MOBILE PHONES, GROUP IMPROVISATION, AND MUSIC: TRENDS IN DIGITAL SOCIALIZED MUSIC-MAKING

by

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CHAPTER 3. MOBILE PHONES IN MUSIC

Introduction

In this chapter I will trace how the mobile phone has been used a musical instrument, and will explore the reasons that motivate mobile phone musical instrument development. Ubiquitous computing is a part of the equation, but improvements in hardware and accessibility of programming tools for mobile phones have been significant factors in attracting composers and engineers to turn toward mobile phones for musical experimentation.[1] I will focus on how and where mobile phone musical scenarios take place, and examine the efforts made by mobile phone music ensembles.

3.1 Mobile Phones as Instruments

3.1.1 Introduction

In this section I will trace the paths in which the mobile phone has been used as an instrument: as a 'pocket' version of extant acoustic instruments, as a standalone instrument not modeled explicitly upon acoustic instruments, and as networked instruments or controllers. I argue here that, like computers and laptops, the multiplicity of functions—both musical and non-musical—of mobile phones prevent the devices from being universally recognized as legitimate musical instruments. At the same time, the flexibility of configurations has led to diverse means for personalization and implementations in musical contexts. As a result of both of these factors, it is and will remain difficult for instrument-builders to establish culturally

[1] The term *ubiquitous computing* is now its own field of study, as inspired by Mark Weiser's vision of computing artifacts that disappear. Here I use apply this term to the widespread entrenchment of mobile phones in modern society. The total number of individual cellular subscribers topped 5 billion in 2010, more than two-thirds of the world population. Figures from UN agency International Telecommunications Union (ITU), as quoted by UN News Centre, "Robust regulation of information technology crucial for economic growth – UN," posted March 31, accessed April 1, 2011, http://www.un.org/apps/news/story.asp?NewsID=37962&Cr=technologies&Cr1; see also Vivienne Waller and Robert B. Johnston, "Making Ubiquitous Computing Available," *Communications of the ACM* 52, no. 10 (2009): 127-130.

understood metaphors and gestures associated with mobile phone music. The mobile phone as an instrument will likely remain defined by its indeterminate quality.

3.1.2 Mobile Phone Music Prior to Smartphones

Before the advent of the smartphone, most mobile music pieces tended to leverage the networking features of phones to allow users to place phone calls or SMS text messages to trigger sound events. If the phone was used as the primary sound source, the sound producing options were either limited to ringtones or to the mic and speakers designed for phone calls. In order to execute ringtone playback, the most direct way was to place a phone call to the corresponding number from another telephone. *Telephony* (2000), *MobilSymfoni* (2001), *Spring Cellphony* (2001), *Dialtones: A Telesymphony* (2001), *SIM-phone-ya (New Ring Cycle)* (2002), *Drumming Hands Orchestra* (2003), *Wählt die Signale!* (2003), and *Concertino for Cellular Phones and Symphony Orchestra* (2006) are all ringtone-based works triggered by placing phone calls.[2] A slight variation includes pieces that rely on phone calls for input, but with sonic output handled through an external system and sound source. Brucker-Cohen's *Musical/Devices* (2002) and Knowles and Paek's *3001: Massively Multiplayer Musical Instrument* (2007) are two iterations of this concept.[3] Other works incorporate the receiver of the phone, linking individual callers' audio input to a loudspeaker output; Max Neuhuas's *Public Supply* pieces (1966, 1968, 1973), Kelly Dobson's *Agoraphone* (2002), and Giles Perring's *Exchange* pieces (2001-2003) are examples.[4] Usman Haque's *Japanese Whispers* (2000) and *Sky Ear* (2004) are works that incorporate the device's microphone and receiver in tandem for

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[2] With the exception of Baker's *Concertino*, all these works are cited within Golan Levin et al., "Informal Catalogue of Mobile Phone Performances, Installations, and Artworks."
[3] See further discussion of Knowles and Paek's work in chapter 2.
[4] Although Neuhaus's *Public Supply* works precede mobile phone technology, conceptually it is the same. The change from landlines to mobile devices affected sound quality on the receiving end, but these are not significant differences. In other words, the mobility of cellular phones for pieces described here is not a crucial component of the artistic framework and design. Kelly Dobson, "AgoraPhone," (master's thesis, MIT, 2002), http://dspace.mit.edu/handle/1721.1/61129; Perring, "The Exchange."

musical purposes.[5] *SimpleTEXT* (2003) takes anonymous SMS text messages from audience members as input, then parses the messages and coordinates them to be played rhythmically with music through a speech synthesizer. Other SMS-based sound works include *Text.FM* (2002), *Intelligent Street* (2003), and *Tool for Armchair Activists* (2005).

