FOUNDATIONS OF INTERACTIVE SOUND DESIGN FOR TRADITIONAL STORYTELLING

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ABSTRACT

The traditional practice of oral storytelling has particular characteristics that make it amenable to extending with interactive electroacoustic sound. Recent developments in mobile device and sound generation technologies are also lending themselves to the particular practices of the traditional art form. This paper establishes a context for interactive sound design in a domain that has been little explored in order to create an agenda for future research.

The goal is to identify the opportunities and constraints for sound particularly suited to live storytelling, and to identify criteria for evaluating interaction designs. The storytelling domain addressed includes not only particular instances of telling, but also the variability of stories between tellers and tellers, as well as the mechanisms by which stories are passed between tellers. The outcome of the research will be a computer-based platform providing storytellers with the ability to create auditory scenes, sonic elements, and vocal transformations that are controllable in real time in order to support the telling, retelling, and sharing of stories.

1. INTRODUCTION

There is a tremendous variety of storytelling traditions across cultures extending back to (and frequently even explaining) the very beginning of time. For the purposes of this paper, we consider “traditional storytelling” to be characterized by a single teller addressing an audience using speech, physical gestures, props, and non-speech sounds. Sounds might be generated vocally, with physical gesture, or with a sound-making device which could be anything from a staff to a percussion or musical instrument. Stories are in general fluid and involve improvisational components, and as part of an oral tradition, are passed from one person to another unencumbered by physical or technological baggage. The objective of the research agenda outlined here is to provide wider access to sound for storytellers than the traditional vocal and instrumental techniques provided, and to do so without disrupting their long-established modes of practice.

This “design research” formulation implies some stringent constraints which will be studied by working with storytellers themselves.

Hand-held, sensor-rich, devices such as the Wii controllers, as well as those with touch screen devices such as iPods, mobile phones and tablets, have demonstrated their effectiveness for sonic interaction in countless musical works such as those produced by the MoPho Orchestra (Wang, Esil, & Penttinen, 2008). A hand-held device imposes minimal constraints on, and can be designed to be sensitive to the kinds of physical gestures storytellers typically make with other hand-held props or instruments or when their hands are free. The sound control, generation, and transformations for these devices are no longer critically limited by computational power. For these reasons, this platform seems an ideal candidate to provide the extension of the sound palette for storytelling. However, there remain several outstanding challenges:

1. How to design an interface that works for the possibly very many sounds a story requires.
   a. The physical interaction must be appropriate for all the sounds.
   b. It cannot require physical gestures that detract from the story.
   c. It must be easily learnable.
   d. It cannot require cognitive bandwidth that detracts from the storytelling.

2. How to represent sounds to accommodate the flexibility and improvisation that characterizes the stories the teller will accompany.

3. How to represent the sounds in such a way that they can be customized by different tellers.

4. How to represent the story with sounds in such a way that the whole package can be passed as fluently between tellers as stories are in the classical oral tradition.

The term “rig” will be used for the collection and organization of sounds and interfaces that are prepared in advance for a given story.

2. BACKGROUND

In most oral storytelling traditions, stories are generally not told verbatim from memory, nor are they entirely made up on the spot as they are told. They are instead typically passed from teller to teller, over generations, and sometimes over thousands of years (e.g. the Ramayana) undergoing constant mutation. For example, one can find dozens of variations of Little Red Riding Hood (many of which have been written down) – told for different purposes, and frozen at different times and locations in the course of their mutations. Red Riding Hood tales differ in every detail from the age group of the targeted audience, to who gets eaten in the end. Even stories that are read aloud are delivered differently each time they are presented. Thus one fundamental characteristic of storytelling is its combination of prepared material and structures with variability and improvisation.

A teller is armed with a variety of prepared elements to support an otherwise improvised tale. In addition to plot elements, characters, voices, specific memorized lines, and gestural and theatrical elements, there might also be a variety of props, media, puppets, and musical instruments ready to support a tale. The guitar is one of the most story-tellingly strong accompaniment instruments ready to support a tale. The guitar is one of the most story-tellingly strong accompaniment instruments ready to support a tale. The guitar is one of the most story-tellingly strong accompaniment instruments ready to support a tale. The guitar is one of the most story-tellingly strong accompaniment instruments ready to support a tale.

