Mobile Sound Communities
Sonifying a Shared Landscape

William Carter
Division of Interactive Media | CNTV
University of Southern California

Abstract: This paper describes a research project aimed at developing authoring tools for the collaborative creation of soundscapes and an associated system for the storage and playback of those soundscapes in a physical environment.

Key Words: Mobile Communities, Emergent Systems, Sound Ecologies, Embedded Data, Soundscapes, Location Authoring

I. INTRODUCTION: MOBILE DEVICES, SOUND AND COMMUNITY

Mobile Devices offer users the ability to form new relationships with the environment by providing them access to virtual layers of information that are embedded on the physical world. In a simplified example of this embedded media, a book store could send an SMS message to a user, who is equipped with an integrated GPS cell phone, a list of books on sale as the user comes within a certain proximity of the store. In this example, the physical location of the bookshop is embedded with data that details current bargains. Digital Media—in this case text—is layered on top of a physical space.

With this new environmental awareness, users forge new and unique experiences with the physical world. However, much of the recent discourse surrounding mobile media is typically centered upon a single user, documenting an individual's emerging awareness of new virtual layers and the myriad information embedded within them. Even more, social tools, such as keitai dating services in Japan, or AT&T's Find Friends system, still promote connections that have already been explicitly articulated by an individual user. All these tools are worthwhile, but what is often overlooked is the importance of community within virtually embedded environments—the existence of discrete, idiosyncratic spaces forged through community and shaped by community members. Social software tools make us aware of our community of friends, but they do not enable a greater consciousness of the communities in which we live.

At the same time, the lack of location-based communities in the mobile media sphere is not an intrinsic flaw of the tools used to access these spaces. Mobile devices can have a significant effect on this internal sense of community. Howard Rheingold, in his book *Smart Mobs* and its accompanying weblog,[1] writes extensively about the ability of mobile phones to articulate community. Be it Filipino citizens staging political demonstrations after receiving mass text messages, or WTO protesters organizing resistance through various mobile devices, Rheingold sees mobile platforms as powerful

[1] The Website for Smart Mobs, http://www.smartmobs.com, is maintained and updated regularly by Howard Rheingold and a group of researchers who post developing mobile research, tools, and technologies that extend material presented in the book.

tools in the creation of community.[2] Studying what he calls the teenage "thumb tribes" of Japan, he notes that mobile phones allow these youths to "construct a networked alternative space that is available from anywhere they are."[3] Rheingold's insight into mobile communities, therefore, is based upon the fundamental notion that mobile devices give their users the ability to construct spaces or create communities that are also mobile—relationships and alternative spaces that move along with the user wherever they go. What is missing from this conception of mobile communities, however, is the important aspect of location-awareness.

With the growth of the Internet, physical location has become less important in our conception of space. British expatriates can read the BBC online, or get soccer scores streamed to their mobile phone. A driver in Los Angeles can check current freeway speeds from the net at sigalert.com, or a displaced skier can view images streaming from webcams of their favorite ski resorts. As a result, we have become increasingly disconnected with the physical space in which we exist. As mobile devices become increasingly aware of their position on the planet, and even inside buildings and rooms, they become a means by which we can begin to reconnect to this physical space and reestablish the important sense of community built by living and moving within a shared environment.

Indeed, there have been a number of efforts in the mobile media arena to emphasize our physical presence within space. The paradigm established thus far has largely been one of mapping textual or graphical elements to location—connecting users to places visually. However, we often most readily recognize these important community landscapes by ear, listening to music emanating from an open apartment window, or overhearing a conversation in a foreign tongue. The city of Vancouver has consistently recognized the effect of sound on their urban community, harboring a city Urban Noise task force that constantly surveys the population in an effort to maintain a more appealing soundscape. The World Soundscape Project at San Francisco University, throughout the 1970s and 1980s, investigated the soundscapes of numerous other communities, and attempted to draw attention to these important sonic environments.[4] Sound and music are an important means by which we establish relationships with communities, and therefore are important tools we can use to reconnect with our surrounding environments.