Prior to the advent of smartphones, some artists created custom-made augmented personal digital assistants (PDAs) to leverage mobility in their artistic works. Atau Tanaka presented a system for collaborative music-making through the use of pressure sensors and accelerometers attached to PDAs.[6] Günter Geiger developed a method for porting Pure Data patches to Linux-based portable devices in order to combine real-time synthesis with touch screen input.[7] GPS-based works such as *Sonic City* by Gaye et al. (2003) and *Tactical Soundgarden Toolkit* Mark Shepard (2007) also make use of PDAs as tools for exploring urban landscapes with sound, and will be discussed in Section 3.3. Schiemer and Havryliv (2005) created *pd2j2me*, a desktop application cross-compiler that translates Pure Data patches into Java, for the purpose of eliminating the need for composers to compose for mobile phones by writing java code.[8] This project enabled Schiemer to pioneer the first synthesis-based instrumental use of mobile phones with his PocketGamelan in 2006.[9]

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[5] Usman Haque, *Japanese Whispers* (2000), last updated November 19, 2003, accessed February 11, 2013, http://www.haque.co.uk/japanesewhispers.php; Haque, "Sky Ear."
[6] Tanaka, "Mobile Music-making."
[7] Günter Geiger, "PDa: Real Time Signal Processing and Sound Generation on Handheld Devices," in *Proceedings of the International Computer Music Conference*, Singapore, 2003; Günter Geiger, "Using the Touch Screen as a Controller for Portable," in *Proceedings of the 2006 Conference on New Interfaces for Musical Expression (NIME06)*, Paris, France, 2006, 61-64.
[8] Java 2 Micro Edition (J2ME) is an application programming interface (API) designed to allow a standard Java platform for systems with minimal hardware. Greg Schiemer and Mark Havryliv, "Pocket Gamelan: a Pure Data Interface for Mobile Phones," in *Proceedings of the 2005 International Conference of New Interfaces for Musical Expression (NIME05)*, Vancouver, Canada, 2005, 156-59.
[9] Greg Schiemer and Mark Havryliv, "Pocket Gamelan: Tuneable Trajectories for Flying Sources in Mandala 3 and Mandala 4," in *Proceedings of the 2006 International Conference of New Interfaces for Musical Expression (NIME06)*, Paris, France, 2006, 37-42.

3.1.3 Smartphone as Standalone Musical Instrument

As mobile device technologies have matured and smartphones have become prevalent, composers have had more available options for hardware and software configuration. In 2009 Georg Essl and Michael Rohs presented a detailed summary of the technical capabilities and limitations of mobile handheld devices.[10] This approach was deemed important from a conceptual standpoint, "in the same sense that a good composer of orchestral music has to know the capabilities and limitations of orchestral instruments."[11] Essl and Roh's work provides the best summary to date of the range of possibilities for an instrumental use of mobile phones. In brief, the different kinds of musical interactions leveraging onboard sensors include optical tracking of markers and grids using the phone's camera, optical movement detection, acceleration sensing, magnetic field sensing, gyroscopes, touch and multitouch screen, capacitive proximity sensing, and microphones. Essl and Rohs have also been prolific authors and leaders in the exploration of implementing the wide range of onboard sensors in musical contexts.[12]

Although only some makes and models of phones make all of these sensing parameters available, a typical phone has a far greater range of onboard sensors than a laptop computer, giving the device several advantages over the laptop as a performance device. The handheld nature of the device, coupled with the array of sensors, make it far easier to perform and track gestures that would be awkward to replicate using a laptop. It is far less cumbersome to use tilt

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[10] Georg Essl and Michael Rohs, "Interactivity for Mobile Music-Making," *Organised Sound* 14, no. 2 (2009): 197-207. Their summary for mobile devices is modeled after Eduardo Miranda and Marcelo M. Wanderlay, *New Digital Musical Instruments: Control and Interactions Beyond the Keyboard*, (Middelton, WI: AR Editions, 2006).
[11] Ibid., 198.
[12] Michael Rohs, Georg Essl, and Martin Roth, "CaMus: Live Music Performance Using Camera Phones," in *Proceedings of the 2006 International Conference on New Interfaces for Musical Expression (NIME06)*, Paris, France, 2006, 31-36; Michael Rohs and Georg Essl, "CaMus 2 – Optical Flow and Collaboration in Camera Phone Music Performance," in *Proceedings of the 2007 Conference on New Interfaces for Musical Expression (NIME07)*, New York, NY, USA, 2007, 160-163; Ananya Misra, Georg Essl, and Michael Rohs, "Microphone as Sensor in Mobile Phone Performance," in *Proceedings of the 2008 Conference on New Interfaces for Musical Expression (NIME08)*, Genova, Italy, 2008, 185-88.

on a phone than a laptop, for instance. On the other hand, the smaller screen size and reduced computational capacity of handheld mobile devices are disadvantages in the kinds of tasks they can realistically handle. Complex synthesis algorithms or memory-intensive musical processes are not viable for phones at this time. Hence, a common approach to mobile phone-based application design is to leverage the phone's mobility to offer scaled down 'pocket' versions of existing desktop software, hardware, or acoustic (and less portable) instruments. NanoStudio, DJ Mixer, Theriminator, Animoog, Magic Guitar, Pocket Piano, and iBone are only a few examples of this approach within the commercial sector.

Another current in mobile music development is the creation of modular toolkits and programming interfaces permitting real-time sound synthesis such as FM, wavetable, and additive synthesis. These efforts, primarily situated in academia, are designed to offer open-ended platforms for sound generation in a similar vein as Max/MSP, Pure Data, and RTcmix.[13] They are also clear attempts to attract more composers and programmers to the mobile music community, or to at least integrate existing musical platforms for desktop computing with the advantages of mobile devices. Essl and Rohs (2006) ported Perry Cook and Gary Scavone's Synthesis Toolkit (STK) to Symbian OS and later to iOS to create MobileSTK.[14] This was the first full parametric synthesis environment available on mobile phones.[15] It has since served as the sound-generating platform used in combination with sensor-based projects ShaMus and MiMus.[16] ShaMus was the impetus for the first repertoire-based mobile phone ensemble,