3. ASPECTS OF SOUND AND STORY

3.1. Auditory Scenes

Sound has many unique qualities that make it an important part of storytelling (no matter what the form). Sound can create atmosphere in ways that neither words nor images can, evoking a strong sense of space and place (Schaefer, 1994). For example, the sound of fog horns, seagulls, water lapping, and an irregular pattern of metallic “dings” of ropes hitting masts can locate us at the waterfront. We can be positioned in historical time by, for example, the kind of ring a telephone makes, or the particular quality of engine sounds.

Sounds can inform us about things we can’t see, and nondiegetic sound (Chion, 1990) can set mood. Environmental scenes are difficult for a storyteller to create by traditional means, but stylized versions are sometimes created with the help of instruments.

Specific sound effects are also frequently called upon by the storyteller. They might be made vocally (the “tummy-scratch” of the hobbled man who creeps up on unsuspecting campers) or with the help of the hands and feet. Instruments are also sometimes used for extraneous sound effects, such as a clock or door knocking. In the Tholu Bommalattam theater of Tamil Nadu, the storyteller sometimes sole performer of puppets, music, and sound effects rigs up a puppet on planks that can be clapped with his foot when needed (Verle-Burger, 1997). Enriching the palette of sounds available to the storyteller for creating scenes and specific effects or even abstract sounds and music with technology would be a natural extension to the vocabulary and traditional practice of the storyteller.

A vast explosion of the sound palette could be supplied by synthetic sound. A further advantage that synthetic sound would have over physical instruments is that they could be designed to be flexible for real-time manipulation by the performer, for example, may need to wax and wane through rage calm as the story unfolds. A range of techniques from physical modelling (Cook, 1997; Smith, 1990) to acoustic modelling (Arbib, D., 1979; Horner, Beauchamp, & Haken, 1993; Serra, 1997; Wyse, 2004), and sample based techniques can be used to provide flexible, interactive, and when appropriate, realistic sounds under the real-time control of a storyteller.

3.2. Text and sound

One of the most important elements of storytelling is the creation of voices for different characters. The sonic rig would offer the storyteller new possibilities for extending their voice for characters as well as for other sounds.

Of course, manipulating the voice has long been an important part of synthetic and electroacoustic sound arts. Karlheinz Stockhausen in Gesange der Junglinge (1955-56), for example, explored the relationships between voice and synthetic sound with the use of electronic and tape techniques for manipulation. Live electronic processing of voice has also been used in text
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sound and sound poetry by artists such as the Swedish Bengt Johnson and Lars-Gunnar Boden, although much of this work is targeted towards noise and sound as a social or political phenomenon, such sounds are created with a purpose and a structure that can also be understood as music.

3.3. Interaction

One of the most challenging aspects of integrating a sound rig into the storytelling performance is the interaction design. Constraints and challenges come from several aspects of the specific performance culture. The roots of storytelling are grounded in personal, family, and community contexts that do not always bear a resemblance to the concert auditorium. Storytelling has also always been accessible and practiced by communities of every economic stratum. It would be self-defeating to design a system necessitating expensive unobtrusive wearable sensors (Kapur et al., 2005) which have become so widely available. Another is to consider mobile devices such as phones and tablets as a platform. In large parts of the world, mobile phones are far more pervasive and affordable than personal computers. New devices are rich in sensors, and have processes with ample power for complex sound synthesis (Estil & Wanderley, 2004). An effective strategy for amplifying sound from mobile devices is an open question, though one interesting wearable solution has been demonstrated (Cheliotis & Yew, 2009).

Another challenge for the development of a sound interface is the nature of story's delivery. The storyteller's hands and eyes are busy with expression and communication, so an interface demanding visual attention is out of the question. It is clear that an ideal instrument would burden the already fully engaged body as little as possible. It would be well to then the gestures that a storyteller otherwise makes. Wearables and hand-held mobile phones again seem well suited to this purpose. Sounds need to be as flexible as necessary for the specific demands of the story, but not more so in order to minimize the cognitive load of dynamic control strategies for a heterogeneous collection of sounds. Mapping strategies (Hunt, et al. 2003; Wanderley & Depalle, 2004; Pendharkar, Gurevich, & Wyse, 2006) could play a key role for this design goal. The spatial nature of sound is also important for creating a sense of place and realism. Sounds must exist in the proper environment (e.g. room size, resonance, and reverberation qualities), and perhaps most suggestive of the need for real-time control, sounds need to move through space depending on the storytellers needs.