As evidenced, many of the current soundscape projects are involved with cataloging a preexisting sonic landscape, rural and urban alike. Projects such as Ear to the Ground at Bell Labs aim even aim to further extend this representational conception of soundscape by attempting to sonify the data and information flow along our computer networks.[5] In contrast, the goal of this research is to grow new, discrete sonic ecosystems—not simply representations—through the use of mobile technologies that articulate the fundamental qualities of a given community. By allowing users to generate distinct sounds on a mobile device and plant them in a shared virtual layer, embedded

---

[2] Howard Rheingold, *Smart Mobs: The Next Social Revolution* (Cambridge: Perseus Publishing, 2002), 157-158.
[3] Ibid., 5.
[4] City Noise: http://www.city.vancouver.bc.ca/ctyclerk/cclerk/970513/citynoisereport/
WSP: http://www.sfu.ca/~truax/wsp.html
[5] Bell Labs…

within the geographic space of the community, the community is given the ability to generate a soundscape that mirrors it's authors. By promoting collaborative authoring of a shared location, this research aims to reconnect mobile users to the physical locations and communities in which they exist.

II. CONTEXT | RELATED WORK

While a number of researchers have recently been focusing either on mobile communities or emergent soundscapes, there has been little current work that attempts to bring these two areas together. Rodney Brooks' work with sound communities, most notably the alife music of Feeping Creatures and Gakki-mon Planet, have dealt with the creation of simple sound modules that create music through their interactions with each other.[6] While such systems generate highly dynamic and interesting sound and music, the user mainly plays the role of listener, subject to the twists and turns of the virtual music-makers. Certain systems, such as John Kilma's Glasbead, and SMDK's installation SimulationSoundMosaic, take the idea of community a step farther, allowing groups of users a more active role in the creation of content. Glasbead allows users to manipulate and exchange sound files to create different musical and sonic sequences.[7] SimulationSoundMosaic takes a similar route, compiling a database of user submitted sounds, then planting them in an installation space and listening to the evolution that occurs based upon the relationships between sounds.[8] Although both Brooks and SMDK created virtual communities to generate sonic landscapes, their communities are not meant to correlate to any physical space, but rather virtual ones. In these works, music and sound are generated by emergent behavior, which simulates the complex nature of community. But furthermore, each piece also does not employ any system that serves to tie users to the location in which that community exists. A separation between location and community still exists.

Mobile media projects have perhaps taken the biggest strides forward in regard to this relationship between users and their physical locations. Scott Fisher's work at Keio University developed a model for authoring media content linked to physical locations, and SoMa's Urban Tapestries Project in London allow users to access and author location-specific content, and in the process create a large web of virtual annotations of an urban environment.[9] By simply allowing community members to collaboratively author and annotate virtual layers upon real spaces, much of the current mobile research is more directly addressing the reconnection of individuals with their environments, yet for the most part sound is still largely ignored as a viable aspect of mobile media. One project that has made strides towards a compelling location-audio system is the Hear&There project by Joey Rozier and Karrie Karahalios at MIT Media Lab. Users of this system create "SoundSpots" at real world locations that are then accessed by any Hear&There equipped person.[10] However, while this project is location based, it requires

---

[6] Brooks, Feeping Creatures, Gakki-mon Planet
[7] Glasbead
[8] SMDK
[9] Urban Tapestries, MR Annotation Fisher
[10] Joey Rozier, Hear&There

an elaborate interface to retrieve sound files. The Mobile Sound Communities project is an effort to reconcile the power of increasingly ubiquitous mobile platforms to reconnect users to physical space, with the social and cultural power of environmental soundscapes.

