All research to be conducted in accordance with AFTRS best practice guidelines.

1. Research Strategy: An Iterative Methodology of Experimentation and Audience Testing

The research strategy for the *Precipice* project was designed to achieve three core innovative aspects: 1) to create an immersive drama podcast; 2) to write specifically for binaural; and 3) to avoid using narration to tell the story. To do this, an iterative methodology was applied to script and production by alternating practice with audience testing.

The method and findings will be presented in two phases:

Phase 1: Research and Experimentation: a technology review (see Image 2), creative labs, story development, field and studio experimentation, and audience testing;

Phase 2: Filmmaking for Cinematic Radio: testing and adapting filmmaking and scriptwriting practices for a dimensional audio production by drawing on a set of established story, script and technical research questions.

Image 2: Chris Milk's binaural audio recording instrument.

2.1 Phase 1: Research and Experimentation

The first phase of the project consisted of extensive research into the technology through visits and consultation with Princeton University, Columbia University and BBC's Audio Research Division. Parallel to the technical research, the first creative labs brought together a small group of collaborators from film, theatre, academia and industry. The approach to the labs was inductive, casting a wide net around what the best fictional realm might be and how practitioners might go about creating a dimensional audio experience. An early commitment by collaborators was to explore the idea of an unreliable protagonist through both real and imagined scenes. This transitioning between realities would become central to writing a script specifically for binaural and answering the question that would inform every decision: Why binaural?

The first-phase results were threefold:

1) The purchase of a 3Dio Free Space Pro II Binaural Microphone (see Image 5);
2) A formulated set of research questions for story, technology and production;
3) A series of experiments to answer some of these questions.

Each of these results will be presented in more detail in the following sections.

2.2 The Technology

Visits to sound labs and consultation with sound researchers and practitioners, including BBC, Princeton University and Columbia University (see Images 3 and 4), informed decisions on the technology purchased for the *Precipice* project and the set of technical research questions established for its research strategy. In basic terms, binaural recording technology is a ‘dummy head’ that has two microphones —one in each ear — replicating human spatial audio perception tocreate a unique three-dimensional naturalistic sound sensation for the listener. A 3Dio Free Space Pro II Binaural Microphone was purchased based on its portability and reviews supporting the microphone's excellence in capturing a wide dynamic range and dynamic binaural realism for both field and delicate recording needs.

Image 3: Phase 1: Research, Princeton University Sound Lab, USA.

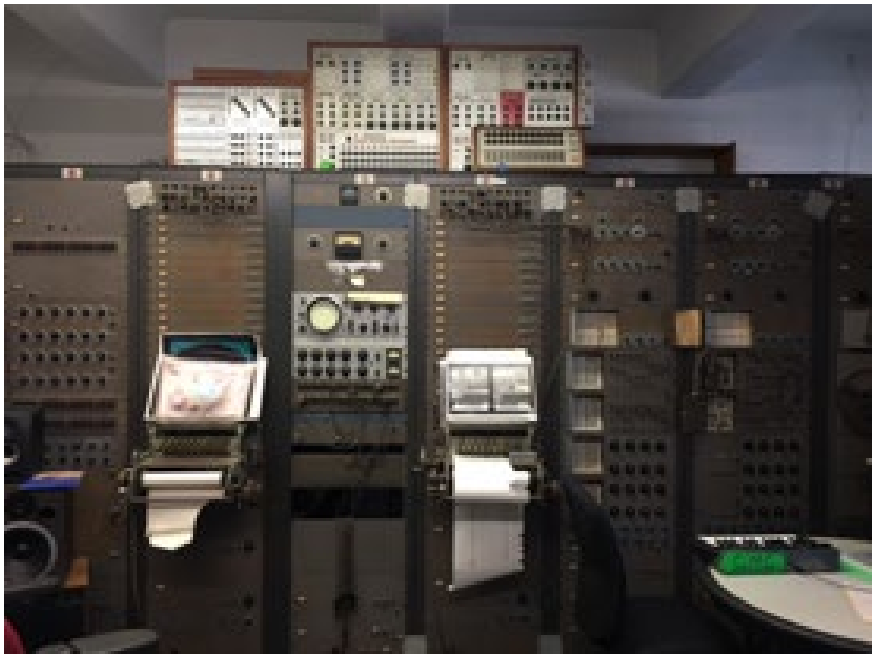

Image 4: RMC Mark II synthesizer. Prentis Hall, Columbia University, New York, USA 1958. The first modern synthesizer, voltage control, revolutionised the synthesis of music.

Four types of microphones:

- Mono = 1 x microphone
- Stereo = 2 x microphones (spaced, coincident)
- Binaural = 2 x microphones (dummy head)
- Ambisonic = decoded to mono, stereo or binaural in post-production.

Today's audiences are accustomed to forms of recorded sound that are generally known as 'stereo' and 'surround', which allow some localisation of sources with a 'sound stage'. Stereo sound results in a left-to-right 'staging' of sources, while surround sound provides some sense of sound occurring beside or behind the listener. In both cases, sound sources are perceived to be in a more or less horizontal plain, although new surround technologies such as Dolby Atmos (Dolby Atmos, n.d.) and Auro-3D (Auro-3D / Auro Technologies: Three-dimensional Sound, n.d.) add channels of height information that create a greater sense of three-dimensional space around the listener.

Surround sound is a multi-channel technology, typically reproduced over speakers, with capabilities and spatial accuracy varying between specific installations and proprietary formats. Stereo sound, as traditionally recorded and reproduced, is a two-channel ('left' and 'right') format that can be more easily auditioned using either speakers or headphones.