3.4. Rigs as social media

Stories in oral traditions often spread from teller to teller and come down through the ages. They are passed between tellers with no dependence upon physical support mechanisms - if one hears a story, one has it. In this way too, stories can simultaneously be passed from one to many peoples since there is no single and authentic copy. This property of stories is mirrored in the nature of digital media as well (much to the chagrin of producers and distributers).

Another important implication of the oral mode of transfer itself is that it facilitates, indeed insures, variability. This kind of mutability also bears a striking kinship to what we now call social media (Cheliotis & Yew, 2009). CCmister (“ccmister,” n.d.) for example, is website through which people share, transform, and mix audio samples to create new works that are again shared. Because of the interactive and computer-coded foundations of the proposed sound rigs, if the oral traditions of sharing and mutability are to be respected then something like a social media network is called for. The means of interaction with digital media are more complicated than for the fixed media delivery vehicle of CCmister works. While many people with lay skill are capable of mixing and editing audio and video files, developing interactive environments is more specialized. Graphical coding and scripting may help address this issue, and Max/MSP patch sharing or game “modding” cultures (Saucchi, 2004) are potentially useful models.

3.5. Prototype

Although the goal of this paper is to articulate a research agenda, the specific platform choices that must be made have important implications for the feasibility of meeting the design criteria. For that reason, several experimental prototypes have been developed. One promising version utilizes JavaScript, HTML5, and the Web Audio API (a draft proposal to the W3C with implementations available for WebKit-based browsers). A server running on a low-latency local network configures controllers and synthesizers via plain URLs and performs real-time message routing between them. Sensors and touch screen activity on mobile devices are accessed through the JavaScript API provided by mobile browsers. Synthesis capability is provided by the WebKit browser running on computers on the same network. The advantages of this system with respect to the design criteria identified in this paper are that

1) It is accessible - there is no need to download any application specific code to the mobile device and it just works on major mobile platforms.

2) Web-based authoring tools for this platform can be developed to minimize the skills needed to customize sounds in ways consistent with the mutability of stories, and

3) The sound rig lives in the “cloud” which means that the platforms for performing, customizing, and most importantly, for sharing the stories are identical.

4. CONCLUSION

We have identified the key opportunities and constraints for the design of an interactive sound system to accompany storytellers, as well as to support a social networking-like infrastructure modelled on oral traditions for passing evolving versions of code-based media between practitioners.

In this paper we have attempted to identify the characteristics that define the genre, and interpret them as design constraints on a system the offers new sonic capabilities to storytelling. A prototype was developed on a system that embodies many of these first-iteration design goals, notably a platform for transmitting stories in an easy and flexible way between people.

The goal of the research is not to revolutionize storytelling with a “disruptive” technology, but rather to integrate the wonderful capabilities of interactive media into the existing fabric of the storyteller's art. The motivation is that by providing these capabilities to the storyteller the world might as well appeal to a new generation, and develop in new ways without sacrificing the live and improvisational qualities not possessed by its more popular “big media” rivals such as television, film. This approach is based in the belief that preserving a tradition does not mean freezing it, but rather enabling it to adapt to a new context without its essence getting lost or obliterated.

5. ACKNOWLEDGEMENTS

This work was supported by Singapore MOE grant FY2011- RCR3-003, “Folk Media: Interactive sonic rigs for traditional storytelling.”

6. REFERENCES


sound and sound poetry by artists such as the Swedish Bengt Johnson and Lars-Gunnar Boden, although much of this work never reached large audiences because the control must be intimately coordinated with the vocal work of the storyteller. Microphones and amplification already commonly support storytellers, but well-designed hand-held interfaces are all that is needed for the storyteller to have dynamic control of how their voice sounds to the audience.

