Falling Forward

applications of procedural sound design techniques in sound for the theatre

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Abstract

This is an exploration of the ways and means that environments are described on stage: how both realistic and abstract places are created for actors to perform in, and how their actions on the stage affect audience responses. By examining the history of theatrical performance modes, the technologies currently in place, and the applications of those technologies, trends in design for the theatre can be determined, and areas for future development can be assessed. In particular, the future applications of procedural sound design techniques are explored through the development of a prototypical system that allows for actors to generate footstep sound effects based entirely on their natural movements: including a mechanism to identify footfalls in real time, a patch in Max/MSP to generate various floor textures, and means for tying the two together so that the physicality of the actor and the resulting sound may be connected, and therefore serve as a better method for designing sound that creates an environment that optimises the expression of the human body.

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Description of Work Submitted

A printed and bound copy of the written thesis

A DVD Including:

- A PDF of the thesis text
- Max/MSP patches referenced in the text
- Audio recordings of the produced sounds
- Video of the system in performance
- Photographs documenting the insert construction process

1: Introduction

All phenomena are real in some sense, unreal in some sense, meaningless in some sense, real and meaningless in some sense, unreal and meaningless in some sense, and real and unreal and meaningless in some sense.
-Robert Wilson

The means of developing a theatrical sound design that adequately brings the world of the play into the minds of the audience requires pulling from many disparate resources. In addition to skills and techniques to fool the audience into believing the falsehood of drama, the dramaturgical modes of Realism, Naturalism, Epic Theatre, and Non-Narrative Drama can be used to examine the role that sound design plays in the creation of performance situations that optimise the higher order communicative aspects of theatre. By creating worlds on stage that emulate the real world, understanding of our own experiences is made possible, and with that comes the ability to exhibit and consequently assess our personal relationships with the world. These created worlds are not always feasible, possible, or even conceivable, but treating the given circumstances of the drama with the utmost attention to detail permits these impossible scenarios to affect the spectators.

The technology utilised at this point in the constantly evolving theatrical landscape can be developed further, allowing the internalised and subtle variations expressed by performers to be better understood and appreciated by the audience: bringing the stage ever closer to the patrons of a performance. Computers, particularly with programming environments like Max/MSP, can be utilised to ensure greater cohesion on the stage, and with greater coherence comes a deeper and more profound understanding of the performance. Using the work of George Bernard Shaw as an exemplar of the balance struck between a realistic and a fantastic world, and the feasability of creating a world onstage that features both real and non-real environments: allowing for better implementations for future practice in generating a theatrical space that gives audience members not only a believable, but a worthwhile and engaging spectacle to behold. This theoretical work colludes into the development of a system that allows a performer to exist as fully as possible in their assumed theatrical reality, and gives them the ability to explore as fully as possible the physicality of performance, leading to a greater sense of verisimilitude on the stage.

2: Realism

Art is not a mirror held up to reality, but a hammer with which to shape it.
- Bertolt Brecht

Willing Suspension of Disbelief

Theatrical illusion underlies everything that happens inside a theatre. The whole experience of attending a performance of any sort, from buying a ticket to the final curtain is predicated on the inclusion of every audience member into the world of the play, and as a result the audience agrees to be taken on that journey. If we operate on the assumption, that the audience goes to the theatre for an engaging, live, truthful experience in which the audience agrees to believe what they are told and take what they see, hear, and feel for granted; we can examine how the audience is able to appreciate the greater narrative by making that process of accepting the presented reality as easy as possible.

Often referred to as the willing suspension of disbelief, this principle engenders an ideally non-critical environment, one where the theatre artists can focus all of their time and energy on exhibiting the truth inherent in the work, and allow the audience to see past the artefacts of production to the truth the production presents. Therefore, one of the primary purposes of sound design in the theatre should be supporting the theatrical illusion: but it is important to realise that illusion purely for the sake of deception is a critically limited view of the theatrical illusion as a function of the theatre experience. The presented illusion is worthless if it does not serve a grander purpose, illusion for the sake of illusion is only so much smoke and mirrors.

Illusion and Suggestion

If illusion can be put into service in the creation of a new theatrical reality, the fidelity with which sounds from the intended reality can be brought to the performance venue is a possible metric for the efficacy of that illusion. Essentially, if the sound the audience hears is close enough to the intended reality of the play, the illusion is complete. However, that is no easy task: as sound designer Richard K. Thomas asserts, “every time we introduce a sound effect masquerading as a real sound, we jerk the audience out of the performance by the incongruity of the acoustic signature of the theatre environment” (Thomas 2001, 9.) This

implies that the distance inferred by two non-compatible acoustic signatures makes absolute realism in sound design impossible. In addition to these acoustic incongruities, there is the problem of the omnipresent cognitive dissonance in theatre.

Even if the resulting sound that the audience perceives is acoustically identical to the physical phenomenon we are trying to reproduce, it is still an illusion. However accurate the reproduced sound, the audience will always be aware of the fact that it is a part of the production, a conscious choice intended to communicate an idea. This can be taken one of two ways: that either we can never create truly convincing realistic sound effects, or that the permanent disconnect between the intention and reality indicates a more forgiving audience. Acceptance of the impossibility of a completely realistic sound design therefore liberates sound design from pure illusion, and allows it to transcend simple mimicry. Therefore, in the creation of realistic sound designs, the goal should not be complete replication of the intended sound, but instead a version of the intended sound that fits into the perceived world of the play. Indeed, Thomas goes on to conclude that "natural sound is not so much the function of sound in the drama as it is a style employed to allow sound to affect the emotional state of the audience" (Thomas 2001, 10.)

This leads to a method for sound design in the theatre that emphasises small parts of the soundscape as suggestive sounds that lead an audience to the intended conclusion, without overloading them with sonic information that may or may not be realistic. Kaye and LeBrecht describe what they refer to as a representational style as "selecting sounds that will support the action without fleshing out every nuance" (Kaye 2000, 18.) Theatre is a collaborative art form, and sound in particular, is focused on creating a large scale cohesive image, composed of several smaller inter-related elements. This seems to imply that realism is determined by detailing: that while we can take huge amounts of suggestion and indication from sounds, it is in fact their smallest constituent parts that convince us of their appropriateness and their related efficacy.

A sound design that is more suggestive than prescriptive allows the audience to fill in the gaps with their own imagination: after all an audience can imagine a more vivid and detailed soundscape than could ever be designed and implemented, for the theatrical

imagination is not constrained by the laws of acoustics, space, and time. Indeed, the willing suspension of disbelief on the part of the audience is not just a means of ignoring flaws, but actively engaging with the performance; an audience that actively resists the course of the presented narrative will not have a positive experience. The audience member who is constantly searching for indications of breathing from a character recently killed onstage has no chance to appreciate the greater implications of the character's death because they are searching for the underpinnings of the theatrical framework. By focusing on the fact that the actor is not actually dead, but merely playing, not only breaks the cohesion of the theatrical space, but that audience member is actively engaged in disassembling the theatrical framework as a whole instead of paying attention to the performance. This issue can be compounded by offering the audience a series of difficult to accept images, sonic or otherwise. So, by overloading an audience with a variety of simultaneous attempts at details of realism, the illusion as a whole can be ruined.