Stereo sound recordings can be produced in many ways, from the use of just two microphones through to the mixing of multiple sources that are 'panned' between left and right channels to

position them in the horizontal sound stage. Binaural recording is a specific case of a two-microphone recording that attempts to closely model the shape of the human head and ears, which together provide the most important sound localisation cues. That is, binaural recording uses microphones as though they were the ears of the listener, positioned in the space of the recorded sound. When listened to via headphones, this creates a kind of direct connection between the microphones and the listener's own hearing.

Image 5: The 3Dio Free Space Pro II Binaural Mi-crophone used for the Precipice project.

Thus the key difference between binaural recording and other forms of stereo recording is in the creation of a more accurate three-dimensional sound stage – including not just left and right, but in front and behind, above and below. Sounds can be perceived as though they move around the listener, situating them very specifically within a 'place'. Sound and Atmos are anchored to the architecture whereas binaural moves when the listener moves. This three-dimensional sound space can be used as a story space that the listener can move through as they experience the story.

3. Research Questions

A set of research questions were formulated for the project, based on three main areas of inquiry: Story, Technical and Script.

3.1 Research Questions: Story

The set of questions about story focused on what story world or universe might best exploit the medium, as follows:

1. What is the world?
2. Who is the listener in that world? Is it possible to combine subjective and objective points of view in binaural?
3. Do we need to provide for an immediate understanding? Of what?
4. Can we create a binaural fictional podcast without narration?
5. How can we introduce and get to know a character through sound?
6. How does the music come into the world? What role does it have in telling the story?
7. Can we indicate character through repetitive leitmotif, such as recurring music?
8. Are there key moments in the story timeline that need to be structured a certain way?
9. To what extent is it possible to tell a story without dialogue? Can environment tell a story?
10. How do we represent story elements sonically?
11. How do we record the scenes we want to create?
12. How do we describe the location and movement of sounds?
13. How do we lead the listener through the story? What can

they cope with?

14. What role does silence play?
15. How much can we leave to interpretation?
6. Can we get emotional responses? How scary can it get? What is tolerable?
17. What about tone: gritty, suspenseful and comical?
18. How far can we get inside the listener's head?
19. What settings and locations will work best?

Image 6: A *Precipice* creative lab at AFTRS (clockwise from top left: Julia Weber, Ben Ryan, David Bruggerman, Andre Shannon, Jack Atherton, Meredith Penman, Holly Lyons and Jordan Church).

3.2 Research Questions: Technology

Technical questions came from creative lab discussions about how well the technology might serve the story, and in what ways the story might need to be tailored to the technology, as follows:

1. In what ways does captured space impact drama and audience engagement? Method: Record test scenes in multiple environments and compare.
2. Can studio recordings be effectively combined with or used as an alternative to location recordings? Method: Record the same scenes/sounds in studio and exterior and compare/mix.
3. Is there a significant/material difference between ambisonic recordings encoded to binaural and native binaural recordings? Method: Record the same scene simultaneously with Soundfield and 3Dio Binaural Microphones and compare.
4. Is location or studio recording of 'complete'/staged scenes easier or better in the final result than artificially placing sounds in space (e.g. using Unity or other software)? Method: Create a scene using software-encoded spatial audio with the mono output of a Soundfield microphone as source.
5. How effectively can sounds recorded using different spatial techniques be combined for final binaural listening? Method: Combine (mix/add) various sounds recorded in different formats and converted to binaural to create a 'complete' scene. Audience test.
6. Does a location need to be established through sound as the initial part of a scene? In what ways? Method: Test multiple versions of scene openings with listeners and check response/comprehension.
7. What additions or changes need to be made to audio-visual script formats and production documentation to support audio-only production? Method: Trial various formats and supporting documents (e.g. mud maps) and test during pre-production/production. Start with e.g. 2-column A- V formats or radio-drama script formats.

3.3 Research Questions: Script

Several questions evolved to address the need to provide additional information about immersive sound production in the script:

1. Do current conventions of scriptwriting provide for the medium?
2. What does a conventional podcast script look like?
3. What should a binaural script look like? What components are required? Is it more like a score for a symphony or a film script, or a hybrid of the two? Can we use a set of symbols? How do you indicate pace or position/location of sound?
4. Can we create a script model for binaural storytelling? (see Figure 1)

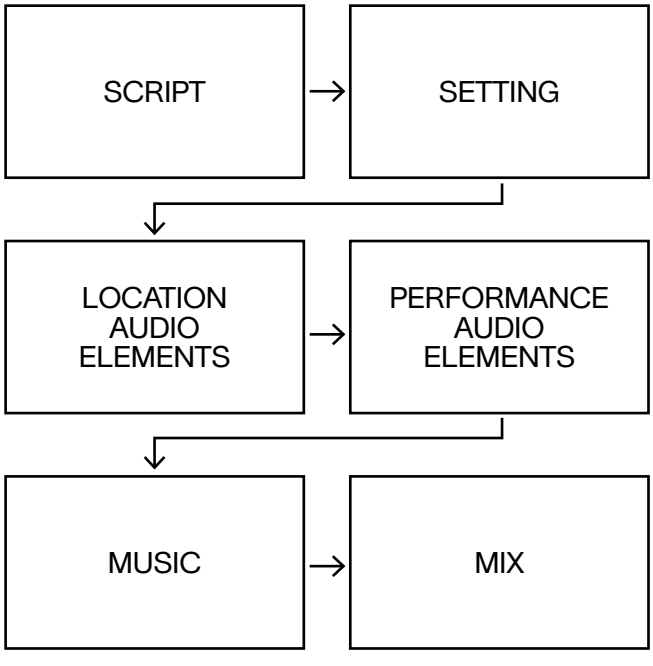

Figure 1: A suggested model for early testing of a binaural script format.

4. The Experiments

From the lab outcomes, field and studio experimentations were conducted to answer questions about the capabilities of the technology and what story might best exploit the medium:

1. The Old 505 Theatre: Record the story as a theatre production and capture the audio performance in dynamic ways. Collaborators gained permission from The Old 505 Theatre, Newtown, to record a performance of Hurt (see Image 7).