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[13] Cycling74.com; Puredata.info; Rtcmix.org.
[14] Georg Essl and Michael Rohs, "Mobile STK for Symbian OS Audio Support of Symbian OS," in *Proceedings of the International Computer Music Conference (ICMC)*, New Orleans, USA, 2006; Perry Cook and Gary Scavone, "The Synthesis ToolKit (STK)," in *Proceedings of the International Computer Music Conference (ICMC)*, Beijing, China, 1999.
[15] Essl and Rohs, "Interactivity for Mobile Music-Making," 201.
[16] Georg Essl and Michael Rohs, "ShaMus – A Sensor-Based Integrated Mobile Phone Instrument" in *Proceedings of the International Computer Music Conference (ICMC)*, Copenhagen, Denmark, 2007; Misra, Essl, and Rohs, "Microphone as Sensor in Mobile Phone Performance."

founded at the Center of Computer Research in Music and Acoustics at Stanford University.[17] Bryan, Herrara, Oh, and Wang (2010) developed MoMu, an expanded version of MobileSTK built using the iPhone OS SDK, with OSC and FFT capabilities.[18] Essl's SpeedDial (2009) and urMus (2010) are other modular programming languages for the iPhone, essentially written to offer a graphic user interface (GUI) for programmers interested in open-ended musical toolkits.[19] Brad Garton, Damon Holzborn, and Terry Pender similarly ported RTcmix to the iOS to form iRTcmix.[20] For RTcmix users, this allows one to download custom-made musical apps onto the iPhone without the need to 'jailbreak' the phone's operating system. These toolkits operate from the premise of mobile phone as standalone instrument, without need for connectivity to an outside system for sound production or algorithmic processing.

3.1.4 Mobile Phone as Controller

Alternatively, phones can operate as controllers rather than as a primary sound source. As the need has increased for customizable music interfaces to simplify or streamline whatever hardware and software combinations a musician might use, various mobile app developers have authored software for the express purpose of using the mobile phone as a remote control. *TouchOSC*, *Mrmr*, *Control*, *C74*, and *OSCemote* are popular apps that transmit OSC (and in some cases MIDI) messages via wireless local area networks.[21] Most of these apps permit custom

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[17] Ge Wang, Georg Essl, and Henri Penttinen, "Do Mobile Phones Dream of Electric Orchestras?" in *Proceedings of the International Computer Music Conference (ICMC)*, Belfast, UK, 2008.
[18] Nicholas J. Bryan, Jorge Herrara, Jieun Oh, and Ge Wang, "MoMu : A Mobile Music Toolkit," in *Proceedings of the 2010 Conference on New Interfaces for Musical Expression (NIME 2010)*, Sydney, Australia, 2010, 174-77.
[19] Georg Essl, "UrMus – An Environment for Mobile Instrument Design and Performance," in Proceedings of the International Computer Music Conference (ICMC), Stony Brook, NY, USA, 2010.
[20] Brad Garton, Damon Holzborn, and Terry Pender, "iRTcmix – Rtcmix on the iPhone/iPod," June, 2010, accessed February 12, 2013, http://music.columbia.edu/~brad/irtcmix/README.html.
[21] Rob Fischer, *TouchOSC*, http://hexler.net; Eric Redlinger, *Mrmr*, http://code.google.com/p/mrmr/; Charlie Roberts, *Control*, http://charlie-

layout design, but have the downside of working only within local area networks (LANs). This can be problematic in audience participatory concert settings in which connectivity and setup issues may be too problematic for large-scale audience participatory works. Another obstacle is that many of these apps are only available for iOS, or have less stable versions for Android. Within a large audience, the inevitable variety of models and makes of mobile phones makes it impractical for an OS-specific app to be downloaded and implemented within a short setup time. Jesse Allison proposes the use of a phone's web browser as an interface for connecting, eliminating the necessity of operating within a LAN or with a specific app.[22] Oh and Wang (2011) and Knowles (2012) have similarly implemented Ajax programming and Node.js respectively to achieve the same outcomes.[23] Oh and Wang note:

> Especially in consideration with the tremendous growth in popularity of consumer mobile devices with built-in browsers, the mobile web provides us with an ideal setting to enable audience participation in music performances in a manner that is software-free (beyond an internet browser) and less dependent on the hardware (that is, in comparison to building device-specific applications).[24]

In the realm of audience participatory works, an alternative could be to deliberately avoid newer or non-standard technologies in order to establish broader access. Because SMS is a standard feature on nearly all mobile phones, it continues to be a viable option for real-time audience participatory works, where user inclusion and broad access across platforms is more desirable than feature-rich devices.[25]

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roberts.com/Control/; Leo van der Veen, *C74*, http://nr74.org/software/c74.html; Joshua Minor, *OSCemote*, http://pixelverse.org/iphone/oscemote/.

[22] Jesse Allison, "Web-Based Control of Mobile Devices," in *Proceedings of the 1st Symposium on Laptop Ensembles & Orchestras (SLEO 2012),* Baton Rouge, USA, 2012, 82.

[23] Oh and Wang, "Audience-Participation Techniques"; Joshua Knowles, email conversation with the author, November 2, 2012.

[24] Oh and Wang, "Audience-Participation Techniques," 669.

