SMULE = SONIC MEDIA: AN INTERSECTION OF THE MOBILE, MUSICAL, AND SOCIAL

Ge Wang [ωλ] *Georg Essl* [χλ] *Jeff Smith* [ωλ] *Spencer Salazar* [λ] *Perry R. Cook* [θλ] *Rob Hamilton* [ωλ]

Rebecca Fiebrink [θλ] *Jonathan Berger* [ωλ] *David Zhu* [λ] *Mattias Ljungstrom* [λ] *Arnaud Berry* [λ]

Jennifer Wu [λ] *Turner Kirk* [λ] *Elon Berger* [λ] *Jillian Segal* [λ]

Center for Computer Research in Music and Acoustics (CCRMA) Stanford University [ω]

Smule (SonicMule, Inc.) [λ]

Department of Computer Science (also Music) Princeton University [θ]

Deutsche Telekom Laboratories [χ] (also TU-Berlin)

{ge, georg, jeff, spencer, perry, rob, rebecca, jonathan, david, mattias, arnaud, jen, turner, elon, jillian}@smule.com

ABSTRACT

We explore the potential for and implications of musical (or proto-musical) social interaction and collaboration using currently available technologies embedded into mobile phones. The dynamics of this particular brand of social intercourse and the emergence of an associated aesthetic is described. The clichéd concept of a global village is made a vibrant reality by introducing instruments with inherent communal and collaborative properties. A proximate sonic connection encouraging social linkage within a microcosm is coupled with a global communal music network. We describe the development path to this paradigm describing a series of commercial iPhone applications that each introduces a unique aspect of sonic-based social community building.

1. MOTIVATION

The use of purposeful communication media devices is extensible to the notion of "non-verbal interactive sonic media". We explore aspects of technology, design, and engineering as well as the resulting implications for global social interaction and a new aesthetic for collaborative musical engagement within this framework.

Smule, a company designing and implementing tools to facilitate such musical social intercourse provides a unique platform for research and development of this new paradigm, combining computer music research with a unique potential to bring its visions to a wide population. In the first six months since Smule's inception, it has reached a user base of more than one million iPhone owners. Smule demonstrates that, through mobile, sonic, social means, it is possible to effect immediate penetration on a massive scale, creating global communities overnight.

The initial catalyst for Smule stemmed from the iPhone and its App Store, the combination of which, we believe, represents an inflection point in mobile computing. The intersection of existing technologies on the iPhone has never before been integrated into a single, personal mobile device, and deployed at such a pervasive scale. The iPhone contains a powerful CPU, GPU (graphics processing unit), multitouch (up to 5 points), three-axis accelerometer, high quality audio pipeline (two speaker outputs, microphone, headset), GPS, persistent data (via 3G, Edge, or 802.11). The iPhone software development kit contains API's to access all of these components, as well as provides libraries for concurrency, graphics (via OpenGL ES), and user interface. In terms of scale and reach, the iPhone, at the time of this writing, has an install base approaching 25 million users worldwide in over 70 countries (with a significant additional install base of iPod Touches). Meanwhile, more than 25,000 third party applications have been released in the App Store.

Figure 1. Smule's Ocarina transforms the iPhone into an instrument and a social artifact.

The arrival of such new technology is accompanied by exciting new opportunities to explore and discover novel uses that can change the way people make music and relate to each other. This is our research mission: to change how people think, do, and play through sound, afforded by new technologies. In the next sections, we apply these and other notions to the idea and aesthetic of Smule's Sonic Media.

2. DEFINING SONIC MEDIA

The field of mobile music has been explored by various bodies of research, much of which has informed and inspired this work [8, 4, 7, 6, 1, 2, 5, 10, 3, 4].

Smule explores what it calls "Interactive Sonic Media", which contains three primary axes. Firstly (and most obviously), *Sonic Media* is about real-time expressive audio. Secondly, Sonic Media is based on the belief that everyone – not just "musicians" and "artists" – is inherently and creative. Smule aims to unlock and encourage this creativity. Thirdly, Sonic Media seeks to use new technology to enable novel social interactions at both the personal and at a global scale.

