Metropolis raised her voice:
Live digital-Foley & Multimedia accompaniment.

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ABSTRACT

Since sound was first recorded on a cylinder wrapped in tin foil by Edison in 1877, technology has steadily evolved to allow an ever increasing level of sonic mutability. Gradually, pre-recorded sounds (or 'inputs') which where once fixed could be increasingly manipulated both before and during playback. While early gramophones and tape players afforded the operator very few parameters to experiment within, the development of digital technology transformed sound into a fully plastic medium. As such, sound in the age of digital reproduction has achieved a level of playability more commonly associated with the performance of live music. The sound-operator is now able to react to events unfolding in a live environment and adjust both subtle and prominent aspects of the sound in many of the same ways a musician can.

Through a series of theatrical productions and collaborations Challis & Dean have explored the sonic and dramatic possibilities created by the utilization of digital technology in a live performance context. Their current project is a multimedia adaptation of the novel and film *Metropolis* (Harbou & Lang, 1927). The aural accompaniment for this project will be performed live using a range of adapted and purpose built sonic triggers (such as accelerometers, gyroscopes, tilt switches, and proximity sensors). This paper will outline the processes and techniques adopted in this production and consider how this way of working has altered the interactional relationship between those that perform sound and those that receive it.

Categories and Subject Descriptors

Design, Experimentation, Human Factors, Performance.

General Terms

Performance, Design, Reliability, Experimentation, Human Factors.

Keywords

Technology, theatre, drama, liveness, sound, music, digital-Foley

1. INTRODUCTION

The term Foley is most commonly associated with its current modern application within the film industry. In this context it is the creation of sound effects for a film which takes place as part of the post-production process. However, the art of creating sounds to accompany a dramatic work is not limited to the filmic medium. The foundations of Foley were first established in the theatre and later developed and adapted for the performance and broadcast of radio drama. Before the technology required to record and playback sound became widely available and economically viable in the latter half of the twentieth century, Foley accompaniments were performed live. Indeed, Foley's contemporary incarnation as a pre or post-production activity is a recent development when considered alongside the long tradition of live sound effect generation and accompaniment.

Of course, in many ways the benefits of working with recorded sound justifies this shift in procedure and production. Recorded sound can be manipulated, tweaked, edited and subtly mixed. Far more realistic sound-effects can be produced with the use of modern recording technology. Moreover, this way of working is a dependable and efficient alternative to employing a team of Foley artists, and musicians, to perform the sonic accompaniment each time the work is presented. However, despite these advantages the switch from live to recorded sound also dismantled the responsive relationship that existed between those that perform sound and those that receive it.

2. INITIAL EXPERIMENTS

In order to gain an experiential insight into the opportunities and demands this type of live interaction creates, Challis and Dean have taken part in the production of three live radio dramas which re-created the performance conditions of the nineteen-thirties (*The Terrifying Tale of Sweeney Todd!,* 2008; *The Casebook of Violet Strange*, 2010; *Lover's Lane*, 2013). Performing the sound and music live encouraged and necessitated a high level of symbiosis between director, actors, musicians, Foley artists, and engineers. Each discrete element, be it a voice, an instrument, or running on the spot a-top a Foley footstep box, had to work in unison. This reflexive relationship was based upon intuition, practice, and

design. The script, musical score, and sound effects devices had been written, composed, or built. These 'designs' were put into practice through rehearsal. Finally, in performance, the cues, techniques, artistic touches and set pieces were intuitively executed in response to the live interplay between sonic components. Although these radio projects highlighted the possibilities and processes live sound facilitates, they also underlined the restrictions and problems modern technology has overcome. It is this disjunction between the potential of live sonic accompaniment and the practicality of recorded sound that digital-Foley seeks to resolve.