[25] Brucker-Cohen's *SimpleTEXT* (2003), perhaps the most widely performed SMS-based interactive musical work, has most recently been performed in 2008. Still, third party websites such as www.polleverywhere.com offer "Instant Audience Feedback" and can be easily integrated into interactive musical works. Similarly *TweetDreams* (2010) by Herrera, Dahl, and Wilkerson incorporates audience feedback over Twitter. Tweets containing performance-specific search hash tags are projected on screen and sonfied by performers. Brucker-Cohen,

3.1.5 Conclusion

Much of these uses for mobile phones as instruments are reminiscent of Cage's *Imaginary Landscape No. 4* (1951), in which the medium is not so much transformed as it is appropriated for outcomes not originally intended. For the broader public, although the convergence of the mobile phone has increased one's assumptions of what a phone can do, most people do not yet view the mobile phone as a musical instrument in any viable and permanent sense. Marketing efforts by mobile providers certainly have attempted to promote musical capabilities of mobile devices, but it is too early to know whether the mobile phone will be culturally recognized as an instrument the same way traditional acoustic instruments are.[26] For better or for worse, the phone (and all the other devices that are conflated into it; the camera, flashlight, etc.) has its own longstanding cultural presence that interferes with efforts to establish the phone as an instrument.[27]

3.2 Mobility and Spatialization

3.2.1 Introduction

As has been noted previously in Section 2.1, the use of mobile phones within the concert hall has yielded new opportunities for considering how sound is distributed within performance space. Mobile phones have also given composers newfound opportunities to take the concert hall out into town. In many cases mobile phones are used within a network and serve as an extension of network music spatial considerations. Prior to mobile phones and related

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"SimpleTEXT"; Poll Everywhere, accessed February 22, 2013, http://www.polleverywhere.com/; Jorge Herrara, Luke Dahl, Carr Wilkerson, "TweetDreams: a multimedia musical performance made from live Twitter data," accessed February 22, 2013, https://ccrma.stanford.edu/groups/tweetdreams/.

[26] An example is a recent Sprint EVO 4G LTE commercial: sprintnow, "EVO Live (extended)," Sprint, June 1, 2012, video clip, accessed December 7, 2012, Youtube, http://www.youtube.com/watch?feature=player_embedded&v=DuRUXR03CEg.

[27] Ruviaro discusses this obstacle as it pertains to the definition of a laptop plus software as an instrument, and the issue is directly applicable to mobile phones as well. Ruviaro, "From Schaeffer to *LOrks," 23-26.

technologies such as GPS, remote performance was usually realized using non-portable setups: desktop computers, telephones connected to walls, etc. Mobile phones are simultaneously another iteration of a long history of transportable musical instruments as well as a smaller albeit powerful networked instrument. How is musical space and place redefined as a result of these devices? In what ways have GPS technologies been explored in musical contexts? The purpose of this section is to describe how the 'mobility' of mobile phone music is being exploited for artistic purposes, both within and without the concert hall.

3.2.2 Mobile Phones in the Concert Hall

At first glance, mobile phones seem to offer nothing new to spatial considerations, especially within the concert hall. When treated as standalone instruments—that is, using the mobile phone as a primary sound source as opposed to using the phone as a controller forwarding information to another source over a network—, mobile phones do not create any new advantages over acoustic instruments as sound objects within a concert space. For instance, the disbursement of instruments within the audience (as is the case with Levin's *Dialtones: A Telesymphony*) is not a significant deviation from other acoustic works that situate the performers in the aisles or in a choir loft. Nevertheless, unlike other portable musical instruments such as the piccolo, trumpet, or even the voice, mobile phones permit one to separate the location of sound generation from the location of the performer, even over significant distances. In Levin's *Dialtones* the performer's instrument—that is, at least a portion of it—is in the hands of the audience members. The network creates a different type of performer presence than mere physical presence on the stage. That the phones put into play here are the property of the audience members, and familiar to them in completely different contexts apart from the concert hall, adds to the novelty. It is within this context of network music that we begin to see mobile phone music offering new avenues for spatial considerations.

The use of mobile phones as networked controllers certainly expands possibilities to separate user input from the sound source.[28] Dislocated sound is a central aspect of the network music tradition, and according to Golo Föllmer, has significant ramifications on the context of space and presence.[29] In brief, the virtual space of the computer and the Internet is not tied to Euclidian, three-dimensional space in terms of perception and orientation. Föllmer notes:

> Spatial dimensions are nothing but a metaphor meant to help cognition do the shift from our well-known three-dimensional world into the electronic world of indefinite dimensionality inside the computer and the Internet.[30]

This plasticity of network configuration leads to complications in establishing a sense of a presence among participants. "Where there is no physical space, leaving users no way to encounter each other physically, users can only confirm the actual presence of each other by taking a specific action. The action would thus relate previously unrelated elements in such a way that a group can establish a collective meaning."[31] In the concert hall, where participants *do* encounter each other physically, the same issues are nonetheless present when networked controllers are part of the musical performance. A composer or performer of networked instruments needs to convey to the audience a cause-and-effect relationship between performance action and sonic outcome "in such a way that a group can establish a collective meaning."[32] If this relationship is not made explicit, confusion over who is making what sound can set in and hinder the dramaturgy of the performance.

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[28] In many performance situations, especially within the concert hall, other wireless controllers can perform the same functions as mobile phones, and could be used interchangeably. The added value that smartphones offer is the combination of telephony with other wireless protocols, plus their ubiquity. That said, not all pieces using mobile phones leverage all of these aspects. The rise in popularity of using mobile phones as opposed to comparable wireless controllers may be simply a result of convenience.

[29] Golo Föllmer, "Electronic, Aesthetic, and Social Factors in Net Music," *Organised Sound* 10, no. 3 (2005): 185-92.