The Smule aesthetic views mobile computing devices (e.g., the iPhone) not as simply smaller computers, but as something fundamentally different. Because the phone is inherently mobile, personal, and intimate, some activities and interactions intrinsically make sense on this platform. Smule seeks to find these "sweet spots" as related to expressive audio. Furthermore, both phones and music-making are inherently social activities, motivating new paradigms for computer music based on mobility and location. Another *Smulean* notion is one of *physicality*. Our projects seek not to simulate, but transform. For example, Ocarina transforms the iPhone into a flute-like instrument that preserves the physicality of breath and touch. The Sonic Lighter treats the flame as an physical entity inside the phone, which can "burn" the side of the phone if the device is tilted too much. This physicality is reflected in the design process, where the device is treated as a blank slate (and not necessarily as a communication device). The physical notion is also present in the inter-lighter ignition via a Sonic Modem, which requires the participants' devices to be in close physical proximity.

3. ARTIFACTS: FROM LIGHTER TO OCARINA

The idea of sonic media artifacts has evolved over a short time through the development of an array of applications. We discuss them here in the order in which they were designed. All of these artifacts make use of the ChucK programming language [9], environment, and engine for everything from prototyping, sound design, to real-time sound synthesis on the phone. Smule's audio environment, called ChiP (ChucK on the iPhone) brings the programming language to the mobile platform.

3.1. Sonic Lighter

Smule's Sonic Lighter was the first instantiation of an interactive sonic artifact. On the surface Sonic Lighter is just a lighter application, allowing its user to "ignite" a flame, and to interact with it via multitouch, tilt, and breath. Unnerving, crackling sounds accompany the flame "frying" the side of the phone when extreme tilt is applied.

The Sonic Lighter is a *social artifact*. Just like in "real life", lighters are used to exchange and interact, and we wanted the Sonic Lighter to preserve this quality. Hence we made it possible to share flames across any two phones with the Sonic Lighter. One phone can set another phone aflame by placing the two phones in close physical proximity and by pressing a switch that turns one lighter into a gentle flame thrower while emitting custom audio signals. The receiving phone detects these signals and ignites. A more poetic gesture can be made through microphone interactions. Gentle blowing into the microphone will cause slight turbulence that makes the flame wave and flicker. If the blowing exceeds a threshold it will blow out the flame. This furthers the notion of making a virtual artifact physical, interactive, and poetic.

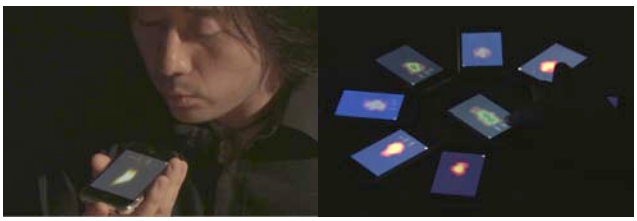

Figure 2. (left) Blowing out the Sonic Lighter. (right) One Sonic Lighter ignites seven other via Sonic Modem.

3.2. Sonic Vox

Sonic Vox is your favorite phase vocoder on steroids, except that it is not (a phase vocoder). It pitch-shifts the input audio, cross-synthesizes it with pre-recorded sounds (lion baby, grumpy old men, lion roar), or processes the input audio with ring modulation or a comb filter. Sonic Vox allows its user to play with their voice, changing their identity in real-time as if the iPhone is a warped microphone. Due to SDK restrictions, it is not possible to use Sonic Vox during a phone call. The primary use case is plugging into external amplification, potentially for use with VoIP applications such as Skype.

3.3. Ocarina

The Smule Ocarina is an expressive musical instrument created for the iPhone (Figures 1 and 3), re-imagining the ancient acoustic instrument while radically transforming it in the "kiln" of modern technology [11]. Ocarina is sensitive to one's breath (gently blowing into the microphone to control intensity), touch (via a multitouch interface based on the 4-hole English Pendant ocarina), and

movement (dual axis accelerometer controls vibrato rate and depth). It also extends the traditional instrument by providing precise intonation, extended pitch range, and key/mode mappings. As one plays, the finger-holes respond sonically and the breath is visualized. Like all Smule artifacts, the sound is synthesized in real-time.