Technological advances over the past quarter of a century have produced a range of options and techniques for triggering, mapping, and manipulating digital sound which can be used to enhance expressivity and connectivity between the sound-artist, the stimuli they respond to, and the sonic-landscapes they create. The digitally augmented Foley artist can react to events unfolding in a live environment and adjust both subtle and prominent aspects of the sound in many of the ways a musician can. Using adapted and purpose built sonic triggers (accelerometers, gyroscopes, tilt switches, micro controllers, and proximity sensors) the digital-Foley artists can trigger sounds and manipulate sonic parameters with direct physical contact (bending, stretching, hitting, and squeezing) and other intuitive interactions.

The instrument which served as the prototype for exploring and experimenting with digital-Foley was the 'Benemin' (Figure 1).

Figure 1. Benemin

The Benemin is a gesture-based sound controller initially designed and built by Challis in 2008 as a means of providing intuitive access to musical activities for individuals with special needs [1] [2]. The design is relatively simple, using eight proximity sensors arranged in a near-horizontal format in front of the performer. Each sensor acts as an interactive 'beam' which can be triggered by a hand (finger, arm, foot). In its original design, this would play one note from a given scale with subsequent movement up and down within the beam affecting the volume or tone of that particular note. As a controller, the Benemin can be mapped to audio-loops and processes thereby enabling the performer to glide rapidly across complex sound sets whilst still maintaining expressive control over the output.

The Benemin was first employed as a digital-Foley device in a stage adaptation of Sam Raimi's *Evil Dead* films (*Dead by Dawn*, 2009). In the production, Challis used the Benemin to digitally manipulate and mix recorded sound-effects in response to the live action on stage and the sonic responses of the other musicians / digital-Foley artists. Primarily, it enabled Challis to create and perform highly atmospheric and complex layered soundscapes with a level of expressivity and connectivity that would not have

been possible through more conventional approaches. For instance, one scene depicting a character's possession by an invisible evil force was accompanied (and to a certain degree directed) by the sonic manifestation of its malignant presence which consisted of animal noises, processed voices and sudden door slams triggered and controlled using the Benemin.

The Benemin was also used to aurally animate props such as a chainsaw and a demonic puppet (Figure 2). The chainsaw sound set consisted of six sonic components: two motorbike engines and various mechanical grinders.

Figure 2. *Dead by Dawn*

The ability to 'slip' between two or more beams and trigger sounds in quick succession allowed Challis to match the sound effect to the actions of the character wielding the weapon. By placing a hand into one of the motorbike beams, an idling state could be suggested with a motor simply ticking over. Natural movements of the hand trying to stay still contributed to this undulating state through constant but subtle volume changes. A rapid gesture down into the beam instantly increased volume. Using another hand in the pitch-beam gave the impression of revving the chainsaw. This could be done subtly with minor hand adjustments or dramatically at the point of attack at which point 'sliding' into the adjacent beams provided various grinding impact sounds to simulate the chainsaw hitting flesh and bone.

In order to be able to respond to the action on stage the Foley artists and musicians were positioned on a high balcony that extended towards the front of the stage. This placed them above the action at the point where the front row meets the on-stage storyworld. On a practical level the viewpoint this position provided enabled the Foley artists to become familiar with the dialogue, movements and effects that prompted certain sounds and sonic states. Once these visual markers had been learnt Challis and his team were able to mould their sonic accompaniment around them. As the action on stage was not shackled to a fixed sonic composition the performers were afforded a level of autonomy as the Foley artists could respond to variations in duration and delivery. During some moments a kind of emotive circuit was created; the sound of an evil force approaching produced a response of terror from a performer, this caused the Foley artists to intensify the sound, which in turn prompted the performer to

heighten their response and so on. This relationship continued to evolve throughout the rehearsals and performances. In a sense it is the inevitable result of having two live elements existing within the same frame. With each run, the connection between the events on stage and the sonic accompaniment became stronger. However, due to the improvised nature of the sound this never became entirely standardised and the more familiar the Foley artists were with the parameters the freer they were to experiment within them.