Naturalism

While creating a realistic environment on the stage has been a theatrical priority since antiquity, the first attempt to establish an aesthetic theory for dealing with the problems associated with the disconnect between performance and reality was the Naturalism of Émile Zola. Zola believed that the only way for art to be effective was to have it exhibit reality honestly, unflinchingly, and without alteration: and for theatrical applications, he asserted that any falsehood on stage would result in a dissolution of the theatrical framework. Zola called for a "scorning [of] the tricks of the clever hack, smashing the imposed patterns, remaking the stage until it is continuous with the auditorium, giving a shiver of life to the painted trees, letting in through the backcloth the great, free air of reality" (Zola 2000, 47.)

The extreme demands of Zola's Naturalism, including an abject refusal to have one object stand in for another, made it largely unsuccessful as a theatrical mode, but the concepts have lived on in those he influenced, including Henrik Ibsen, George Bernard Shaw, and Anton Chekov, to name a few of his contemporaries. These writers embraced the idea of Naturalism, but accepted the issues associated with enacting it fully. This led to a theatrical

practice, commonly called Realism, that emphasises the intended reality and portrays it in the most naturalistic style possible, but does not force the mechanism of Zola's theory onto the theatre practice. This concession offers both the benefits of presenting the audience with a familiar and natural world on the stage and the feasibility of a performance style that does not require the meticulous attention to detail that Zola desired.

Epic Theatre

This then engenders the question of how to suggest a theatrical reality with enough specificity to support the storytelling elements of the drama, but without too much detailing that will derail the action, and distract from the production as a whole. One solution to this is to abandon realism all together, in favour of a theatrical style that accepts the limitation of live performance, and seeks not to imitate reality, but heighten it, and in doing so suggest more. Chief among the responses to a realistic theatre is Bertolt Brecht and his Epic Theatre.

Brecht's theatre suggests that the audience should be conscious of the performance as a performance, liberating the theatre artists from the menial task of building elaborate theatrical illusions to allow them to focus on the performance. This technique, known as *Verfremdungseffekt* or the distancing effect, allows the audience to observe the performance without the tendency to get involved in the narrative and therefore better appreciate the performance as a whole: making the traditional necessities of pulling the audience out of the venue and into the performance inapposite. Dramturge Mark Fortier quotes Roland Barthes saying "that Brecht's theatre of discrete scenes means that there is 'no final meaning, nothing but projections, each of which possesses a sufficient demonstrative power" (Fortier 2002, 31.) In short, by not attempting to create an illusory environment for the whole of the performance, Brecht, and by extension those who follow his principles, is able to create smaller scenes with a higher density of meaning, thereby giving the audience a more truthful, if less realistic experience.

This acceptance of the futility of attempting a purely realistic performance then implies that sound, as well as the rest of the theatre arts, has a greater function to serve in supporting performance, namely that ephemeral theatrical concept of "saying something."

This conception of a theatre with no need for a realistic narrative has continued, notably with Brecht's literary successor "[Heiner Müller who] had come to doubt 'that a well made story (the fable in the classical sense) can adequately deal with reality anymore. Instead he began to develop a dramaturgy of 'synthetic fragments.' Even at their 'most' narrative, these fragments contain only snatches of story, flimsy interpersonal history" (Rouse 1999, 152.) Müller's work extends the disregard for an illusory version of a cohesive realistic narrative to the disregard for narratives in any form: making the attempt to represent any part of reality on the stage a detriment to the grander purpose of the performance. This extreme response to depicted reality may assist in creating vivid images, but in rejecting the demands of realism the concept of narrative is also rejected. This may work for avant-garde performances, but the vast majority of theatrical productions tell some kind of story, making this approach have a limited application.

Combining Modes

These production styles attempt to create a theatrical framework that strives to allow the audience to relate more closely the the action on stage. While the means of each approach varies greatly, the intended result is largely the same, allowing the audience to understand the action allows them to then understand the performance in a larger context. With the exception of Zola's strict Naturalism, all of these theatrical modes make room for external sound to be added in support of the narrative, but say little as to how that can or should be done. Traditional practice for the adding of external sound usually includes recording sounds, editing them to fit the situation, and playing them back as fixed entities. This accomplishes the simpler goals of design, in that these sounds can offer clues to help the audience better understand the action onstage, but limiting the content playback mechanism can concurrently limit the effect the content has on the audience. Therefore, the techniques for content generation and playback in the theatre deserve as much consideration as any other aspect of the production's design.

3: Technology in Theatre

He carries a marvel of mechanism that lets loose at the touch of his finger all the hidden molecular energies.
-George Bernard Shaw

Show Control and Systems Integration

Thomas proposes a greater breadth of control for the playback of external sounds introduced into a theatrical context, writing "the sound board operator [ideally] not only has control over the keyboard, but has the option of using pedals, thumb wheels, and breath controllers to control any relevant parameters of the sound – including color, mass, line, rhythm, texture and space" (Thomas 1986, xxxiv.) If we think about these controllable qualities of sound as having some basis in their physical attributes, why should we ascribe a secondary physical control to them, instead of basing them on the physicality of the relevant object? While this futuristic look at how sound can be controlled certainly must have been innovative when written, this conception is heavily rooted in an archaic notion of control. Thomas' description of a sound engineer focuses on a distinctly analog, one-to-one correlation between adjustable parameters and the means of adjusting them. This idea, that every distinguishable aspect of every sound can and should be controlled separately, is but the first step in the creation of sound designs that are coherent with the entirety of the production. The romanticised picture Thomas paints of the front of house engineer as a conductor, exerting control over several sections at once, ensuring cohesion among the disparate elements, is worthwhile, but need not be limited by the technological conceptions of the time of writing.

Surely it makes more sense for the determining elements in our sonic landscape to be based on the corresponding elements in our dramatic one. By building a system that pulls data points from the physical environment to be used in the creation of the acoustic one, we eliminate a transduction stage, where an operator has to observe a thing, place that in context, make a decision about how that impacts the operator's localised zone of responsibility, and then take some action to be sure that the physical phenomenon is being adequately represented as an acoustic event in the context of the dramatic environment. Show control and sound designer John Huntington asserts that "by adding computers to the traditional entertainment control loop, incredibly complex sequences that are

difficult or impossible to implement manually can be repeated flawlessly night after night" (Huntington 1990, 3.) Huntington's approach is rooted heavily in complex stage spectaculars, incorporating programmable logic controllers as triggering mechanisms for audio and video playback, as well as stage automation, lighting changes, and other stage effects, but the principles of systems integration are worthwhile on a smaller scale as well.