[30] Ibid., 185.

[31] Ibid., 185.

[32] Ibid., 185. See also Schloss, "Using Contemporary Technology in Live Performance." Levin et al. took steps to make the various complex calling sequences visually clear: they placed a giant mirror over the audience, with LED lights affixed to each seat and corresponding to a ringtone.

One particularly effective example of the mobile phone used as controller within a concert piece is Jason Charney's *Compass* (2011).[33] A single performer uses a mobile phone as a controller to trigger and control sounds that are played within a quadrophonic array of speakers. Though there is nothing inherently new in terms of spatialization, the contribution of the mobile phone in this instance is dramaturgical: due to the wireless nature of the phone as a controller, the performer can be situated on stage and push sounds to various speakers in a way that allows the audience to see the connection of gesture to sound. As Charney twists the phone within a horizontal plane in a deliberate and slow manner using the onboard compass sensor, drones pan from one speaker to the next. The shake gesture is linked to more percussive and bell-like sounds.

The challenge of maintaining cause-and-effect connections between controllers and sounds becomes more complex when multiple performers are onstage. At the same time, deliberately concealing who is doing what can be leveraged for dramatic effect. In the MoPho's first performance on the 11th of January 2008 at Stanford University's CCRMA Stage, they were cognizant of the role of spatialization that could take place within the concert space.[34] Ge Wang's pair of pieces *Drone In/Drone Out,* bookending the concert program, began with some members of the ensemble sitting, disguised among the audience. As the remaining players walked into the space with phones droning, the concealed players joined and helped surround the audience with a total of twelve players with phones. The *Drone Out* at the end of the concert also explored additional spatial configurations before players exited or returned to their original seats in the audience. Other pieces also explored spatialization in the MoPho ensemble: Henri Penttinen's *The Saw* (2008) situates performers in a semicircle and explores panning effects

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One could then see when a sweep across the audience would take place as well as hear it. Golan Levin, "Dialtones: A Telesymphony."

[33] Jason Charney, "Compass," 2011, accessed December 12, 2012, http://www.jasoncharney.com/compass/.

[34] For more details on the following pieces, see Wang et al., "Do Mobile Phones Dream of Electric Orchestras?"

within the ensemble. Chris Warren's *phoning it in* (2008) is primarily concerned with diffusing a fixed media piece in space. In each of these instances, the movement of sound among performers or throughout the space becomes a primary compositional focus.

When treating mobile phones as standalone instruments rather than controllers, MoPho addresses the amplification limitations of mobile phones by using wearable speakers attached to gloves. This allows for sound generation to be physically tied to a performer the same way a traditional acoustic instrument would be. At the same time, the networked functions of the devices allow for sounds to travel from one person to the next. This feature of 'passing the sound' has been used in several networked compositions.[35]

With *4Quarters* I confront the problematic of establishing presence between performers—and making their actions clear to the audience—by creating a visual projection displaying all actions by all users in one central location. Any change to the sound initiated by a performer has a corresponding visual component (e.g. a volume adjustment made on the phone will match a slider on the projection). The sound source is also centralized in a stereo speaker image. When viewing user performance as an audience member, the task of determining who is doing what is assisted by viewing the projection, but it does not make all actions explicitly clear unless performers dramatize their actions by exaggerating movements.[36]

3.2.3 Mobile Phones - Bringing the Concert Hall into Town

In addition to networks, broadcast media, and especially the Internet, mobile phones have been one of several kinds of digital tools that allow artists to situate musical performance and sound art outside the concert hall or gallery.

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[35] Luke Dahl's *SoundBounce* (2010) and Jesse Allison's *Divergence* (2012) are two excellent pieces using mobile devices to pass sounds from performer to performer. See also Gil Weinberg, Roberto Aimi, and Kevin Jennings, "The Beatbug Network – A Rhythmic System for Interdependent Group Collaboration," in *Proceedings of the 2002 Conference on New Instruments for Musical Expression (NIME-02)*, Dublin, Ireland, 2002, 1-6.

[36] In many respects the need to dramatize actions is no different than performance practice considerations for traditional musical instruments.

Many of the first serious efforts to use mobile phones in public spaces to generate sound were tied to civic activism. Limited by the technology available at the time, these sound art pieces used SMS text messaging and text-to-speech software to amplify anonymous messages within a public space. Examples include Harwood and Fuller's *Text.FM* (2002), Dobson's *AgoraPhone* (2002), and Troïka's *Tool for Armchair Activists* (2005).[37] Eacott et al.'s *Intelligent Street* (2004) represents one of the first SMS-based interactive music environments. Users collectively affect a shared soundscape via text commands. Resulting changes are played over loudspeakers placed over a high-traffic public walkway.[38]

The 'flash mob' performance style represents a second musical use of mobile devices in public spaces. Because these works typically foreground choreographed movements or dances as opposed to music-making, they are not considered in depth here. Some examples of this trend include Ligna's *Radio Ballet* (2002-03) and Improv Everywhere's *Mp3 Experiments* (2004-12), among others.[39] While these represent the most popular type of performance art ported from a concert space into the community, flash mobs are not so much reliant on mobile phone technology as the Internet for coordination and planning.