In recent years much has been written on the concept of 'Liveness', particularly in relation to theatre and performance. The traditional claim that 'Liveness' is important in the theatre as it means that each performance is unique, has been presented as something of a misleading misnomer. Barker offers the following summation:

> …a committed company of players will surely be working towards minimizing random changes between performances. They will seek a plateau where everything in a production is controlled, where characterization is organic and consistent, movements are choreographed, timed and effective, where dialogue is delivered with the patina of appropriate emotion, and so on. [3]

The problem with Barker's position is that it assumes standardisation to be the overall goal of theatrical performance. As such it overlooks the argument that it is theatre's very resistance to standardisation, by virtue of its 'liveness', that gives the medium its vibrancy. A medium for which plateaus are deadly and the infinite permutations of live interactions are exploited to avoid (or at least defer) them for as long as possible. Indeed, from this perspective, digital-Foley techniques also offer an approach which grants performers a degree of improvisational flexibility and thereby helps retain the energy and spontaneity of the rehearsal process.

Placing the Foley artists in view of the audience added a third contributing factor to the circuit, as actors, audience, and Foley-artists reacted to and influenced each other in a variety of unique and intersecting ways. At a basic level the combination of visual and sonic spectacle had a direct affect on the audience who responded with clear enthusiasm for the way in which horror, suspense, and gore was rendered. In addition to the ephemeral energy exchange that develops in live situations which participants (in this case actors, Foley artists, and audience) contribute and respond to, there were more tangible signals that the Foley artists picked up on; vocal exclamations, covering of eyes, leaning forward in their seats etc., which could be exploited for maximum effect.

Using electronic and digtal-Foley devices in projects such as *Dead by Dawn* has revealed a set of principles that demonstrate the potential and practicalities of adopting a process utilising digital-Foley techniques within a live performance context [4] [5].

Digital-Foley for Live Performance:

1. Creates a communicative circuit between actors, Foley artists, and audience.
2. Enables and encourages improvisatory patterns within set parameters.
3. Allows sonic outcomes to be achieved through intuitive instinctive interaction and skill-based performance behaviours.
4. Grants control over the spectromorphic shape of the sounds played and the composition to which they contribute.
5. Provides the freedom to move quickly across numerous sound sources thereby enabling complex sound transformations to be performed.
6. Can introduce an engaging visual dynamic into the performance.

Digital-Foley instruments that enable a high level of sonic interaction (like the Benemin) demonstrate the performative potential of digital-Foley. These factors invite comparisons to live musical accompaniments which also operate within similar parameters. Indeed, the creative possibilities this divergence between sound and music creates are also referred to by Visell who makes the following observations:

> A device that generates sounds in a continuous fashion as we interact with it is like a musical instrument, its interactive response arguably affords a measure of creative expression to its user… This includes the sense of effort needed to produce a response, the role of a gesture in parametrically modulating or energetically exciting a sound source, or the way in which sensor data are mapped to sound synthesis parameters. [6]

3. *METROPOLIS*

It is with these principles and our pervious experiences in mind that we are approaching our current performance project, a multimedia adaptation of the novel and film *Metropolis* [7] [8]. This production will consist of scenes from Lang's 1927 silent film, interspersed with sequences of live radio drama, animated projections, and theatrical interpretations of the events, sub-plots, and additional details included in the novel. The first task we have set ourselves is to design the sound created by the machines that power the city of Metropolis. This will provide a sonic motif that runs throughout the production. The first part of this process has been to put together a palette of sound effects and develop the digital-Foley devices upon which they can be performed.