Spectacle and Intimacy

This push towards a more technically complex system may seem like so much technophilia, but there is a precedent for the use of modern technology in the theatre. A history of early theatre practice includes in large part an analysis of their success at adapting the technology available for the purposes of the theatrical performance: to make their performances more believable and more appealing. The ancient Greeks used huge levers and cranes to allow actors to descend from the heavens to dispense judgement as a *deus ex machina*, the morality plays of the middle ages featured hellmouths belching fire and otherworldly screams, and Shakespearean performance often included a barrage of live foley artists augmenting the action onstage with relevant and appropriate sounds. Certainly, there is an element of Spectacle there, both Aristotelean and otherwise, but the Spectacle serves a purpose beyond the awe they inspire in the audience. One of the reasons to attend a theatrical production is to observe in some way an amplified reality, a version of life somehow grander than what the audience is familiar with. But in both small, disconnected segments and in fully immersive naturalistic pieces, there is the appeal of observing the actions of performers on display; watching the performers express something brings the reality of the drama into the understanding of the audience.

To display these things, they often have to be amplified, extended and made grander than they are in a physical reality: but still maintain their authenticity. Therefore, one of the goals for an effective sound design for the theatre, is to extend the expression on stage, to a point where audience members can grasp fully the minutiae expressed by the performers. This is easier done in small, intimate venues, but the extension of intimacy can be accomplished with judicious application of well crafted and relevant sonic elements

in much larger and less traditionally intimate performance spaces. Thomas proposes that "sound in theatre must technically surpass in both performance and quality that which is available at home. As audience sophistication evolves, so does the attitude towards theatre sound" (Thomas 1986, xxxii.) Even though Thomas focuses his thoughts here on the medium and fidelity of sound, but the principle can be extended to responsiveness. Audiences used to watching films with rigorously detailed post production, foley sounds, and other chances after the performance to make the sound fit with the image will come to expect similar a cohesion in live performance.

This cohesion can be achieved in part by the triggering of content playback, and if we are to take Thomas' assumption that the technological developments of non-theatrical audio influence the way sound is or should be designed for the theatre, it means that the sound generated in the theatre needs to be rooted in it's generative action. Therefore tying the means of playback with the means of how the sound would be generated in the natural world allows the sound to more accurately reflect both the action onstage and the intention behind the action, drawing the audience into a more detailed version of the theatrical world. Because every contact between two objects creates sound, and the human body is constantly in contact with other physical bodies, constantly making noise with every movement, the sound of a body existing in a space. This is a risky proposition however, as the transfer of playback triggering to the performer implies an uncertainty of result: if the actor's body is the control mechanism a consistent sound design is then predicated upon a consistent performance.

Repetition and Indeterminacy

Consistency may seem like a priority for a production that has to repeat itself nightly, but more important than the performance being the same from night to night is the performance being the same throughout. This model of soundscape creation, one where the audible elements of the production are not fixed, lines up with a less prescriptive performance style. Described by John Rouse here highlighting that "the director's control is less over performance writing than over performance discourse... Directorial discourse is in

fact, usually investigated at this level, the level of the Brectian *Gestus*- of a 'how' that can reveal the 'what' in a new light" (Rouse 1999, 147.) This notion allows for a performance to occur differently from night to night, but accomplish the same thing with each iteration. Though certainly not a completely new concept, the reticence to accept that performances can change vastly over time is a recurring theme in the analysis of theatrical productions.

This idea, that every performance has to be exactly the same as the previous implies that there is an ideal version of the production, that there is a correct and incorrect way for the drama to unfold. Fortier breaks from this Platonic version of performance, writing "Are we to believe that only those who saw the world tour version towards the end of its run were privy to the definitive production?" (Fortier 2002, 146.) Indeed, how can there be a definitive version of anything if it occurs more than once? This Platonic model for sound design has lingered on more in the theatre than musical performance. John Cage highlights the inevitability of indeterminacy by posing the question, "performance time... timbre... the architecture of the room... all of these elements [not included in the notation of the music] evidently of paramount importance, point the question: what has been composed?" (Cage 2009, 61.) Freed then from a reliance on content that has to be exactly the same for every performance, sound design for the theatre can take cues from other disciplines, like sound design for video games.

Procedural Sound Design

Procedural audio programmer, writer, and theorist Andy Farnell, explains the principles behind procedural sound as follows, "any sound can be generated from first principles, guided by analysis and synthesis. An idea evolving from this is that, in some ways, sounds so constructed are more realistic and more useful than recordings because they capture behaviour" (Farnell 2010, 1.) This approach then allows for the creation of content in real-time, which by extension means that every procedural sound created, can be crafted based on the situation it is about to be played in.

While a relatively simple concept, this method further expands the amount of sonic possibilities at any given point in time, and by extension increases their ability to function as

a part of an expansive sound design, one that responds directly to the action that it supports. Farnell expands, “procedural sound is a living sound effect that can run as computer code and be changed in real time according to unpredictable events” (Farnell 2010, 1.) This ability to change the very nature of the content gives the production a sense of authenticity and believability that would be impossible with sampled effects. Consider the possibilities of a sound design that bases its development on concurrently developing action; all that is necessary is to formalise the environment for which the sound is destined, and assign parameterised aspects of the physical world to the generative theatrical one. In addition to reproducing difficult or impossible to record effects, tying the generation of content, as well as its execution, to live performance engenders a more cohesive experience on the whole.

Applications

In practical terms, the use of procedural sound design techniques can be used to create soundscapes that change based on how the performance is going. The speed with which actors trade lines could increase the tempo of musical underscoring, building an *accelerando* into a scene based solely on the performers actions. An actor’s voice can be modulated based on its amplitude, transforming the shouted terminus to a monologue into a distorted reverberant punctuation mark. The actor can become an instrument, and everything from body positions and orientation to large and small motor movements can be directly correlated to the generation and execution of content. Even something as simple as a footstep, when crafted in the performative context based on the intended reality of the drama, can transcend its traditional role, and become much more than an indicator of movement.

This is all well and good, but what does it actually accomplish, Laying out a sound system with connectivity between the different elements has been shown above to solve specific problems: But why design an entire system to do that? Above all the purpose for this kind of synchronicity is to develop and maintain a sense of cohesion in the production. Cohesion between the disparate elements of a production not only make it easier for the audience to accept the presented drama, but reinforces the impression that the entire

production is cut from the same cloth, that the displayed signs are interconnected rather than pulled from whatever convenient source. To illustrate their efficacy, and potential applications it seems best to apply them in a sort of idealised theoretical production.

4: Conceptual Development

Was the first man that leap'd; cried, 'Hell is empty And all the devils are here.'
-William Shakespeare

Man And Superman

In the interest of of exploring the potential applications of procedural sound design in the theatre, selecting a play to use as a exemplar allows for both an assessment of specific techniques and practices, but also to examine the role that sound design can affect a narrative. For the purposes of this assessment, the extended dream sequence in the third act of George Bernard Shaw's Man and Superman, commonly referred to as *Don Juan in Hell*, will be used.