Prior to GPS-enabled mobile phones, Tanaka and Gemeinboeck (2006) experimented with using participants' locations as a musical controlling parameter. Participant physical positions within a concert space were deduced by determining each phone's signal strength as received

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[37] Matthew Fuller and Graham Harwood, "Text.FM," accessed December 20, 2012, http://basecamp.netbase.org/e_index.html; Dobson, "AgoraPhone"; Troïka, "The Tool for Armchair Activists," accessed December 20, 2012, http://goodparticipation.com/2010/01/the-tool-for-armchair-activists-by-troika/.

[38] Eacott et al., "Intelligent Street."

[39] As these pieces predate the widespread use of smartphones, neither of these works make use of mobile phones; *Radio Ballet* uses portable radios with a central coordinator giving instructions via radio broadcast, whereas *Mp3 Experiments* generally use mp3 players with a central coordinator giving instructions based on an agreed time in which participants synchronously push the play button on their own devices. Ligna, "Radio Ballet"; Improv Everywhere, "The Mp3 Experiments."

over a GSM cell antennae.[40] This proved to be difficult to implement because participants were reluctant to move around the space during performance.[41]

3.2.4 GPS and mobile phone music

As GPS technology became available, many mobile phone works emphasizing *mobility* featured embedded sounds onto a virtual soundscape or 'soundmap' via geotagging. Thus far, there have been two main approaches to implementing GPS in musical contexts: the expansion of the concert hall or performance space on a larger geographic scale, and the sound walk. First, GPS affords one to re-conceive of the space in which a musical performance resides, in many cases expanding the concert hall into public space, at times on a massive scale. Choloniewski's *GPS-Trans* pieces (2000-01) both predate the advent of GPS-enabled mobile phones, but exemplify this approach of the 'spread out' concert hall. The Smule Ocarina presents a *World Listener* view, where one can see locations of other Ocarina players, and hear one another through GPS-tagged sound snippets that are recalled and played. Although this feature does not create a concert space, overwhelming user feedback indicates that the anonymous sharing of music, a self-chosen username handle, and GPS-location is nonetheless compelling.[42]

Sound walks with recorded media predate mobile phones and GPS technology, but have become more popular because of accurate location tracking. GPS-enabled devices equipped with headphones can allow participants to explore terrain in via 'augmented' soundscape, with digitally recorded sounds corresponding to specific geographic locations and made accessible once a participant arrives in proximity to a given tagged location. Layla Gaye et al.'s *Sonic City* (2003) incorporated GPS locative devices as one of several sensors to allow a user to interact

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[40] Atau Tanaka and Petra Gemeinboeck, "A Framework for Spatial Interaction in Locative Media," in *Proceedings of the 2006 Conference on New Interfaces for Musical Expression (NIME06)*, Paris, France, 2006, 26-30.
[41] Atau Tanaka, conversation with the author, 2010.
[42] Wang, "Designing Smule's iPhone Ocarina," 306.

with the urban landscape.[43] Mark Shepard's *Tactical Sound Garden* (2007) facilitates peer-to-peer interaction by 'planting' or 'pruning' sounds at a specific urban location via geotagging over wi-fi.[44] Using the garden metaphor (i.e. one plants a seed, another sews), this work establishes a presence between users separated by time but sharing the same geographic location. Freeman et al.'s *Urban Remix* (2012) is a more recent project with the same ideal of establishing a community through shared sound and location.[45] The concept of establishing presence between individuals over great expanses of time and space is also found in Teri Reub's site-specific sound installations *Core Sample* (2007) and *Elsewhere:Anderswo* (2009), both of which allow visitors to explore a location through sound by using headphones connected to GPS-enabled portable devices. Carter and Liu's *Location 33* (2005) is yet another approach to the sound walk, using geotagging to create an augmented experience when listening to an album.[46]

3.2.5 Conclusion

Although my personal interest in using mobile phones is not motivated by the mobility of mobile phones so much as it is the ubiquity of the devices, it is clear that many artists are interested in the possibilities of working with locative media and sound dislocation. Mobile phones can allow communities to emerge through shared sound in like manner to an online forum, which allows conversations to take place without regard to physical location or proximity through time. It is unclear whether these types of interactions have staying power within music communities or even with the broader public. For now, these efforts are largely experimental. It is plausible that mobile music will endure, like many online forums, as a special-interest group.

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[43] Gaye et al., "Sonic City."
[44] Shepard, "Tactical Sound Garden [TSG] Toolkit."
[45] Jason Freeman, Carl DiSalvo, Michael Nitsche, & Stephen Garrett, "Rediscovering the City with UrbanRemix," *Leonardo Music Journal* 45, no. 5 (2012): 478-79.
[46] Carter and Liu, "Location33: A Mobile Musical."

3.3 Mobile Phone Ensembles

3.3.1 Introduction

In the effort to define the mobile phone as an instrument worthy of long-term experimentation and dedicated performance practice, the concept of mobile phone ensembles has emerged as a plausible format for developing the phone-as-instrument. In this section I will examine the state of mobile phone orchestras, their origins, developments, and their application within the concert hall paradigm. The following questions will be explored: To what extent are mobile phone orchestras successful as ensembles with an audience? Is the traditional orchestra an appropriate analogy for emulation with mobile phone, or do these new instruments suggest a different model as a basis for development? Do mobile phones suffer from a 'gimmick factor' that will be difficult for a general public to accept as instruments?