Image 7: Experiment 1: The Old 505 Theatre, Newtown (AFTRS student, Ben Ryan).

1. The Ritz Cinema: Record the internal space of a cinema known to be quiet with sudden influxes of sound either side of session times. Collaborators gained permission from The Ritz Cinema, Randwick, to record an afternoon session.
2. Central Station: Record an extremely busy space that might demonstrate transient noises associated with patterns in human behaviour. Collaborators recorded the sound scape of Sydney's Central Station at rush hour, as well as actor improvisations.
3. Leichhardt: Record actors performing improvisations in a variety of settings: house, street, city-bound bus (see Image 8). A house was selected for its location underneath the international flightpath, as well as its internal and external textures: timber floors, inner stairway and front and backyard spaces.

Image 8: Experiment 4: Leichhardt (AFTRS students, Elise Cociuban and Ben Ryan).

1. Aikido Dojo: Record unusual non-dialogue sounds that have the potential to build character and stimulate audiences. Collaborators gained permission for the project's sound supervisor to do a more advanced binaural recording at Aikido Sydney City (see Images 9, 10 and 11).

Images 9 & 10: Experiment 5: Aikido Sydney City, Chippendale (5th dan, Berin Mackenzie, and class).

Image 11: Experiment 5: Aikido Sydney City, Chippendale (sound supervisor, Stephen Murphy).

5. Phase 2: Filmmaking for Cinematic Radio — Discussion of Findings

This phase will be presented as a series of discussion points and areas of interest explaining how practitioners used an iterative methodology and audience testing: to 1) write specifically for binaural, rather than adapt an existing work or write a traditional radio drama; 2) test filmmaking practices for a dimensional audio production; 3) create the best possible entertainment experience for listeners.

Image 12: A radio drama presented as simulated news bulletins by Orson Welles caused panic.

"The ability to form mental images of objects and events not immediately available to the senses is the essence of human imagination."

Gary Ferrington (1994: 2)

5.1 Telling a Story Blind

One of the most significant sources of inspiration for the *Precipice* project is Notes on Blindness: Into Darkness (Archer's Mark, 2016). The VR and documentary film production takes audiences into the world of writer and theologian, John M. Hull, who documented his experience of losing his sight in a series of audio diaries. In one scene, the narrator describes the way falling rain gives shape to his environment, where the sound of the rain coming into contact with various surfaces provides depth and dimensionality. He ponders the idea of it raining indoors and the scene brings this imagining to life (see Image 13).

Image 13: Scene from *Notes on Blindness* (an Archer's Mark production) (notesonblindness.co.uk; accessed 12.05.17).

Thinking about sound this way inspired *Precipice* collaborators to consider how an audio-based story might provide more than a passive experience by allowing the listener to co-create the story world. In an immersive audio environment, how might each listener construct what they imagine the source or location of the sound(s) to be? Techniques might provide for an interpretation of the qualities of various surfaces, including shape, size and texture: the sound of wind moving through leaves on a tree might create an entire environment; footsteps across a room might create both a sense of movement and of the space around that; the sounds of keys jangling and a door opening might add detail to the visual space.

Based on this and other examples of audio-storytelling, the *Precipice* project identified a number of questions and challenges that might need to be considered in the creation of a sound-only story. These were primarily around the details of the production process, the impact on performance and, to begin with,
the development of a suitable story as the basis of the experiment, as follows:

Production Issues

- Ambisonic/binaural recordings of spaces can capture all of an environment, even sounds that do not serve a dramatic/narrative/emotional purpose.
- Recordings may capture a space, but it may not be the exact space (room) desired.
- Each environment is captured in detail and, as such, studios sound like studios.
- Choice of locations and staging of action may become more important.

Post-Production Issues

- To combine multiple recordings/sources, they should be in the same format.
- Ambisonic recordings will need to be decoded to binaural to mix with binaural recordings.
- Detailed (binaural) sound stage can increase separation in a useful way: more sound sources, but each identifiable.

5.2 Painting the Audio Picture

Sound designer and film editor Walter Murch has written about the tension encountered between the simple and the complex when creating a sound mix that supports both (constructed) reality and dramatic narrative. In ‘Dense Clarity – Clear Density’, Murch (2005) uses the colour of light as a metaphor for unpacking a spectrum, or range, of sound. This is not a literal spectrum composed of frequencies, but a metaphor describing how components mix together. In the case of light, there are individual colours in the spectrum, but when mixed these colours can be observed as a single source of white light. In Murch’s (2005) model for sound, especially for film sound, the spectrum is a range of elemental types: dialogue, music and effects, and other less easily categorised noises. Mixed together, they are heard largely as a single entity, communicating and affecting the listener as a painting might be observed. Murch (2005) describes the spectrum as ranging from ‘encoded sound’ (speech) at one end to ‘embodied sound’ (music) at the other. These two concepts will be explained further by example throughout project findings.

5.3 No Narration

Many audio dramas use either a narrator or the internal monologue of a character to describe actions or scenes, or to provide additional context for the dialogue in the narrative setting. This project was identified as an opportunity to innovate within the form, addressing the key question of how to generate meaning through sound without relying on narration.

Following the choice to write *Precipice* using the rule of 'no narrator', the project team needed to find an alternative to spoken language. Sound, encoded, could potentially operate as a language with its own rules, to create context for the listener. Language works when both the sender and receiver understand the same code. In order for the project team to learn how sounds might be perceived by any listener as a code, recording and listening tests were conducted at the earliest stages of development, before the script (and even the story) was conceived.

5.4 Location

Binaural recordings allow the listener to imagine and construct a coherent three-dimensional space and a sense of place. The task for the project was to identify suitable environments for recording scenes to capture not only the dialogue, but also spatial characteristics that would enable the listener to locate the scene. In addition, beyond the spatial, how much and what kind of story information could be gleaned from encoded sound to create context?