Shaw sits in a peculiar place in theatrical history, and this play is indicative of not only his political and philosophical leanings, but of his approach to the theatrical depiction of environments. Shaw's allegiance to the tenants of realism does not stop him from straying from the strictly realistic in his plays, and he is certainly not a proponent of Naturalism, but his attention to detail is paramount in his work. He writes of his own work, "a fact as invented by a dramatist differs widely from the fact of the same name as it exists or occurs objectively in real life" (Shaw 2000, 210) and rather than admit defeat in the translation from the real world to the stage, he continues, "real life... is so ill understood, even by its clearest observers that no sort of consistency is discoverable in it" (Shaw 2000, 211.) Shaw simultaneously accepts both the falseness of the dramatic presentation of reality, as well as the lack of order in the real world; he therefore crafts his plays so that they can make sense out of that chaos inherent in the real world, by turning reality into an abstract version of itself. This makes Shaw's work a perfect exemplar of how a realistic environment can be created on the stage, while still maintaining a sense of theatrical distance.

Man and Superman on the surface is a relatively simple comedy of manners, whereupon a slightly stodgy older man and a radical young socialist are appointed as joint guardians to a young woman whose father's death allows the play to start *in media res*. The two are constantly at odds, and only through the scheming and machinations of said ingenue do the two see eye-to-eye, which only occurs when the young Ann Whitefield convinces Jack Tanner to marry her. Written as a modern take on the story of Don Juan, (Shaw 1903,

v) the play explores the sexual mores of early 20th century London, and by extension the hypocrisies exhibited by those involved in 'polite society' in regards to the various relations between men and women, both those within the sanctions of God, Law, and Man, and those without. The play notably reverses the traditional gender roles found in British literature, in which the the Rake pursues the Ingenue, much to her dismay, only to be won over in the end by his anagnoris in the name of chastity and love for his bride to be. Shaw has the Ingenue, Ann, acting as a viscous and scheming flirt of a woman, who makes it her mission to marry the self-proclaimed Rake and socialist, Jack Tanner. This dynamic is explored throughout the course of the play, with Tanner trying to steer Ann's affections elsewhere, and during a continental motorcar race, Tanner veers off course in his desperation to avoid his besotted ward and passes the night with a band of brigands in the Sierra Nevada mountain range, where upon falling asleep a protracted dream sequence ensues.

Don Juan in Hell

This dream sequence, which in performance runs approximately ninety minutes, is presented as a sort of group dream where Tanner and the brigand band's leader Mendoza take on the roles of Don Juan and the Devil, respectively: with Ann appearing as Don Juan's Ana, and the other half of Ann's tutelary team, the elder Roebuck Ramsden, appearing as the statue of Ana's father. Upon arriving in Hell, the recently deceased Ana encounters a melancholy Don Juan, and not recognising him at first, begins to try and make sense of her apparent damnation. The pair is soon joined by the Statue and the Devil, and the three men try and explain the true nature of Hell to the newly arrived Ana, not as a place of pain and suffering but as the Devil states, "here, I repeat, you have all that you sought without anything that you shrank from" (Shaw 1903, 129.) What began as an introduction to Hell for the arrival of Ana soon turns into an abstract discussion of the afterlife, the benefits of Heaven versus Hell, and then gradually shifts to a blatant discussion of the themes present in the rest of Man and Superman.

The conflict in *Don Juan in Hell* is not between the characters, but instead the ideas that each character represents. Since Shaw has drawn upon characters presumably

familiar to the audience, he is free to use them as personified concepts, rather than more traditional *dramatis personae*. This allows Shaw to eschew the tenants of realistic theatre and focus the work as a whole onto a grander concept, in this case the nature of life and by extension afterlife: eventually coming to discuss the titular concept of the entire play, Nietzsche's *Übermensch*, often translated as 'Superman.' Because of this, *Don Juan In Hell* reads less like a traditional drama and more like a scripted debate; interpersonal relations are largely ignored, except when they are used as a means to further the discussion at hand. The discussion can hardly be called that in good conscience on occasion, as in true Shavian fashion, back and forth exchanges of dialogue with utterances of relatively equal length are few and far between. As seen by the figure below, the play could really be considered a series of monologues, with the longest single line approaching one thousand words, over six percent of the total length of the play.