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One approach to addressing this issue is to use inexpensive unobtrusive sensors (Kapur et al., 2005) which have become so widely available. Another is to consider mobile devices such as phones and tablets as a platform. In large parts of the world, mobile phones are far more pervasive and affordable than personal computers. New devices are rich in sensors, and have processors with ample power for complex sound synthesis (Essl & Müller, 2010). An effective strategy for amplifying sound from mobile devices is an open question, though one interesting wearable solution has been demonstrated (Kapur et al., 2010).

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SYNCHRONISATION AND ITS APPLICATION IN MUSIC SYSTEMS

Andrew Lambert

ABSTRACT
Non-linear and chaotic dynamics, predominantly used in engineering, have become a pervasive influence in contemporary culture. Artists, philosophers and commentators are increasingly drawing upon the richness of these systems in their work. This paper explores one area of this territory: the synchronisation of a population of non-linear oscillators used for the generation of rhythm as applied in musical systems.

Synchronisation is taken as a basis for complex rhythmic dynamics. Through the self-organisation notion of stigmergy, where entities are indirectly influenced by each other, the notion of local field coupling is introduced as a qualitatively stigmergic alternative to the Kuramoto model and noise, distance, delay and influence are incorporated.

An interactive system of stigmergic synchronised oscillators was developed, that is open to be used across many fields. The user is allowed to become part of the stigmergy through influencing the environment. The system is then applied to the field of music, generating rhythms and sounds by mapping its state.

1. INTRODUCTION
Oscillator synchronisation is a potential biological root of musical creativity. Through oscillation, interesting musical behaviour can be achieved.

In section 2, stigmergy, a notion where entities are environmentally influenced by each other, is used as the mode of exploration into self-organisation. The Kuramoto model is introduced as a powerful and elegant mathematical formula describing the phenomena of oscillator synchronisation in the natural world. However, since synchronisation has its roots in self-organisation, the Kuramoto model encounters a problem and falls short of complete plausibility. An alternative model, local field coupling, derived from Kuramoto and other methods of oscillator synchronisation taken from biology and neuroscience, is described to solve this problem.

Section 3 discusses theories from the fields of chronobiology and biomusicology, which use oscillator synchronisation phenomena to explain many forms of behaviours in living systems. A clearly rhythmic, but not necessarily creatively musical behaviour is achievable through stigmergic synchronisation, termed protomusical behaviour.

An interactive system developed by the author, Crickets, is detailed in section 4. Crickets is an environment in which low-level creativity is achievable through biologically inspired protomusical behaviour. The protomusical behaviour generated by the system is able to be used in many applications across disciplines.

2. SELF-ORGANISATION AND OSCILLATION

2.1. Stigmergy
A self-organising system is a system that forms a pattern or order without a central control mechanism or external influence. The pattern is formed instead via interactions on a local scale, with each part of the system knowing nothing of the global effect of these interactions. Self-organisation is interfused with two other related terms, emergence and stigmergy, which seek to encapsulate organisation is interlinked with two other related terms, emergence and stigmergy, which seek to encapsulate organisation from differing viewpoints.

In emergent behaviour, a set of properties or rules are defined through which a sophisticated pattern not present in the design of these rules is revealed [2], [16]. The main criticism of emergence is that an observer must be present. It is only via external observation that emergent behaviour is defined. Agents within the system, by their very nature, cannot intend to produce emergence as that will defeat the point. Furthermore, it is the observer that labels that outcome of the process a ‘pattern’ prior to being an emergent pattern. This leads to the area being difficult to study with great accuracy.

Stigmergy on the other hand circumvents this problem through its own definition. It is another term that has its roots in the natural sciences, being devised to explain the control of collective behaviour of social insects such as ants and bees [21]. It is a notion common today in many agent based simulations, in that the agents remain independent entities. Their interactions with the environment affect the behaviour of the other agents, which in turn affects them. Stigmergy is therefore defined as pattern formation in a collective via an interaction with an environmental mediator.

A common example of Stigmergy is an ant following a pheromone trail to a food source. The ant is merely following a trail it senses in the environment. The ant in turn leaves behind a trail of its own, thus strengthening...