3.3.2 MoPho Origins

The Stanford Mobile Phone Orchestra (MoPhO) was created in 2007 under the direction of Ge Wang, Georg Essl, and Henri Penttinen. Essl subsequently replicated the orchestra at the University of Michigan in 2009 with the Michigan Mobile Phone Ensemble (MiPhos), and Penttinen founded the Helsinki Mobile Phone Orchestra.[47] These ensembles are extensions of the laptop orchestras founded at Princeton University and elsewhere.[48] Generally speaking, both laptop and mobile phone orchestras have been guided by a particular set of aesthetic goals:

- Reclaim a community-based paradigm for making music from within the computer music tradition, especially within the institutional domain.[49]

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[47] Oh et al., "Evolving The Mobile Phone Orchestra," 83. See Stanford Mobile Phone Orchestra, accessed January 3, 2013, http://mopho.stanford.edu/; Michigan Mobile Phone Ensemble, accessed January 3, 2013, http://mopho.eecs.umich.edu/; and Helsinki Mobile Phone Orchestra, accessed January 3, 2013, http://www.acoustics.hut.fi/projects/helsinkimopho/.
[48] Laptop ensembles have been well established both within academia and without, with expansions to orchestras of larger sizes surfacing around 2005. For more information on the history of laptop ensembles, see Trueman, "Why a Laptop Orchestra?"
[49] This return to collaborative computer music-making is presented as a departure from studio-based computer music composition, a format that has become decentralized (due to hardware

- Promote live real-time performance of digital media as opposed to studio-based fixed media.
- Champion experimentalism and discovery as part and parcel with the emergence of the ensemble, and its corresponding instruments and performance practice.
- Create an ensemble that allows a lower barrier for entry than traditional orchestras.[50]
- Attempt to take the best virtues of a traditional orchestra while also solving some of the inherent disadvantages.
- Generate a repertoire of works created for these ensembles to help evolve the model, establish best practices, and develop a range of performance difficulty from easy to advanced works.

Other mobile phone ensembles of various configurations include Yamaha's Mofiano Mobile Orchestra, Mobile Phone Orchestra Berlin, and the KAIST Mobile Phone Orchestra (KAMPO).[51]

Institutionalized ensembles within university settings yield obvious benefits in promoting and evolving mobile phone ensembles. There is a natural accretion of works over time as students cycle through the classes and present projects and concerts. Teaching the ensemble as a course permits a steady influx of students exposed to the problems inherent to performing with new instruments. The growing community can then glean best practices and infuse them in the next round of classes. This has proven to be applicable for both laptop ensembles and mobile phone ensembles.

In spite of the similarities between mobile phone ensembles and laptop ensembles, there are some distinguishing differences that influence performance and composition considerations.[52] First, for getting to and from a venue, all equipment for mobile phone ensemble can be carried in a standard size laundry basket or crate by one person. There is no

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and software becoming cheaper and brought to the home) and fragmented into isolated workspaces. See Trueman, "Why a Laptop Orchestra?" 177.

[50] Ibid., 175. Trueman states, "Does it make sense, after all, to create a new large ensemble like the orchestra which requires its players to begin practice at a young age and prevents all but a select few from ever reaching a professional or near-professional level?"

[51] Yamaha, "Mofiano Mobile Orchestra," accessed January 3, 2013, but no longer available, http://www.yamaha.co.jp/product/lsi/mofiano/mmo/; see PingMag, "Yamaha Mobile Orchestra," August 7, 2008, video clip, accessed March 1, 2013, Youtube, http://www.youtube.com/watch?v=90556od8IsI&feature=share&list=PL8CBD661CD703E598; MoPhoneOrchestraBln, "MoPhOs Part 1 – Gedrone," June 16, 2009, video clip, accessed February 6, 2013, Youtube, http://www.youtube.com/watch?v=DhZ9g5U81io; KAIST Mobile Phone Orchestra, accessed January 3, 2013, http://kampo.kaist.ac.kr/.

[52] Georg Essl, "The Mobile Phone Ensemble as Classroom," in *Proceedings of the International Computer Music Conference (ICMC)*, Stony Brook/New York, USA, 2010.

need for a dedicated rehearsal space. By contrast laptop orchestras classes require a location where equipment can be set up for the duration of a course, creating a difference in rehearsal time allocation for students. In the concert paradigm, laptop ensembles do not yield the same in-motion performance opportunities that mobile phones do. For many mobile phone-based pieces choreography has been brought to the foreground in performance because it helps establish motion as a defining quality of mobile phone instruments.[53]

The current trend in developing mobile applications for ensemble performance has benefited from the proliferation of mobile platforms—not just phones, but other consumer devices such as Nintendo DS or PSP—and their corresponding SDKs and APIs.[54] This has created fertile ground for a variety of mobile performance scenarios outside of academia. One common approach to mobile performance is to create a jam session using multiple mobile app instruments. This 'mobile instrument mashup' concept has taken shape in both edited YouTube video performances and live concert settings.[55] This can be done as a single performer or as a group.

3.3.3 Ensemble and Orchestra as Metaphor

The words 'ensemble' and 'orchestra' have been used interchangeably in describing coordinated group mobile phone performance. Still, the words carry with them deep semantic

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[53] In the inaugural Michigan Mobile Phone Ensemble performance at the 2009 Premiere Final Class Concert, Colin Neville and Owen Campbell's *Shepard's Escher* explores motion in both pitch (using the Shepard-Risset glissando) and space (through a series of choreographed motions among players). In *Space Pong* (2010) by Gayathri Balasubramanian, Billy Lau, and Lubin Tan, performers 'pass' sounds from device to device using a tossing gesture between performers. See "The Michigan Mobile Phone Ensemble @ Premiere Final Class Concert 2009," December 9, 2009, accessed February 7, 2013, http://mopho.eecs.umich.edu/events/finalclassconcert09.html; EECSatUM, "Space Pong – Michigan Mobile Phone Ensemble," January 28, 2011, video clip, accessed February 9, 2013, Youtube, http://www.youtube.com/watch?v=ejocScps1sk&feature=youtu.be.