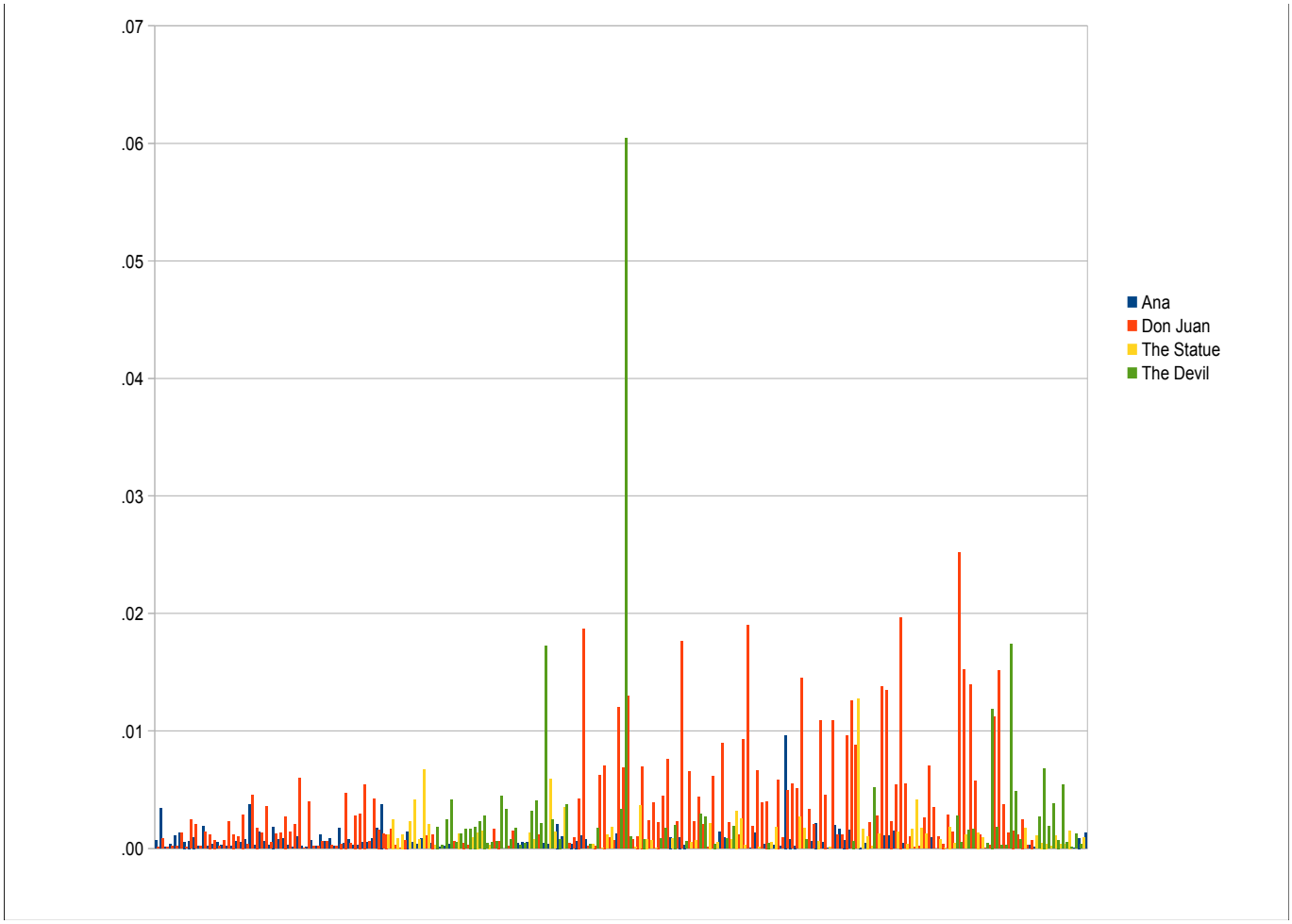

Figure 4.1: Line Duration by character, expressed as a percentage of total scene length

Textual Suggestion

Shaw is sill eager to craft a world that is realistic on stage, and one of the ways he assures that his plays are accessible is by creating detailed environments for his characters to exist in. Indeed, the first three pages of the original printing of Man and Superman are a lengthy description of the home, appearance, and character of Roebuck Ramsden, a precedent repeated with the introduction of each new character or location. Where many modern playwrights insert stage directions and notations throughout the work, guiding delivery and execution with suggestive or prescriptive blocking and acting notes, Shaw's notes are thorough, but irregular. He describes, for example the transition from the realistic world of the Sierra Nevada into the dream sequence depicting Hell, thusly, "Stillness settles on the Sierra; and the darkness deepens. The fire has again buried itself in white ash and ceased to glow. The peaks show unfathomably dark against the starry firmament; but now the stars dim and vanish; and the sky seems to steal away out of the universe. Instead of the Sierra there is nothing; omnipresent nothing. No sky, no peaks, no light, no sound, no time nor space, utter void. Then somewhere the beginning of a pallor, and with it a faint throbbing buzz as of a ghostly violoncello palpitating on the same note endlessly" (Shaw 1903, 86.)

This extensive, almost poetic description continues on, and gives anyone planning on staging the production a wealth of information about the world that Shaw has intended onstage. Because of his specificity in stage directions and descriptions, the text of the play has an added layer of meaning that is observed quite simply when reading the play, but is more difficult to grasp during performance. In relation to this translation difficulty, Fortier wonders "in the kind of theatre practised by Ibsen and Shaw, doesn't what appears nonverbally on stage begin as words in the stage directions written in the drama text? Is performance merely a nonverbal translation of the text's words?" (Fortier 2002, 29.) Certainly, the words put there by the playwright are intentional, and belong there because they support the intended reality to be depicted, but how are such prescriptions to be interpreted? Fortier elaborates, asserting that "fidelity to the words of the text is not enough; there must be fidelity to the sense of those words, and that sense is to be determined by authorial intention" (Fortier 2002, 143.) This, while a liberating perspective

on the struggle to actualise a realistic intention in a theatrical context, means that a literal translation is insufficient to transfigure a text into a performance, and that interpretation is needed to flesh out those details suggested in the text.

Hell On Stage

This is particularly problematic with depictions of Hell: partially because every culture, in every era, has a very different perspective on the place, but the art objects of that period persist much longer than that conception of Hell does. The Puritans of Arthur Miller's The Crucible have to conjure up the same fire and brimstone of Goethe's Faust: but the two cultures for which those plays were written for have vastly different associative signifiers for the audience to understand. Similarly, the Hell believed in by the Don Juan of legend is a different place to the one described by Mozart in his opera, still different from Moliere's in his play, and from Byron's in his poem. Hell is a very real place in those art works, as much as it is in Sartre, Shaw, and Sondheim's plays, and the means of accessing it have to be understandable for the audience. Shaw even makes note of the various versions of Hell propagated on Earth, with the Devil proclaiming, "Hell is a place far above their comprehension: they derive their notion of it from two of the greatest fools that ever lived, an Italian and an Englishman" (Shaw 1903, 107,) The referenced Italian being Dante Alighieri, and the Englishman being John Milton. Shaw leaves an essentially blank slate for the depiction of Hell in this dream sequence, and he offers very little in his own description, besides it's sparseness, which offers an ideally suggestive, but not prescriptive vision of Hell.

The way to accomplish this is to make whatever Hell we are taken to seem sufficiently Hellish: but how do you make a realistic or believable version of a place no one in your audience has been? Though, that same problem exists for any audience that hasn't been to every place in the world; American audiences may have never been to to the highlands of Scotland, but they have a conception of what it is like, and how it feels, and how it should therefore be depicted in realistic staging of Macbeth. More importantly though, this conception does not necessarily have anything to do with the actuality of the depicted place. Ignoring the theological implications of Hell's existence, or lack thereof, it simply does

not matter what it is really like for the purposes of performance, only that it seems to the audience to be what it is like. Therefore the creation of Don Juan's Hell has no boundaries to speak of and its potential is unconstrained, and therefore ideal for experimenting with procedural sound design techniques.

5: Actualisations

Taking the first footstep with the good thought, and the second footstep with the good word, and the third footstep with the good deed, I came up to the Chinwad bridge, the very wide and strong and created by Ohrmazd.
-The Book of Arda Viraf

Footsteps

We can think of footsteps in the theatre as a bit of a contradiction of terms, as they assist in the clarification of both characters and environments. They are definers of space, texture, and intention: they can define a character through their gait or their choice of footwear. Shaw even includes a stage direction, near the top of Act II referencing a particular footstep sound, "*Tanner, a little annoyed, is about to pursue the subject when he hears the footsteps of Octavius on the gravel. Octavius is coming from the house, dressed for motoring, but without his overcoat*" (Shaw 1903, 47.) But why does Shaw, and most other playwrights for that matter, only reference the pitter-patter of actor's feet as offstage effects? This instance is a simple sound cue designed to make the audience aware of both the environment that exists beyond the visible theatrical landscape, and also an interruption to the previous dialogue. Shaw does not include any more references to the gravel footsteps during the play, even when more characters come the same place Octavius does, in the remainder of the act. This is largely because while the sound of footsteps is not a complicated one to generate in small doses, as a sustained and regular occurrence the sound is difficult to tie to action onstage. Since the footsteps should serve the twin goals of suggesting a source, and making that source seem coherent with the rest of the given theatrical world, any mismatched footsteps break the theatrical reality, and so rather than offer a more detailed and informative sound, a simpler, less complex one stands in and suggests the rest. The amount of sonic texture required to lead a person to believe the sound they are hearing is a footstep of any type has less to do with the sound itself, and more to do with the situation the sound is heard in. A prerecorded sound of a person approaching by foot on gravel is easy to include from offstage, but to create the same effect on stage requires a much more complicated system. Directly tying the physical performance of an actor to the generation of the sound of their movement makes this a much more manageable task, and the output is much more detailed for the audience to respond to.