RESEARCH DESCRIPTION

a. Authoring Space

To realize this objective, the project allows authors to create their own sounds using a Tablet PC and proprietary synthesis software. Clicking and dragging in the authoring window offers users the ability to create different rectangles, the shape of each

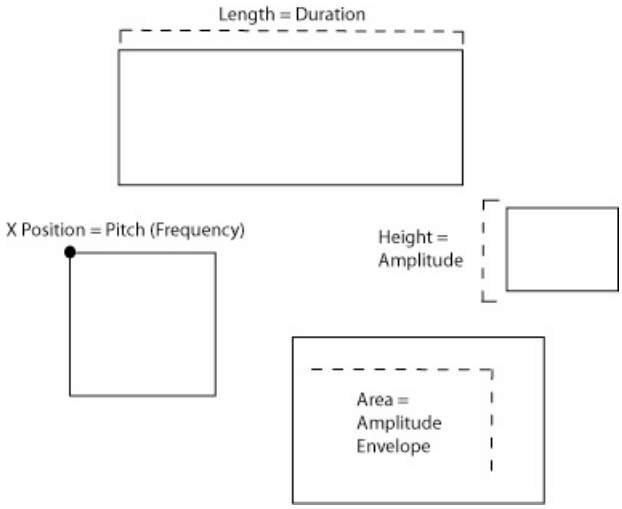

Figure A: Extrapolation of Sonic Qualities from simple rectangle

determining the quality of the sound based on certain rules [Figure A]. The software is largely exploratory, asking the user to click and drag out shapes, listening to how different creations affect the attributes of the sound, rather then giving them instructions on exactly how the synthesis engine makes the extrapolation [Figure B].

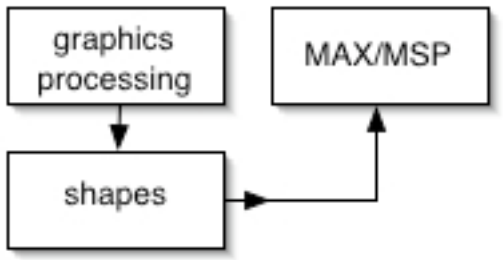

Figure B: Authoring Flow

Since this creation process is largely a learning experience for new authors, they are therefore given the ability to preview their sounds, making necessary adjustments before planting them in the overall sonic ecosystem. All sounds are stored in a textfile that

contains their specific attributes, along with the width and height of the rectangle. Since we live and move mainly throughout our own communities, we primarily affect the ecosystems built by our own communities. This system then, lets the user create a sound avatar represented by a graphic and stored in a texfile, that they can carry around on a mobile device and upload into sonic ecosystems that they come into contact with. The author then uploads the file, via Bluetooth, onto a main server running the ecosystem. The server is installed somewhere in the community space, displaying a graphical representation of the ecosystem, and playing the soundscape through a set of speakers. Because this system is highly concerned with the relationships between soundscape and community, Bluetooth is used to ensure that those living and moving throughout a specific location are those primarily responsible for it's authoring. As a result, sonic ecosystems will sound distinct, reflecting the motivations of the community that grew it [Figure C].