One test recording in particular illustrated the story problems that can arise when spoken language is at odds with information gained through other sounds present in the recording. In the Leichardt experiment, an actor was recorded on location in an urban house, having a telephone conversation with her mother. In the conversation, the time of day was clearly referred to as morning; however, the scene was recorded early afternoon. In film production, scenes are often shot without regard to the exact time of day in the script's chronology. Film dialogue, too, is typically recorded in an isolated way so that background sounds can be replaced in post-production (and with the accompanying image already establishing the scene, the sound of the space does not need to be captured as for an audio-only work). However, in this case the background sounds of birds and even the passing traffic, captured to establish the scene, were identified by a test audience as inauthentic for the implied time of day. Conducted early on in the project, this test established a point of reference in the project for the power of sound as language or code. It became clear that the production of *Precipice* would require a recording schedule based on a high level of sonic verisimilitude in time as well as place because the sound environments were being captured alongside character dialogue.

5.5 Code-Switching

Apart from location, another type of context that can more easily be gleaned from an image than from sound alone relates to the placement of the character within the story space/dramatic action. For example, are they at home alone, among friends, or in a formal dialogue with another person? Is there a way we can detect from the first line(s) of a speech the situation of the character so that the listening audience can quickly locate the scene in their imagination? The project team decided to explore this through the notion of 'code-switching', a term in linguistics used to describe the way bilingual or multilingual speakers tend to interchange between a language, register, variety and/or style depending on their communicative situation and purpose (Romaine, 1992:110).

With *Precipice*, code-switching in dialogue provided the possibility of turning the sound of spoken language into a source of encoded audio information. The way a character is speaking can indicate who they are speaking with and what the relationship between them is. The type of register used would not only immediately establish character but also the character's situation and/or relationship with another character. From the early stages of the writing process, the *Precipice* team began to examine how and to what extent characters could be introduced to the listener, using techniques reliant on a listener's ability to construct context from encoded sound. This led to a search for systematic ways or sonic devices that could be used to establish complete scenes or the character relationships within them.

5.6 Sound Effects

Other forms of production (film, conventional radio drama) may be able to leave some of the detail for designing and setting a scene to later stages of production or post-production. However, with *Precipice*, these questions clearly needed to be carefully addressed at script stage. Could a line of dialogue be used in the same way as an establishing shot to quickly set up the context of a scene — location, characters present, etc. — or might this be achieved more effectively with sound effects? How much would the use of sound effects depend on quick recognition of the context by any individual listener?

The possibilities and limitations are illustrated by the previously described test in which listeners identified an intended morning scene as having been recorded in the early afternoon. In this instance, the recognition of the time of day was likely influenced by their prior knowledge/experience of birds and traffic specific to an urban Sydney context. That prior experience meant that for these listeners the background sounds were already encoded. However, the code allowing this particular setting of context may not be available to other listeners, raising questions of what sounds can be relied on to guide the listener's internal construction of a multi-layered and multi-dimensional story world.

Sound effects, then, may or may not accurately establish the context of a scene, and in any case would need to work alongside elements such as dialogue. Background and foreground sounds work together to create the spatial layers of the story world, and may provide other narrative cues. Yet, clearly, dialogue would need to serve multiple purposes as with other forms of fiction: not only dramatic/narrative purposes, but setting a scene and presenting details about characters and their relationships. There is also the opportunity within spatial audio to use more than the usual three or four sound elements and direct the listener's attention to specific sounds.

5.7 The Story

Precipice is a three-part trilogy that interrogates the relationship between grief and love.

Episode one begins in the present in Sydney, Australia. We meet an international physics student, Amira, in a session with her therapist, Dr Ferenc. Turkish-born Amira talks about the last memory she has of her family after they had immigrated to France. The conversation upsets her: she does not want to talk about the dead anymore. As the episode continues, Amira will start to question if Dr Ferenc's treatment can be trusted and if the people around her are who she believes them to be. Transitioning in time to early 90s France, Amira's memories are given an

unanticipated perspective and Dr Ferenc's past brings her own actions into question.

Precipice is an emotionally charged thriller that attempts to disrupt perception by transitioning through the temporal and spatial texturing achievable with dimensional audio storytelling. The *Precipice* experience is created to question any logical understanding of reality, time and memory.

5.8 Establishing Character

Finding a way to introduce a new character was a challenge that demonstrated the complexity of the multiple elements at work. The listener may note a new character's voice; however, this new sound alone does not provide information about the relationship to established characters or the importance of the new character within the story. Setting the scene through background sounds may provide some context, yet it is through dialogue that the audience can gather facts that are often more important for the story. As a simple example, listeners might recognise the sounds of a cafe and build a relevant internal image; however, dialogue would help to define whether a character was a server or a customer and then further develop the listener's understanding of any pre-existing relationships. The addition of code-switching allows for deeper context, such as inter-character familiarity and comfort within the time or place.

The *Precipice* creative team determined that when introducing any new character it was most important to establish very quickly in the opening interaction both the identity and the relationship between the parties heard. For example, when introducing the character, Sen, friend of Amira (protagonist), it was important for the audience to immediately understand that: they were close; they had expectations of each other from the length of time that they had known each other; and Sen is someone who is likely to know the 'real' Amira. The combination of the sonic world (their shared house), code-switching (informal style) and dialogue (content discussed) was used to provide as much information as possible for the listener.

Image 14: A binaural scene capture, Leichhardt (*Precipice* actors Emilie Coquerel and Kimie Tsukakoshi).