In the notes for his procedural footstep patch, Farnell sums up his work, writing,

"Footsteps are more than simple clonks; they are complex patterns generated by an elaborate biomechanical process involving different muscles and different parts of the foot, and they change according to the behaviour of the actor" (Farnell 2010, 555.) This is an accurate assessment of the intricacy hidden in the seemingly simple footstep, but Farnell's patch is designed to work with a parameterised input of near constant movement, instead of short motivated bursts of activity, which makes his triggering mechanism difficult to utilise in a performative context. Since his patch was written for computer games, where speed can be expressed as a numerical value representing rate of movement, the control parameter has to be adapted to serve a live performance. To accomplish this a patch in Max/MSP and a triggering mechanism was built, described by the control topology seen below in Figure 5.1

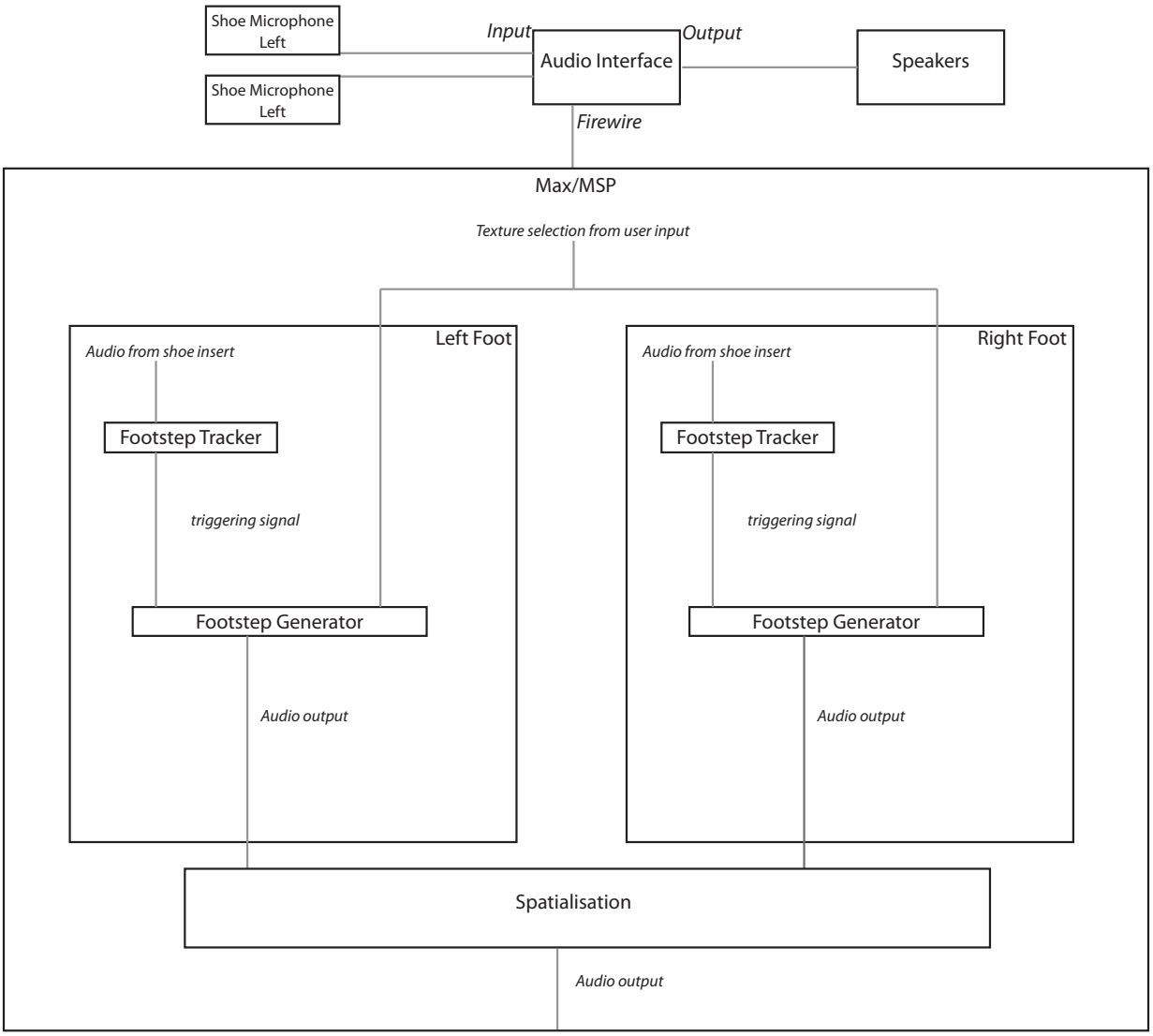

Figure 5.1: Control topography diagram

Sound Triggering

The principle behind the triggering mechanism is simple, every time an actor puts their foot on the ground, it should trigger a footstep. Ideally, because a single footstep is actually comprised of two discrete points of contact the sensor should be able to sense when each phase of the footstep was beginning. The original design featured a pair of contact microphones in each shoe, one at the heel and one at arch, so the two discrete phases of the footstep can be triggered separately. This design, which simply required a contact microphone to be taped to the removable insert in a shoe was too sensitive, and anytime pressure was put down on any part of the shoe, both microphones clipped, almost simultaneously. To solve this issue, the contact microphones were then cast in an insert of their own, made of flexible silicone sealant: this would have ideally given both sufficient acoustic damping to the microphones, and also provided enough isolation that the two could be triggered independently. Seen below in figure 5.2, this second iteration of the inserts offered both acoustic isolation between the heel and toe microphones and added approximately thirty decibels (30 dB) of attenuation, greatly increasing the dynamic range of the system, allowing the system to more accurately reflect the differences between each footfall.

Figure 5.2: Shoe insert, Mark II while curing

Unfortunately, as seen in figure 5.3 approximately seven days after the silicone had finished curing, the contact microphones stopped responding when stepped on. Upon further investigation it was determined that some chemical byproduct of the silicone corrupted the piezoelectric bond between the copper plate and the potassium sodium tartrate disc, rendering the microphones ineffective. The third and final iteration uses the same kind of contact microphones coated in rubber, affixed in the same position as its two predecessors: while this was originally meant to be a pre-treatment to prevent oxidisation of the microphone before being cast in the silicone mould, the rubber coating provided an additional eighteen decibels (18 dB) of attenuation, which had it been used inside of the silicone insert would have rendered the microphones too insensitive to pick up anything except stomping.