The described interface is only half of the instrument. Ocarina is also a unique social artifact, allowing its user to hear other Ocarina players throughout the world while seeing their location – achieved through GPS and the persistent data connection on the iPhone (Figure 4). The instrument captures salient gestural information that can be compactly transmitted, stored, and precisely rendered into sound in the instrument's World Listener, presenting a different way to play and share music.

Figure 3. A small ensemble of iPhone Ocarina players.

The online Ocarina forum offers user-created Ocarina tablature for more than 1500 melodies. Most encouragingly, perhaps, is the observation that most of the Ocarina users (who are not musicians) are able to be musically expressive in a unique global musical community. Overall, the Smule Ocarina serves as an experiment in making use of technology to explore new types of mobile, social, musical artifacts.

3.4. Zephyr

In Greek mythology, Zephyr is the god of the gentle west wind. As sonic media it embodies messages blowing in the wind, whispered by a random passer-by. Zephyr allows people to send brief pictographic messages, with the allegory of the wind playing a crucial role sonically and visually. Zephyr captures and sonifies a user's touch gestures as he/she creates an image, a greeting, a slogan, an equation, a symbol, and shares it with the world. This personal touch elevates the message beyond just textual information, capable of nuances of a different nature.

Zephyr is a global exchange message system that isn't about direct substantiated one-on-one discussion, but rather about fleeting information, cherished moments and imprecise content. Hence one does not converse but send and catch whims from random strangers. In this sense Zephyr is akin to the notion of a message in a bottle. It is unknown who the recipient would be and it is hard to return an answer. Yet that makes the message itself more intriguing, the content more salient, and gives the social quality a different value.

4. THE SOCIAL FABRIC

At the time of this writing, six months after Smule's instantiation, the user community has exceeded one million in number, with more than 600,000 users of Ocarina. Communities have formed via the Smule Ocarina forum, YouTube, via built-in features in each of the artifacts. This wide area community is complimentary to the social fabric that is constructed on the personal level, as each user is able to be part of a larger global network. This section discusses the globe visualizations built into each of the artifacts.

4.1. "It's a Smule World After All"

The globe view (e.g., World Visualizer or World Listener) is part of the social backbone of most Smule applications and provides a sense of global community. While anonymous, or hidden behind self-chosen identities, people can observe and participate in global activities. The degree of sharing is varied. In the case of sonic lighter and boom, users can see the locations of recent ignitions and explosions. Interestingly, the density of lights on the Smule globe matches closely to those found on actual photographs of the earth, perhaps echoing the distribution of populations and wealth over the planet.

Ocarina is perhaps the first instrument in history that allows its players to hear one another. Given that there are now over half a million Smule Ocarina players around the world, this is indeed significant. Over 20 millions snippets have been collected, each with precise timing, key, melody information. We have only begun to mine this significant body of musical data.

4.2. Community

The social fabric created by Smule is inherently anonymous, at least for now. Everyone is only identified via a self-chosen handle (e.g., Link42), their GPS location, and, in Ocarina, through their music. And yet, this seems to be compelling in and of itself. It reflects that many human social activities can be interesting without identity, and are even enhanced through anonymity. Smule is determined to explore this deeply in the context of Sonic Media.

In addition to the experience on the actual device, Smule's Ocarina has a web portal dedicated for users to generate musical scores and for discussion (http://ocarina.smule.com/). Since November 2008, users of the Ocarina have generated more than 1200 scores using Smule's custom Ocarina tablature (Figure 5), serving over a million views. User-generated scores include video game

music (e.g., Legend of Zelda Theme Song, Super Mario Bros. Theme), western classical melodies (e.g., Ode to Joy, Blue Danube, Samuel Barber's Adagio for Strings), to rock classics (e.g., Yesterday by the Beatles, Final Countdown by Europe), movie tunes (Star Wars Imperial March, Superman theme), to showtunes, holiday music, and more.

Figure 4. (left) Ocarina's World Listener allows users to hear one another. (right) User-generated Sonic Lighter art created by one individual walking several city blocks and igniting every few steps.