5.9 Positioning the Listener

The use of certain phrases as signifiers was also explored, allowing a more specific type of 'encoded sound' to provide shortcuts for sonically establishing a scene. The setup of the therapist–patient relationship used this, for example, via the phrase 'and you're back now', suggesting that a hypnosis session is taking place. As the opening line of the scene, it provides the clue that the scene/session is already in progress, and that this one specific voice is to be identified as the therapist. The audience can then guess that the other voice is that of the patient. Narrative progression is provided through the next line, 'Where were you right now?' Accents (both characters) and other elements of code-switching provide further context, including the possibility that the characters are displaced geographically. The conversation continues and uses the dramatic elements of emotional reactions and conflict to provide further exposition and story development.

Through these multiple uses of sound, and in particular the sound of dialogue, it seemed possible to create a vivid story space that would provide a rich sense of narrative progression. Environments, characters and relationships could be established efficiently. Dialogue could operate much as it does in other media, but it could also do many of the things for which other media requires a well-understood visual language: build a story world for the listener; construct meaning over time through both continuity and juxtaposition; and create an aural aesthetic. The question then was if dialogue would be the only narrative tool required.

5.10 Music as Embodied Sound

Another decision faced by the project team during the early development of the story and script pertained to the role music could play in supporting and enhancing the story. In conventional cinematic and audio drama, music is typically used in one of two ways: diegetic or non-diegetic. The concept of 'diegesis' derives from Ancient Greek dramatic traditions, and refers primarily to the concept of the story world —the world inhabited by the characters present in the drama. Diegetic elements come from that world, while non-diegetic elements would typically be provided by a (possibly disembodied) narrator who tells the story. Most composed music used in films is, like narration, non-diegetic: there is no orchestra present within the scene playing the music. The music performs a function related to the telling of the story; perhaps to add tension, emotion or pace to a scene. Diegetic music is less common, with typical examples being music coming from a radio physically present in the scene. A general rule of thumb is that if the characters within the scene/story world can hear the music, it is diegetic.

The driving exploration of the *Precipice* project was how to generate meaning through sound: how to tell the story without telling the story. The rule to have no narrator raised further interesting questions, such as whether non-diegetic music could be used. If the listener is to be truly immersed in the three-dimensional story space, then music should not take the listener out of that space —it should be part of the same world. In addition,

it should serve to enhance the listener's experience of that world. At some level, the music must be embodied for both the character and the audience.

As with sound effects and dialogue, possible approaches to the use of music were suggested by an early test recording. In that test, the recording team followed behind a couple as they walked into a shopping centre where music was playing. Listening to this test created a clear sense of movement through and from one space to another, contributing to a highly immersive experience. Test audience feedback highlighted that this was largely due to the binaural component of the recording, which produced a unique and enveloping three-dimensional experience unlike that provided by a conventional stereo recording. Not only was the music present within the space (diegetic), it also contributed to the listeners' (embodied) experience of that space.

5.11 Writing for Binaural

The role of music in *Precipice* had to be dealt with at script stage, not left for post-production. In the early stages of writing *Precipice*, this immersive musical device was put into the story in a very loose fashion, and to some degree mimicking the test recording. A scene was drafted with the characters attending a concert, moving through an entry hall and then into the performance space. It was, in essence, a direct translation of the experience of physical movement that can be created through binaural technology. However, what was not clear was the creative choice: why did this scene even exist, beyond demonstrating the technology? Although the *Precipice* project overall was in some sense a technological demonstration, it was always the case that technology must serve the story at all times. Story elements were always expected to answer the question 'Why binaural?', but the chosen approach to this was to never allow the technology to be a kind of trick for its own sake, outside of the narrative experience. Thus music, if it was to exist within the story space, should be more than just another sound within the world, more than a diegetic device. Somehow it has to operate at the level of non-diegetic music. From this, the

decision was made that music should somehow be linked to the emotional state of the main character.

The spectrum of sound described by Murch (2005), from encoded to embodied, provides an insight into how this could be made to work:

Music ... is completely different [from encoded sound]: it is sound experienced directly, without any code intervening between you and it. Naked. Whatever meaning there is in a piece of music is 'embodied' in the sound itself.

This suggests that music could potentially be located within the story world and, through embodied meaning, allow the audience to experience the music as an emotional element.

Image 15: On set at AFTRS (education leaders, Martin Brown and Lisa Sweeney).

5.12 Immortal Bach

This idea shaped the use of music within *Precipice*, given that the story constantly interrogated the stability of the main character's emotional well-being. It was also decided that choral music might provide the same depth and dimensionality described by Hull in Notes on Blindness. After searching for the right music for *Precipice*, the project acquired rights from Norsk Musikforlag, Norway, for Immortal Bach composed by Sebastian Bach, arrangement by Knut Nystedt. In partnership with Sydney Philharmonia Choirs, the VOX choir was recorded at AFTRS using a variety of field- and studio-recording methods (see Images 16 and 17). This will be discussed in a later section.

Image 16: Sheet music for Immortal Bach composed by Sebastian Bach, arrangement by Knut Nystedt, copyright Norsk Musikforlag, Norway.

Music was written into the script as an element reliant on embodied meaning that also added an emotional texture. Playing with both when and why the audience would hear the music could provoke questions about reality, at the same time providing an emotive hook intended to directly create meaning for the audience, even though there was no language or code in use.

Image 17: Recording Nystedt's Immortal Bach for the *Precipice* project, AFTRS Studio (choristers from Sydney Philharmonia Choirs VOX and sound specialist, Geir Gunnarsson).

5.13 Point of View

Virtualisation has been defined as 'the process by which a human viewer interprets a patterned sensory impression to be an extended object in an environment other than that in which it physically exists' (Ellis, 1991:324).

In a binaural story space, sound combined with movement creates our ideas of objects within the environment. As a listener, there is a triangulation process as our ears adapt to understanding where we are in relation to sounds that are all around us. These sounds include 'atmos', as well as sounds that are site specific and have a distinct distance from us, such as another person's voice, a door knock, or footsteps.