Live Foley effects performed alongside a musical accompaniment was a fairly conventional practice in early cinema. However, the standard and appropriateness of the Foley accompaniment varied greatly and tended to be inaccurate, overdone, and badly operated. The critics of the era identified two main problems. Firstly, although the Foley devices used were well established in the theatre, the operators employed in the cinemas consisted mainly of poorly paid boys who were neither skilled nor subtle in the execution of their duties [9]. Secondly, attempting to match the photographic realism on screen with a realistic diegetic soundscape was a virtually impossible task because the effects were all generated manually. As one critic put it, 'the sound artist would have to have as many hands as a centipede has legs, and about a carload of effects …' [9]

The solution developed in the 1910's was the Allefex Machine (Figure 3). This small unit housed hundreds of sound effects that could be manually generated by a single operator. In addition, according to one reviewer, the machine was even easy to use:

> Another striking feature is that its operation demands the minimum of practice, for the majority of the effects are produced by straightforward action. It is only here and there that a little practice is required, such as, for instance, to imitate the bark of a dog, or the cry of a baby. [10]

Despite such inventions live Foley for Silent Film became less popular and gradually receded during the nineteen-twenties, before becoming obsolete with the advent of sound film. Nonetheless, this early foray into film Foley did have its supporters.
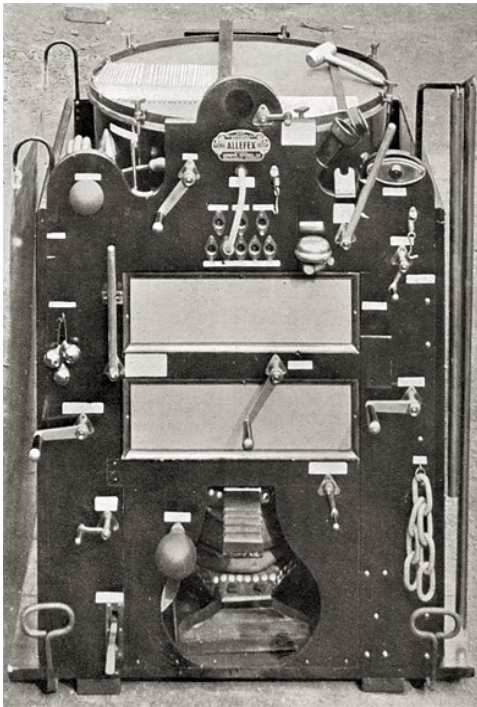

Figure 3. Allefex Machine

While the main priority these advocates identify is the importance of rehearsal and subtlety, the critic Stephen Bush also suggested that sound effects needed to be considered from a psychological perspective: 'Each picture must be studied by itself and only such effects introduced as have a psychological bearing on the situation depicted on the screen.' [9] Bush's terminology prompts the consideration of how sound effects inform and shape the audience's experience. From this perspective, the sound effects are not simply produced in the name of verisimilitude to fill the sonic void of a silent medium. Instead, they share and contribute to the atmosphere, mood, and emotional milieu of the storyworld depicted. This potential Bush identifies provides a useful parameter to consider when composing a Foley accompaniment (digital or otherwise) for a silent film. In the Metropolis project it is a factor that has had a particularly important bearing upon our current experiments in creating the sounds of the machines that are shown or described in the two primary sources on which the project is based (Lang's film and Harbou's novel),

The images that accompany the opening moments of the film are pistons pumping, spinning wheels, ceramic insulators, a rotating prime collector, alternators and cogs. Lang's film also features three machines that provide both the setting and impetus for narrative progression. The first of these is the 'Moloch'; a huge steam driven machine powering pistons that transform into the mechanical teeth of a people eating god during a hallucination scene (Figure 4). Twelve workers are positioned across the front of the machine where they perform a series of relentless mechanical gestures in order to operate it.
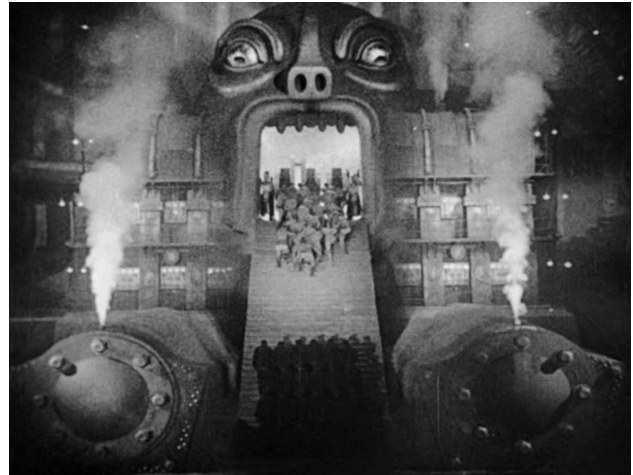