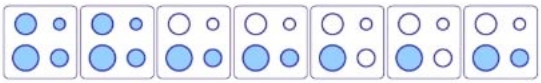

Figure 5. User-generated Score for Ocarina, created using Smule's score generator.

It is also worthwhile to note that, as far as we can tell, most of our users are not "musicians", and yet they play the Ocarina as an expressive instrument, and moreover as a point of social interaction. People engage it over dinner, at family gatherings, to show off the iPhone to their friends. Hundreds of user-generated Ocarina YouTube videos have appeared (search for "smule Ocarina"). We also note that Ocarina resembles a traditional instrument in that players are practicing in front of scores (on their computer monitors) while playing a physical artifact.

5. CONCLUDING NOTES

Interactive sonic media views the mobile phone as a platform for sonic based social exchange. We described an array of artifacts designed by Smule for the iPhone that illustrate the concept of facilitating social closeness and through pleasing aesthetics. They touch on local physical proximity, global exchange and audience, as well as community building. In its first six months, Smule has reached a user base of more than one million iPhone owners, demonstrating that – though mobile, sonic, social means – it is possible to influence populations on massive scale, creating global communities overnight.

While contemporary mobile phone platforms offer increasingly more power and capabilities, there are still limitations imposed, including computational speed and memory capacity. Hence it is still useful to remain creative and economic about the use of audio algorithms during the development of sonic media.

Technology comes and goes, but human nature changes much more slowly (if at all). So while Sonic Media embraces the technology it leverages, it is crucial to relentlessly design for the human. Sonic media artifacts and their underlying philosophy are driven by this idea.

The space for sonic media applications is wide open and we expect many of the ideas presented here to mature into new applications, new interrelations and better facilitation for social exchange. There certainly is a lot of work to be done to invent many mobile phone based instruments that harness the specific features of these devices to the fullest. We are excited to be part of this ongoing mobile revolution. For additional information, forums, musical scores, and videos, check out:

`http://www.smule.com/`

6. REFERENCES

[1] Essl, G. and M. Rohs. "ShaMus - A Sensor-Based Integrated Mobile Phone Instrument." *In Proc. of the International Computer Music Conference*, Copenhagen, 2007.

[2] Fiebrink, R., G. Wang, and P. R. Cook. "Don't Forget the Laptop: Using Native Input Capabilities for Expressive Musical Control." *In Proc. of the International Conference on New Interfaces for Musical Expression*, New York, 2007.

[3] Gaye L., L. E. Holmquist, F. Behrendt, and A. Tanaka. "Mobile Music Technology: Report on an Emerging Community." *In Proc. of the Conference on New Interfaces for Musical Expression*, Paris, 2006.

[4] Geiger, G., "Using the Touch Screen as a Controller for Portable Computer Music Instruments." *In Proc. of the International Conference on New Interfaces for Musical Expression*, Paris, 2006.

[5] Misra, A., G. Essl, and M. Rohs. "Microphone as Sensor in Mobile Phone Performance." *In Proc. of the International Conference on New Interfaces for Musical Expression*, Genova, 2008.

[6] Rohs M., G. Essl, and M. Roth. "CaMus: Live Music Performance using Camera Phones and Visual Grid Tracking." *In Proc. of the International Conference on New Instruments for Musical Expression*, Paris, 2006.

[7] Schiemer G. and M. Havryliv. "Pocket Gamelan: Tuneable Trajectories for Flying Sources in Mandala 3 and Mandala 4." *In Proc. of the International Conference on New Interfaces for Musical Expression*, Paris, 2006.

[8] Tanaka, A. "Mobile Music Making." *In Proc. of the International Conference on New Interfaces for Musical Expression*, Montreal, 2004.

[9] Wang, G. *The ChucK Programming Language: a Strongly-timed, On-the-fly Environ/mentality*. PhD Thesis. Princeton University Press. 2008.

[10] Wang, G., G. Essl, and H. Pentinnen. "MoPhO: Do Mobile Phones Dream of Electric Orchestras?" *In Proc. of the International Computer Music Conference.* Belfast, 2008.

[11] Wang, G. "Designing Smule's iPhone Ocarina" *In Proc. of the International Conference on New Interfaces for Musical Expression*. Pittsburgh, 2009.