In understanding this sense of sound and movement, the choices within storytelling are extended, as the ability to transition the point of view of audiences through sound becomes possible. The ability

to switch between first and third person is a defining aspect of binaural recording, which the *Precipice* team experimented with in the process of building an audio story without a narrator.

The key element was in understanding that with every added layer of movement there is a corresponding story choice that is created in relation to it. When we place the binaural microphone within a scene and allow the cast to move around it, or when we move the microphone around the cast, we put ourselves as the listener within the scene, and much like VR, the experience can at times feel challenging and voyeuristic.

5.14 Spatial Relationship between Sound and Audience

In trying to translate a filmmaking process to a recording process with a binaural microphone, the similarities between a camera and the binaural microphone became apparent. When recording audio narratives for a traditional stereo output, the position of the actor to the microphone would usually be chosen for recording the cleanest 'on axis' sound. The voice actors are tasked with manipulating their performance and the sound designers with adding in any dimension or depth in post-production.

When creating a visual project, a common practice is for the scene to play from a number of camera angles, utilising wide shots, close-ups and movement to add depth. However, what is not changing from shot to shot is the spatial relationship between the sound and the audience. In fact, even when watching a wide shot of a conversation happening far away in the distance, the audio of the dialogue that will be used is the close-up sound. The continuity of the sound is what ensures that the audience's feeling of placement in relation to the scene is not compromised.

When recording with the binaural microphone, the sensitivity of the microphones within a dummy head enabled the actors to treat the microphone like a camera, moving in relation to it – for example, coming in close for close-ups when the moment needed to be an intimate conversation or pulling away to create the sensation of real

movement away from the events unfolding.

For the *Precipice* team, retaining a first-person point of view was raised as an early idea. However, this meant that part of the unique quality of the technology would be lost and the technique would risk losing a layer of movement. Another suggestion was to only use the binaural microphones to record more impressionistic scenes such as 'dream' or 'memory manipulation' scenes. Again, this felt like it would not do justice to the technology, and could risk the use of the technology as gimmicky in relation to the story. In taking on all the complexities of a binaural project, the decision was made to go into the recording with an approach to capture options and to test moving a microphone in the same way that you would a camera.

One of the clearest examples of the effects this created was in a transitional scene, where Amira speaks to her mother over the phone in French. This was recorded on a street location creating a rich layer of movement through site-specific sound elements such as traffic and passers-by. This was created to give a textural pause in the story — to let the audience breathe for a moment. In the polishing stages of the sound design, another layer of movement was added to this scene. The listener can hear the sound of a traffic crossing beeping to gain the understanding that Amira is waiting to cross the road. However, when the lights change and Amira crosses, she moves away from the listener, who remains at the lights, listening to the sound of the crosswalk and the disappearing footsteps. The image conjured is of Amira walking away. An emotional context is evoked through this movement: in filmic terms, she seems to drift away in shot.

Image 18: Applying filmmaking practices for cinematic radio (writer and director, Kerinne Jenkins with actor Victoria Haralabidou).

5.15 Performance and Vulnerability

In the rehearsal stages of the project, a number of techniques were tried to test how to direct specifically for an audio piece and to understand the capabilities of the binaural microphone. The first approach was to follow a more traditional rehearsal with the microphone as silent observer in the room. The action happened around it, yet there was not a context for the microphone and actors to impact each other.

The practice of blocking became essential, as the movement of the actors in relation to the microphone was creating the impression of three-dimensional space. However, it was soon clear that when following this approach the body language and performance between the actors was interfering with what the audio needed to communicate.

Two non-traditional approaches were then tested to explore what level of texture and vulnerability could be channelled through voice alone: Eyes Shut/Ears Open and Spliced Delivery.

5.16 Eyes Shut/Ears Open and Spliced Delivery

With the blocking in place and an idea of timing, the cast were asked to perform the scene standing still to the microphone with their eyes shut/ears open. They were able to move to a degree; however, they had to imagine what their counterpart was doing and feel the space between them. The performance immediately became more intimate and intense. The actors not only had to listen intently to each other for timing, they had to imagine their own movement in relation to how this would affect their voice and breathing. As a rehearsal technique for informing performance, it was a success, but the creation of three-dimensional movement around the microphone was lost. The ability to 'visualise' the space was hindered.

Another approach that was tested came about in response to the technology. In recording dialogue scenes on camera, actors are generally asked to not allow their lines to overlap so that any overlapping can be achieved in the edit; this maintains control over the sound clarity and ability to cut between takes. In considering what might interfere with the ability to cut between takes when recording binaurally, testing was conducted by rehearsing the scene with spliced delivery (i.e. only one actor speaking at a time). To maintain the movement and the spatial visualisation, the actors still performed to each other and were able to react to body language, but one was emoting while the other was able to speak their lines. As with the Eyes Shut/Ears Open technique, having one actor focus on what the other actor is emoting while having to remember both sets of lines gave a certain focus and intensity to the performance.

The Spliced Delivery approach successfully ensured that the creation of the sound space remained intact. Moreover, the Eyes Shut/Ears Open technique was the only way the director could monitor the scene, as this method was the only way to listen to the three-dimensional audio and understand what kind of spatial awareness was being created.

5.17 Microphone as Lens

The project collaborators went into the record days with a plan to continue experimenting with the equipment. All the scenes would be captured on location; however, some of the exterior scenes would also be recorded in a studio environment. Following the findings from the rehearsal stage, the more traditional audio-recording methods such as sound booth recordings would not accommodate the sense of space and movement needed around the microphone. However, in approaching the scenes during the recording, there was no clear answer as to where the microphone should sit within each scene. When focused on Amira's (protagonist) point of view, it was often at the detriment of movement.