Figure 4. Moloch Machine

The second is 'Paternoster'; a one man machine cruelly designed to require three hands to operate (Figure 5). Also referred to as 'the Crucifix Machine' (due to the position the operator may have to adopt) this dial based machine has three metal arms that have to be moved simultaneously in order to correspond with illuminated lights.

Figure 5. Paternoster Machine

The final machine is the Heart Machine (Figure 6); maintained and controlled by the most senior foreman (Grot) this is the machine upon which the running of all the other machines is

contingent. In the final stages of the film the machine is accelerated to full power; an act of sabotage which sends it into overdrive, generating bolts of electricity before finally breaking to pieces.
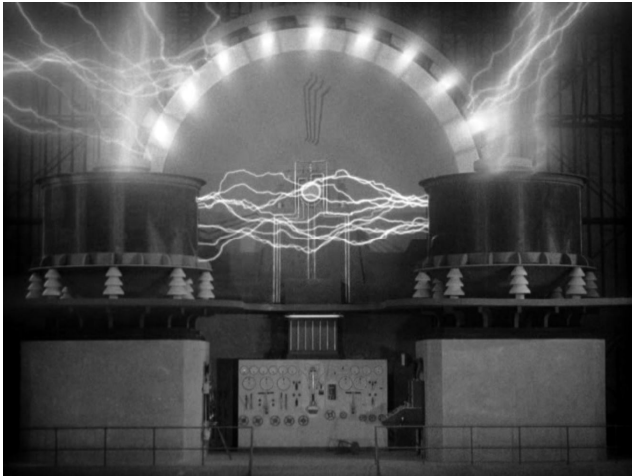
Figure 6. Heart Machine

Despite their silent rendering the depiction of these three machines at work carries and conveys a powerful sonic signature. In *The Haunted Screen*, Eisner goes so far as to suggest that imagery has an almost synesthetic affect on the viewer:

> On the rare occasions when Lang relaxes his hold on the lighting effects, we suddenly notice that the machines have practically no raison d'etre: they do no more than compose a kind of moving background, an accompaniment, a sort of noises-off; in the noisy visual orchestration of Metropolis – a silent film – we can almost hear them …" [11]

Harbou's novel also provides a number of descriptions detailing the noise created by these machines from a variety of perspectives. The most detailed of these is her account of the 'shift change'. The description Harbou gives of this moment is repeated three times during the novel and it provides an evocative and detailed articulation of the noise created and its sonic parallels:

> Exhausted to death, drunken with weariness, he heard, with a sudden wince, that the air around him was becoming filled with an overpowering sound. It was an immeasurably glorious and transporting sound, as deep and rumbling as and more powerful than any sound on earth. The voice of the sea when it is angry, the voice of the falling torrents, the voice of very close thunder-storms would be miserably drowned in this Behmouth-din. Without being shrill it penetrated all walls and, as long as it lasted, all things seemed to swing in it. It was omnipresent, coming from the heights and from depths, being beautiful and horrible, being an irresistible command. It was high above the town. It was the voice of the town. Metropolis raised her voice. The machines of Metropolis roared; they wanted to be fed. [7]

This combination of visual and descriptive material suggests components of the sonic palette with which to experiment, as well as providing a framework in which to explore the physical relationship between the digital-Foley artist, the sounds they manipulate, and those that respond to them.