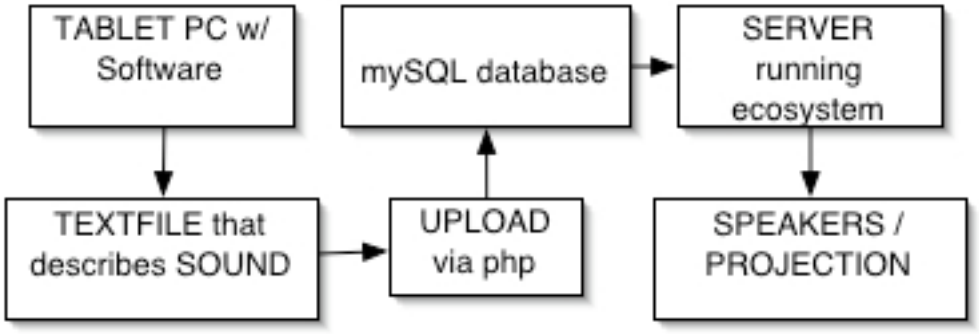

Figure C: From Authoring to Mobile Sound Community

b. User Experience

Once the textfile containing the sound description has been uploaded, it is interpreted by graphics software running on the server, which draws out every rectangle that has been uploaded into the ecosystem. Users in the area of the ecosystem can then attempt to locate their own creation within this space, the specific shape that represents their sound. Users therefore identify their sound visually within the ecosystem. These shapes then move slowly throughout the ecosystem based on simple movement algorithms until they collide with another shape. When this collision occurs, the system sends a message to the audio engine, which analyzes each sound and extrapolates a small melody based on the amplitude and frequency of the colliding sounds. The sound is then output through a set of speakers installed near the server at the physical location, and the ecosystem is displayed through a projection [Figure D]. The overall experience, then, is one that reconnects users to their community and their environment. Standing in a community space, the user watches different sound avatars interact, and listens to distinct sonic landscape beginning to emerge as a result of those relationships. Because of the probability of high diversity within these ecosystems, sound becomes more of a representation of community than of a specific real world soundscape. That is, the sound material in an ecosystem may reflect the attitudes of community members more than the

sound space of the environment itself.

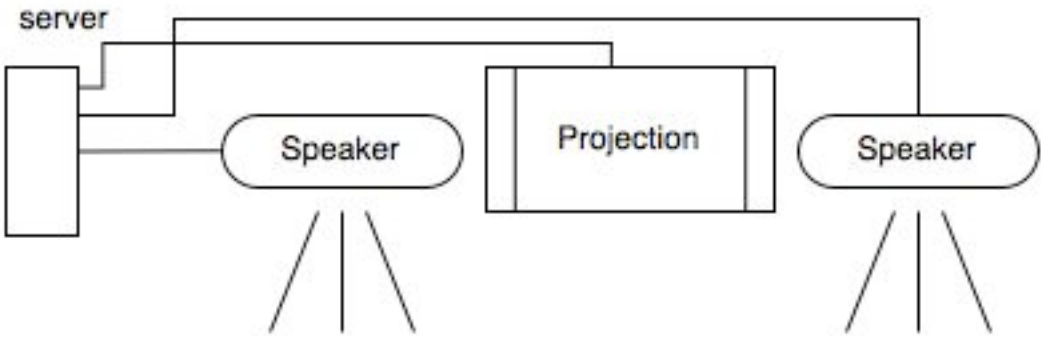

Figure D: Output

c. Example Community: University of Southern California

Los Angeles is a city based on movement. Reyner Banham, in his seminal work *Los Angeles: An Architecture of Four Ecologies* writes, "the language of design, architecture, and urbanism in Los Angeles is the language of movement. Mobility outweighs monumentality there, and the city will never be truly understood by those who cannot move through its diffuse urban texture."[11] The University of Southern California, located in the center of the city, mirrors the urban environment in which it exists. Few students live on campus, and many commute from outlying areas. Mobility is part of life at the University, but as a result, students are disconnected from the tangible location that houses their academic and social community. Installing the Mobile Sound Communities Project at USC would give students a chance to remain mobile, but to re-interface with the physical campus environment.

IMPLEMENTATION (TECHNOLOGIES)

a. File Transfer and Data Retrieval

The system runs on either a standard PC or Macintosh computer running a file server and Bluetooth. The sound textfiles are created on tablet PCs running Ben Fry and Casey Reas's Processing, and Cycling 74's MAX/MSP 4.2. The textfiles are then uploaded to the server using a Bluetooth connection. Sounds can be authored on a desktop machine running the named software, but the textfile must be then transferred to a mobile device capable of moving data via Bluetooth. Once the textfile is on the server, it is automatically read into software running in Processing, which parses the file and draws out the shape in the ecosystem.

b. Sound Engine

[11] Reyner Banham, Los Angeles: The Architecture of Four Ecologies (Los Angeles: University of California Press, 1971), 5.