The microphone position was tested in a number of locations to discover what position would 'crack' the scene, to identify the best position for creating the soundscape, while still working with the story. The results were excellent. With the therapy scene, it was clear that Amira's emotional state was far more heightened and understandable when she was the one moving away from Dr Ferenc. In the bedroom scene to the living room scene between Amira and Sen, it was clear that the microphone had to sit between the two rooms to help create the intimate space and for the door knock to cause surprise. In addition, the movement of the characters down the stairs was brought to life by them moving from a microphone upstairs to one downstairs.

Image 19: Applying filmmaking practices for cinematic radio (writer and director, Kerinne Jenkins).

5.18 What's for Real?

The park scene provided the opportunity to test thoroughly the idea of recording on location versus recording in a studio. The challenge with this scene between Amira and RP was to create the sensation that the couple was moving through a large expanse, yet at the same time provide a reason for the listener to question reality. The location needed to feel real, but RP's character and his existence needed to be more impressionistic.

The real recordings of the park for atmosphere were found to be so detailed and lifelike that they could not be recreated as well in post-production. However, with no control over these specifics, they were often distracting within the story.

Another important finding was made in dealing with so many sound elements. Without control over layering these sounds underneath the characters' movements, it became impossible to discern how far away anything was. Some sounds seemed louder than others but did not tell you where they were within the space.

Two methods were successful in dealing with these issues. While recording these scenes, a number of 'atmosphere' tracks were captured to gain more control over the environment in relation to the main action. In addition, specific placement of RP's voice created the impression of his character that the story required.

5.19 Spatial Awareness

Collaborators knew from first-phase creative lab work that the sound of rain on objects could create audio-visual cues; that wind through trees could do the same; and that footsteps were an easy way to navigate a character around a space. However, practitioners wanted to test the idea of on-location recording further.

One of the aims was to open the episode with a scene that would demonstrate the uniqueness of the binaural experience through a captivating soundscape. Practitioners experimented at the international airport train station. The first records were unsuccessful, as there was so much sound that it was difficult to discern enough specifics. The next attempt was to try moving through the space by recording a person walking up and down the escalators, getting on and off a train, and standing on the platform.

This was successful. The station announcements provided an excellent audio cue to place the story in Australia. In addition, where at first the movement did not seem to create a real sense of presence within the space, on one of the ‘walks’ up and down the escalators, practitioners started to hear their own boots on the floor tiles and obtained a sense of listening as the character in first person. Then movement past a couple talking about their trip demonstrated that although their conversation drifted past, the experience provided a clear sense of presence by moving through a real environment in relation to someone else.

The key finding here was that it is the things moving past that are important to capture. The sound of heels on tiles created a sense of movement, but coming close enough to specific individual moments would really help to locate the listener and create presence within a three-dimensional space. For sound to create an immersive dimensional space, it is critical to establish ‘your environment’, 'who you are', 'your point of view’ and 'what you are doing' in relation to another sound that has a logistical quality.

Image 20: AFTRS binaural microphone (*Precipice* project lead, producer and music producer, Penelope Thomas).

5.20 Focal Points

When recording busy environments binaurally, there was often the feeling that the sound was not curated enough, that it was almost too real and felt messy or flat. Practitioners applied filmmaking practices and found that using focal points worked to direct the experience within a dimensional audio. The sound mix would also need to consider how the depth of field might be used to create focal points.

This finding was a success for the project. While at first it was thought that the experimental binaural tracks were unusable, their true potential was unlocked by using them in relation to other layers. Pin-pointing control over the focal points indicated which elements needed to be recorded and which method needed to be applied. For example, dialogue scenes needed to be recorded binaurally in spaces where practitioners could control the level of interference from the environment. The train station capture required a high level of control over the point of view/person's behaviour, as there was no control over the environment.

5.21 Faking the Moment

Some *Precipice* scenes were more difficult than others owing to a lack of control over the environment. Practitioners test-recorded these scenes in alternate environments. Amira's first meeting with RP is an example of this challenge due to the shift that occurs when the characters move from a rainy street scene into the foyer of an apartment building. To create this feeling, the scene required the transition to contain an echo.

Rather than manipulate the voice quality and add an atmosphere layer, the scene was recorded with the cast walking from a street to beneath a concrete overhang. Using this method, layers of a real environment were obtained as well as an authentic shift between spaces. Another successful finding with this scene is the use of props to understand the physical proximity between characters and to create intimacy. Keys, an umbrella opening and closing, and footsteps are all important in visualising how Amira and RP move within the space and in relation to each other (see Image 21).

Image 21: *Precipice* in studio (actors Emilie Cocquerel and Uli Latukefu).

5.22 Story v. Sound or Plot v. Intimacy

A common question throughout the writing and recording of *Precipice* was how to create scenes where the audience could spend time with the characters and just listen to the soundscape rather than any 'story'. During a location record at the Leichhardt house, an improvised scene with the two flatmates provided an opportunity for practitioners to experiment. When Amira and Sen are preparing food, the myriad of associated sounds are not only stimulating but dictate an understanding of the space.

However, the challenge was to add a layer of dialogue to this capture. The first test had Sen telling Amira a story about something that had happened to a friend of hers. Yet by having to engage with an idea and follow characters and moments, there was suddenly too much information. The next test was to have the cast talk about what they were doing and keep the conversation very much around the food or anything relating to the scene at hand. This was successful. Once the conversation became trivial and arbitrary, it created a different kind of experience for the listener.

The finding here is that within an audio-only story, audiences need to just listen and switch off the part of reception that collects 'story' information. In this scene, the dialogue is working much more within the space of embodied sound rather than encoded sound and significantly contributes to a sense of characterisation and mood rather than plot.

5.23 Music as Character

When the decision was made to make the music an active character within the *Precipice* story, practitioners needed to explore how it would be recorded binaurally. A few methods were put to the test.