At the most fundamental level, there is the direct relationship between Foley artist and sound-object. In this respect, technology can be used to heighten the sense of physical connection between the two, thereby affording the sound-object a hitherto inaccessible palpable dimension. For example, a simple squeezing action can be mapped across a range that requires the Foley artist to exert only the most delicate of pressures at one end, while reaching extreme levels of a given parameter is so difficult that the operator has to seemingly 'crush' the trigger-device to achieve maximum effect. This alternative method of triggering and control is one which we have experimented with when generating the sounds that aurally animate the heart machine and its destruction. When the machine is running smoothly its soothing pulsing hum can be triggered with soft rhythmical movements from the Foley artist. However, as it gradually spins out of control the operator is required to adopt ever more physically assertive playing techniques.

Breath can also be used to offer a range of manipulation which requires only gentle exhalation to activate one end of the spectrum, whilst a far more forceful approach is needed to reach the other. Such technology essentially converts the breathing process into an act which controls and manipulates sonic scales and textures in a manner comparable to a musician. For the purposes of the *Metropolis* project the Foley artist's breath will be used to aurally encapsulate the steam belching, worker guzzling, Moloch machine. Another method used in these scenes draws on the electroacoustic work of Trevor Wishart (Vox Cycle 1990), a sonic artist who uses a phase vocoder to morph between sounds. By adapting this process with a realtime audio morphing plugin the Foley artist can blend audio sources to create hybrid sounds; morphing a human voice into the rattle of a machine gun, the revolution of pistons, or the hum of a machine.

Another interactive relationship that this way of working enables is between the Foley artist and actors. In our adaptation of *Metropolis* the scene featuring the Paternoster machine will be performed live. This creates opportunities for the sound-production to be completed by an actor on stage, using traditional mechanical methods, whilst the actions that they are required to perform are governed by the digital-Foley artist. Using a tablet or three simple dials, the digital-Foley artist can trigger the lights that dictate where the actor needs to move the three arms in order to produce the desired combination of sounds. Correctly completing these tasks will be a time sensitive operation and produce a sonorous and choric sound that juxtaposes the physical effort exerted. Resistance to movement within the interface could be of considerable value too. For example, by making it significantly harder (or easier) to physically work the machine the actor (and through them the audience) will further experience the strength sapping nature of this labour. In effect, the actor is presented as a tortured puppet remotely controlled by the languid finger movements of the Foley artist, sentenced to underscore their own faltering efforts with a soundscape of their own creation.

Lastly, there is the relationship between the Foley artist, the sound-object and the audience. Though there are various ways in

which sound can be used to convey the nature and substance of these machines, it is also important that the audience 'feel' the power and control they wield. Low drones, rumbles and pulses played through subwoofer speakers are a very effective technique for creating a physiological connection between sound and audience. Similarly, panning sound across a stereophonic or quadraphonic field can be employed to disorientate the audience's senses. Through experimentation we have explored the potential of repurposing low-cost games controllers, such as the Nintendo Wii Remote (and Nunchuk), within these spatial contexts. As well as featuring two joystick controls and a variety of switches, such devices contain gyroscope sensors which can provide an intuitive method for mapping physical gestures to movement on a 2D plane. For instance, 'roll' could control stereo panning, whilst 'pitch' (in a directional rather than musical sense) could control vertical placement.

4. CONCLUSION

The digital age we have entered has transfigured the way in which sonic material can be produced, manipulated, and played. Digitally captured audio samples can be controlled across numerous parameters through both traditional and innovative methods. Furthermore, the reduction in the level of manual interaction required opens up new possibilities for the physical manipulation of sound. In this respect, physical computing can enable the Foley artist to work with digitised 'concrete' sounds whilst also maintaining a sense of tangibility. Similarly, the ability to respond to actions unfolding in real time that digital-Foley allows is another key factor guiding the experiments in which we are currently engaged. It is the exploration of these possibilities that lies at the heart of the project we have termed 'digital-Foley for live performance'. The interfaces, interactions and sonic palettes are still emerging but as the project develops we are beginning to establish the founding principles and process through which we hope to establish our future working practice.

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