When a sound is uploaded, a new sound module is created in a synthesis engine running in MAX/MSP. The module reads through the textfile and recreates the sound authored by the user. Processing performs collision detection on each module in the ecosystem, and sends a flag to MAX/MSP when two objects meet. The MAX patch then generates a musical sequence based on an algorithm that interprets the frequencies, durations, and amplitudes of each colliding sound module. The rules for the musical sequence creation are:

1. Calculate the frequencies of each colliding sound
2. Depending on the distance between the frequencies, generate a number of musical notes. If the distance between frequencies is large, there will be more notes in the sequence than if the distance between the frequencies is smaller.
3. Each note in the sequence will be based on a scale, starting from the lowest frequency and gradually getting higher until it reaches the highest frequency.
4. Average the duration of the two notes and play each note in the sequence at that average.

In many ways, this system acts as a type of emergent music engine, in that it is based upon simple algorithms that control the behavior of interactions within the ecology. While the sounds themselves do not adapt or evolve, the music that is produced is the direct result of these interactions, and therefore can drastically change as a result of the specific sonic makeup of the ecology.

CONCLUSION / FUTURE WORK

The Mobile Sound Communities project is based upon the idea of reconnecting people to location, and the communities that exist in those physical environments, through the use of collaboratively built sonic ecosystems. By creating sounds that can be stored and uploaded into physical space, communities become aware of their own physical presence, and their relationship with the areas in which they live and move. In many ways, the project is similar in intent to public murals, and even graffiti. In those forms, certain members of a neighborhood slowly create a unique visual space for their community that is defined by particular iconography or symbolism. Graffiti tags define territories of rival gangs with distinct symbols and signs, while each public mural in an area creates a sense of the spirit of the communities that foster them. For example, in the highly Catholic barrios of Central and East Los Angeles, the art reflects that decidedly religious atmosphere, while in the more contemporary arts influenced region of Silverlake, the public space takes on a more abstract and poetic tone. In many ways, the Mobile Sound Communities project seeks to achieve a similar goal as these spaces, but with more sonic sensibilities.

The future goals of this project are to develop a more complex and dynamic way to create sounds from visual elements. Currently the system allows users to create sounds from simple shapes, but could eventually move into a more complex model of sound visualization. The current developments in multi-channel audio would be a good way to explore three-dimensional visualization of sound, and would form the potential for more

complex behaviors to develop in the sonic ecosystem. Another possibility would be to move away from a textfile standard, letting users import sounds in a number of different formats. While such accessibility would increase the number of people using the system, the danger is that many communities may move away from the authoring of unique content, and simply use existing audio samples. Each community would still be responsible for the authorship of such a space, but its sense of singularity may become increasingly uncertain.

WORKS CITED

Banham, Reyner. *Los Angeles: The Architecture of Four Ecologies.* Los Angeles: University of California Press, 1971.

Brooks, Rodney. (2000). Gakki-mon Planet. *ATR Media Integration and Communication Laboratories*. http://www.mic.atr.co.jp/%7Erodney/gakkimon/gakkihome.html (17 Oct. 2003)

Berry, Rodney. (1998). Feeping Creatures. *Virtual Worlds*. http://www.virtual-worlds.net/vw98/berry.htm. (13 Oct. 2003).

Fisher, Scott S. An Authoring Tool Kit for Mixed Reality Experiences. *International Workshop on Entertainment Computing (IWEC2002*): Special Session on Mixed Reality Entertainment, May 14 -17 2002, Tokyo, Japan

Klima, J. (1998). Glasbead. *Glasbead*. http://www.cityarts.com/glasbeadweb/. (10 Nov. 2003).

Knowbotic Research. (1992). SMDK SimulationSoundMosaic. http://www.t0.or.at/~krcf/smdk/smdk1.html. (2 Nov 2003).

Rheingold, Howard. *Smart Mobs: The Next Social Revolution*. Cambridge: Perseus Publishing, 2002.

Rheingold, H. et al (2002). *Smart Mobs: The Next Social Revolution*. http://www.smartmobs.com. (3 Dec. 2003).

(2003). The World Soundscape Project. *World Soundscape Project*. http://www.sfu.ca/~truax/wsp.html. (20 Oct. 2003).

(2003). The Vancouver Soundscape. *World Soundscape Project*. http://www.sfu.ca/~truax/vanscape.html. (20 Oct. 2003).