The first method was to capture the sound from a first-person perspective. To achieve this, the choir was recorded in a park environment and the sound recordist assumed the part of Amira (see Image 22). The concept that footsteps and breathing would help to strengthen Amira's point of view and maintain the spatial accuracy proved to be the case.

Image 22: Director, Kerinne Jenkins experiments with the binaural microphone (Sydney Philharmonia Choirs, VOX). (Image courtesy of P. Thomas)

The next aim was to heighten the experience of walking through the choir while providing clues that the reality of the experience should be questioned. The method was to have the choir perform in a specific formation to allow the sound recordist to walk among the choristers. This meant that the record would pick up individual singers, and the reality of the character's point of view was maintained.

As a contrast to this sense of realism, the choir was also recorded within a studio space with the binaural microphone. The method

tested was to have members of the choir move individually towards the microphone and to sing as though they were performing to a person, moving around and close to the ears of the dummy head. This proved successful, as it created a sense that the performance of the choir was more dreamlike. Testing showed that combining a first-person perspective with this type of movement and interaction can effectively break from the character existing within a real environment into a surreal one.

Both methods were successful in creating a very intimate and unique rendition of the piece. The movement of the choir towards and close to the microphone required thoughtful choreography, but it worked to create a more textured and dreamlike sensation. Conversely, moving the microphone around the singers made the experience seem hyper-real, as the movement was much more 'human'. With both recordings, there was a difference not only in the embodied texture of the music, yet also in the characterisation and compositional placement within the story.

These findings not only helped practitioners to create a number of different treatments to the music, but allowed the embodied sound to have a secondary layer of effect. Selecting the realistic handheld movement or organising the choir to move around the ears directly influences the audience's understanding of reality within the audio space.

5.24 Layering

When working with a technology that can be manipulated and created in post-production, there is always a question of how much needs to be recorded in a live setting: Is there a benefit in using the binaural microphone on location rather than recreating the effect in post-production?

During post-production stage, the approach to *Precipice* remained iterative. Practitioners identified the scope of what could be created in post and what would require further location and studio recordings. Busy environments that would create dense atmosphere such as the park environment was one. Characters moving through a space in relation to other people was another. Two scenes that demonstrate a very neat combination of the two processes are: 1) when Amira is waiting at the traffic lights; and 2) when Dr Ferenc returns home.

Practitioners had captured a location recording of Amira speaking on the phone while walking on a street in Sydney's Inner West. The capture includes the road sounds as well as a father and son passing by. The moment was intended to be an interstitial: to have Amira speaking in French without needing to know what she's saying. However, the moment was not tapping into a concrete feeling state. In post-production, sound designers were able to build another layer of imagery to the scene while keeping the phone conversation and environment intact. They placed the phone call on the move as Amira reaches a pedestrian crossing. Then as the light changes and she crosses the road, the listener stays with the familiar beeping of the crossing indicator and hears Amira disappear into the distance.

Testing shows that this sound technique provided a visual of Amira moving away. This notion is cinematic, where even when the story is with a character, the feeling state of seeing them leave is greater than constantly being in the moment with them. By keeping the audience with the sound of the crossing, they know exactly where they are in the environment and where Amira is through the diminishing sound of leaving footsteps and phone call.

5.25 Lingering

Throughout the project, traditional scriptwriting practices were tested and adapted for an all-audio immersive drama. One example is the final scene, which had been written as a moment that lingered on Amira after she received the phone call from Dr Ferenc. If it were a film production, the visual would linger on the actor's face. However, with audio only, testing demonstrated that the actor's final words became critical for the final moment to have the same impact as seeing a person lost in thought.

Using the iterative approach, a new ending was written to achieve a powerful close. Testing also indicated that listeners were quite naturally wanting to spend more time with Dr Ferenc at this point. While the episode revolves around Amira's state of mind, it is Dr Ferenc who is active, whose intentions are unclear and who could leave audiences wanting more. Dr Ferenc's final sentence, 'Do you think I'm doing the right thing?' not only connects listeners with her internal struggle, but also leaves them with new questions. Who is she? Who is she talking to?

This scene also reminded practitioners that in working with a thriller genre and playing with reality, not being able to see all the answers is challenging but provides a rich space for creating mystery and intrigue.

6. Conclusion

In writing and recording *Precipice* specifically for the binaural microphone, the project found that there are key methods to attaining high production value. In the three-dimensional space, there is a vast amount of information that sound can infer. With carefully composed layers of sound and movement, and a clear understanding of how to translate perspective and proximity, binaural productions can enable audiences to visualise a total environment and imagine themselves within that environment. Applying an iterative methodology to script and production proved rewarding. Audience testing provided critical insights into writing for the medium and producing encoded sound and embodied texture in dialogue, music and soundscape. Understanding the story requires establishing ‘your environment’, 'who you are', 'your point of view’ and 'what you are doing' in relation to another sound that has a logistical quality.

In creating *Precipice*, it became clear that the techniques used to make a film, or to record a traditional radio play or podcast, were insufficient. Rather, it was a process of testing and combining approaches to make the most of the technology and create a heightened experience for listeners. Filmmakers set out to identify terms and language suitable for the production and analysis of the work, questioning their usual ways of talking about storytelling. What might the term 'cinematic' mean when working in a sound-only story environment? Continuing to build a new descriptive framework for binaural production will establish it as a medium with its own storytelling form and language.

If done well, the incredibly naturalistic dimensionality that binaural offers has the potential to provide a whole new world of entertainment for audiences. The *Precipice* project presents a new technology-mediated experience in the all audio space: a form of cinematic radio, where binaural is to radio what the augmented and virtual realities are to screen. Precipice is being received globally as form of cinematic radio (Vivid Sydney, etc.) and the full *Precipice* trilogy is to be launched as in-flight entertainment (Virgin Airlines).

Image 23: Vivid Sydney 2017 *Precipice* Research Station (AFTRS stu-dent volunteer host crew).

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