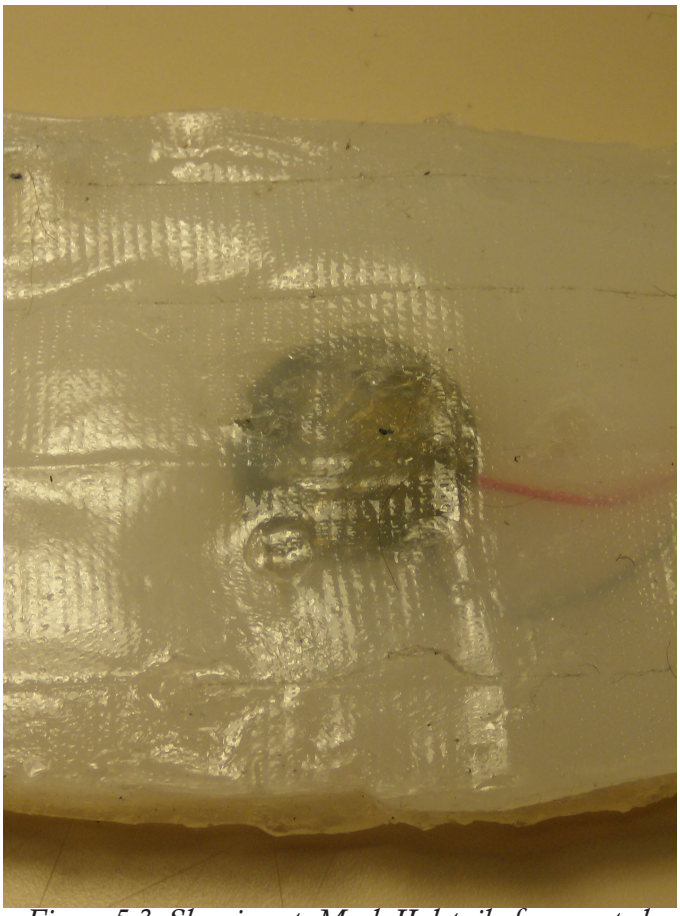

Figure 5.3: Shoe insert, Mark II detail of corrupted microphone element

Because of this, the third version of the inserts features a single contact microphone for each foot, attached via tape to the underside of the second iteration of the inserts, seen below in figure 5.4:

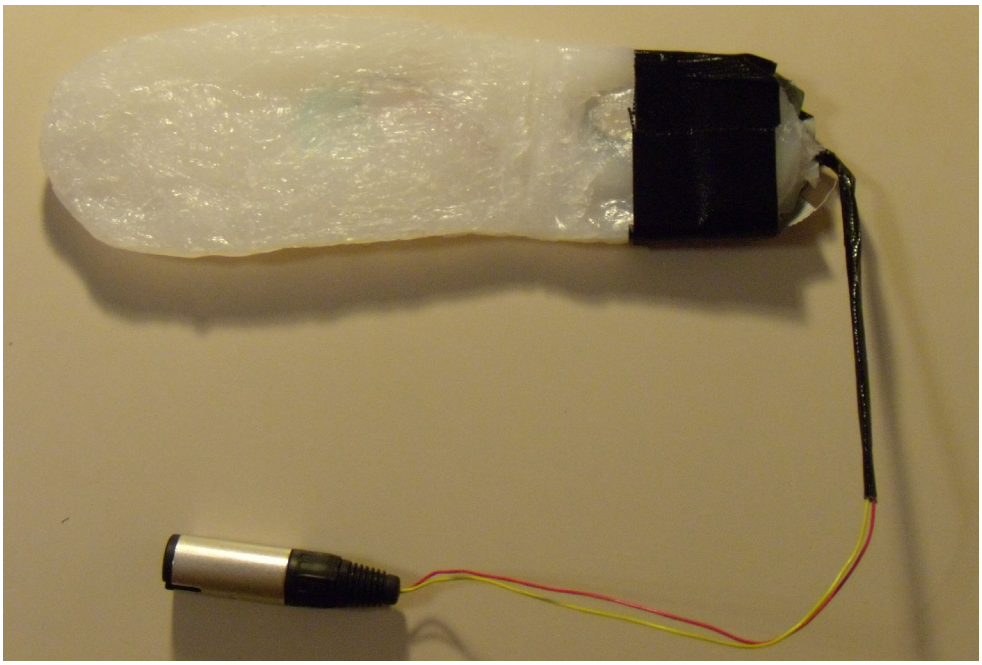

Figure 5.4: Shoe insert, Mark III, shown with connector

This means that the inserts are only able to identify the contact between heel and ground, which has two main repercussions. First, the system can only identify footsteps that begin with the heel. While this might not seem like a concern, it does limit the physical expression of the actor, meaning that any footfalls used to trigger the procedural footsteps must use that physical mode. Walking forward on the balls of one's feet, as if sneaking, will therefore not trigger a footstep accurately, and any steps taken backwards will only trigger the system if the step is not straight back, only if the hips are pivoted with each retreating step, an awkward way of walking to say the least. The second result of having a single microphone for each foot means that the system has no way of knowing how much time there is between the first and second phases of the footfall. This is worked around to a certain extent through randomisation, as after analysis of recorded footstep samples the time difference between the heel and toe fall ranges between seventy-five and one hundred twenty-five milliseconds (0.075-0.125 seconds) and therefore the curve generator randomises a value in that range with each step. A more elaborate system could identify the rate between heel contacts and infer an overall pace, and use that to generate a more accurate delay between the phases of the footfall. Other possible improvements on the the input mechanism would be to eschew microphones in favour of pressure sensors, so

as to avoid the acoustic crosstalk between heel and toe, while, provided the sensors were robust enough, giving a wider dynamic range for footfall intensity, which could allow better amplitude modulation based on the force of the foot's impact.

Sound Generation

In addition to triggering the footstep sounds, they must be also generated, and to this end three methods have been used to create footsteps: procedural, sample based, and loop based. The procedural footsteps are generated with a Max/MSP patch based on Farnell's Pure Data patches included as examples in the book Designing Sound. Each of the four included examples are self contained patches that respond to a bang by generating a creating a pair of unique amplitude curves reflecting the attack, decay, sustain and release for both heel and toe contact. The curve generator can be found on the accompanying DVD in the programming folder. The curve is then sent to control the amplitude of the synthesised sound, and results with a single footstep sound. The patches for each of the four textures can be found in the code section of the accompanying DVD and a screenshot of the gravel texture generator can be seen below in figure 5.5:

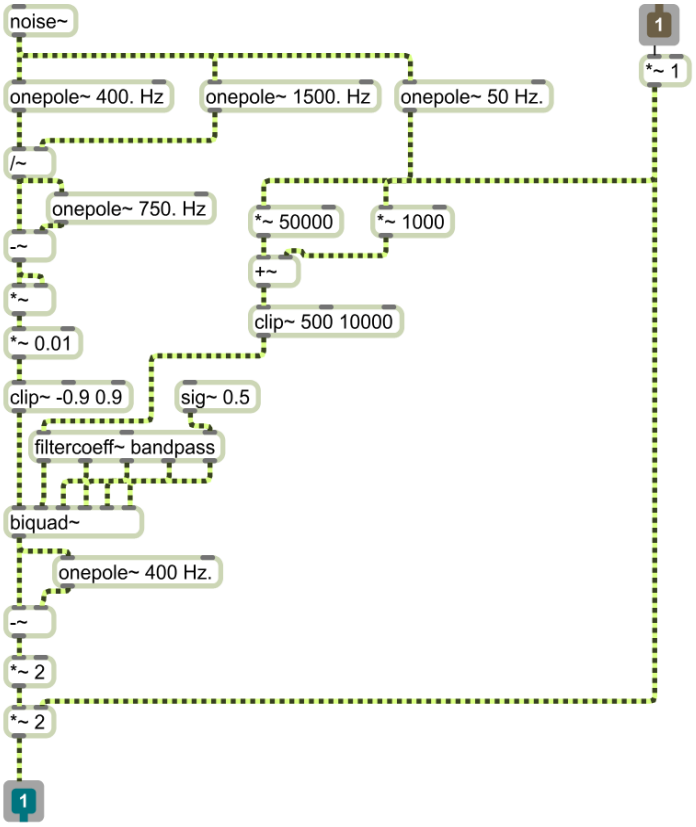

Figure 5.5: Screenshot of procedural gravel footstep texture generator

The sample based footsteps are comparatively less complicated, as can be seen in figure 5.6 below.

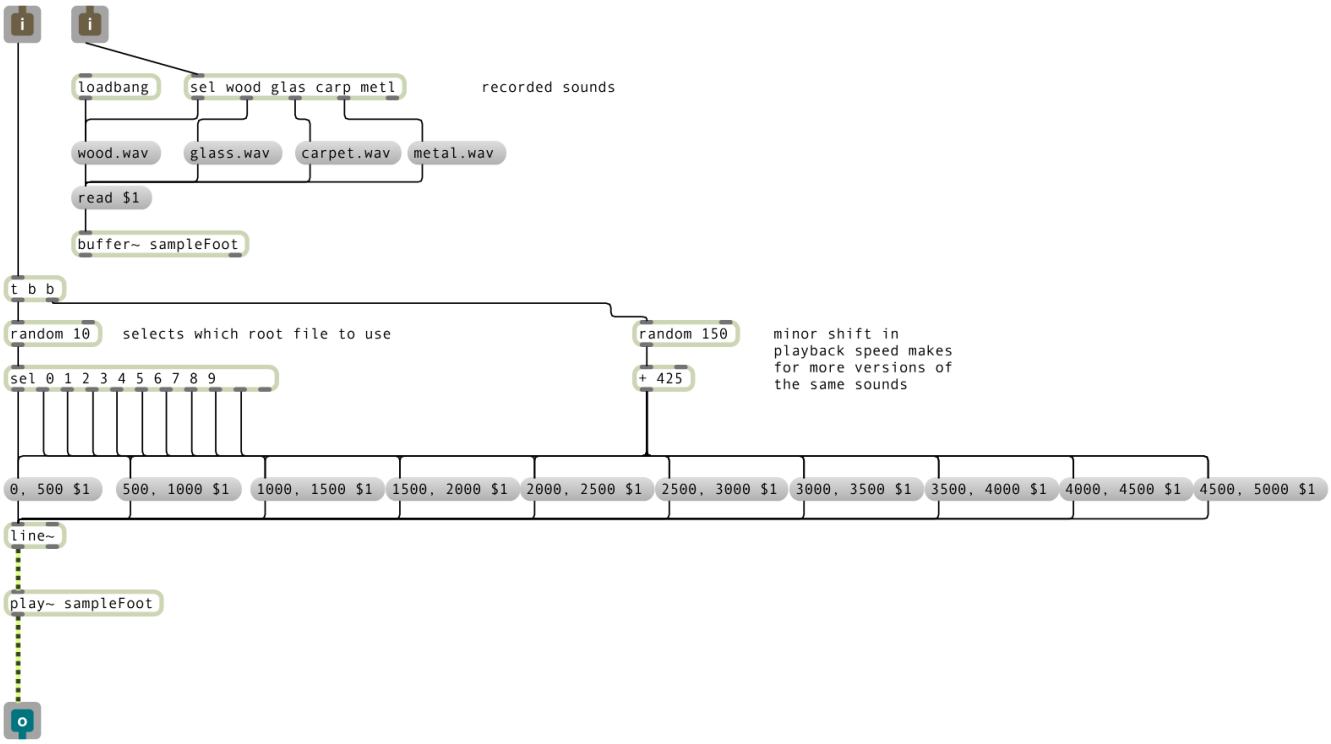

Figure 5.6: Screenshot of sample based footstep generator

After selecting a texture, a .wav file containing ten recordings of a single footstep in the texture, spaced five hundred milliseconds (0.5 seconds) apart, is loaded into a buffer. Upon receiving a bang, one of the ten samples is selected randomly, and played back with randomised speed variation of up to fifteen percent faster or slower, adding additional pitch variance between the sampled footsteps. This allows ten footsteps to be played back with more variance, reducing the chance that two concurrent footsteps will sound the same. The patch and accompanying .wav files can be found in the code folder.

The loop based footsteps combine elements from the procedural and sample examples seen above. After selecting a texture, a .WAV file containing fifteen seconds of an abstract sound that loops seamlessly with itself is loaded. Upon receiving a bang, the same curve generator used in the procedural footstep generator creates an envelope and applies it to looping sound, turning the constant sound into a footstep in a synthetic texture. The patch and accompanying .WAV files can be found in the programming folder.

Conclusions

The walking of man and all animals is a falling forward.
-Ralph Waldo Emerson

This project has explored the possibilities for future applications of a bespoke system to create sound designs that do more for the audience than just allow them to understand the words coming out of the actor's mouth, but to instead help them be understood. Connecting the body of a performer to the generation of sound unequivocally makes the theatrical reality more palatable, especially in non-realistic situations. But of course, the system exhibited here is far from perfect.

Improvements to the triggering mechanisms, both at the hardware and software levels are both possible and necessary before a system like this can be implemented in live performance. The generated audio is interesting, but needs a fully developed production to be accurately assessed. Out of context, these sounds are just that, sounds: but when integrated into a production that can truly benefit from such reactivity the true capabilities can be assessed. For at this point it is just a prototypical version: a proof of concept for future developments.

Ideally this system could be expanded to allow for things like the tracking of performers, bringing the correlation between actuality and dramatic reality even closer by localising the generated audio to an acoustic position related to the body of the actor, and eventually related to the connections between characters. Indeed, the list of possible improvements is long: but this system is a groundwork for bringing together the technologies already developed for musical performance, video game sound design, and popular filmic conventions into a model for theatrical performance. This is a tool, that if properly applied can change the way theatre is performed; relinquishing control from fixed medias to dynamic ones allows performance to adapt to itself as it develops.

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And to the myriad theatre artists I have had the privilege to work with through the years, for inspiring me to create sound that is more than just noise.

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