[54] Oh et al., "Evolving The Mobile Phone Orchestra," 83.

[55] Examples include HirnW, "iBand," February 17, 2008, video clip, accessed January 3, 2013, Youtube, http://www.youtube.com/watch?v=Mh0VX74alwk; thehighams, "iPhone Music Apps," May 30, 2009, video clip, accessed January 3, 2013, Youtube, http://www.youtube.com/watch?v=tevO66NT1uE; Crystal Young-Otterstrom, "iPhone Sextet No. 1," Salty Cricket Concert, premiered April 11, 2009, Salt Lake City.

meanings and cultural connotations, generating debate as to which term accurately describes the nature of the performing group that uses mobile phones as instruments. This debate is accentuated because mobile phones can easily blur the boundaries between audience, performer, and composer, as discussed in Chapter 2. By using the term 'orchestra,' do mobile phone ensembles emulate traditional classical orchestras, or is the usage even appropriate?[56] When posed this question, MiPhos director Georg Essl responded:

> I actually do not see MoPhos as "emulating" traditional orchestras, but rather rethinking the notion of ensemble play with new technological possibilities. But by labeling it orchestra, it helps us not only think it as completely new, but question embedded assumption into what makes an orchestra itself. Standard roles do not just disappear but are either adopted or complexified, perhaps modified and re-instituted. Reference to what we already know (traditional ensemble play) is one of a range of possible ways to explore the space and I think it's a good one, but not the only one. …Mobile phones in ensembles can be radically new and very traditional and what is exciting is to allow the exploration along both these lines.[57]

One avenue of mobile phone ensemble exploration thus far has been audience participation, as discussed in Chapter 2 and found in pieces such as Jiuen Oh's *Heart* (2010), Jieun Oh and Ge Wang's *Converge 2.0* (2010), Jorge Herrara, Luke Dahl, and Carr Wilkerson's *TweetDreams* (2010), and Nick Kruge's *Madder Libs* (2010).[58] But for Essl, audience participation does not necessarily negate the use of the orchestral metaphor:

> I don't think that audience participation *per se* explodes the frame. One can easily envision orchestral performance that diffuses the boundary without a use of mobile devices and I'm sure there are historical cases. What technology does is make

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[56] When Dan Trueman and Perry Cook created PLOrk, they had in mind non-classical orchestras as well, such as a gamelan orchestra. See Trueman, "Why a Laptop Orchestra?" 174.
[57] Georg Essl, email interview with author, January 29, 2013.
[58] Oh and Wang, "Audience Participation Techniques," 670; Ibid., 668; Luke Dahl, Jorge Herrera, and Carr Wilkerson, "TweetDreams: Making Music with the Audience and the World Using Real-Time Twitter Data," in *Proceedings of the International Conference on New Interfaces for Musical Expression (NIME)*, Oslo, 2011, 272-275; Nick Kruge and Ge Wang, "MadPad: A Crowdsourcing System for Audiovisual Sampling," in *Proceedings of the International Conference on New Interfaces for Musical Expression (NIME)*, Oslo, 2011, 185-190. In the case of *Madder Libs*, the mobility of phones was used to capture audio samples generated by the audience. This work became the basis for the mobile app *MadPad*, which is discussed in chapter 1.

> participatory dissemination easy. Moving a cello, a harp or a timpani into the audience is tricky. Moving an app on a mobile device is not.
>
> So in a sense yes, there is a difference in opportunities. But that doesn't mean that one cannot refer to potential similarities or perhaps even mix it. Hybridizing that into a distributed participatory setting would not obsolesce the orchestra or conductor who may well be participating if not integral to the performance.[59]

3.3.4 Mobile Phone Ensemble Performance Practice

Thus far in mobile phone ensemble music, the process for composition and performance relies very much on improvisation and experimentation. This is similar to laptop ensembles that carry out the same procedures. Unlike traditional instruments that require physical modifications to the instrument to modify acoustic results, the hardware for mobile phone instruments stays more or less constant, meaning that the instrument can be refined via software without any destructive physical side effects. This means that the instrument can evolve alongside performance and compositional decisions.

The process can be generally described as follows: when a composer designs a mobile instrument for ensemble use, performers first undergo an experimentation process with the instrument (or instruments) as a group. In rehearsals or 'jam sessions,' the ensemble explores new sounds and ideas that can then be implemented into concert performance. During the process of improvisation with the mobile instrument, the ensemble will discover the features that work effectively while also identifying problems, bugs, and breakdowns. This creates a feedback loop leading to tweaks and revisions of the app.

At the University of Michigan students taking the class *Mobile Phones as Ensemble Musical Instruments* have a goal of composing pieces for an end-of-semester concert, with the idea of building instruments from scratch. Students first undergo a rigorous introduction to coding languages Objective C, C, and C++, as well as exposure to the iPhone SDK. They also build their own wristband speakers. The second unit of the class focuses on preparation for

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[59] Essl, email interview with author, January 29, 2013.

performance, with an array of topics such as spatial arrangements, composing for distributed instruments, dramaturgy, and choreography.[60] "Students engaged with different forms of performance, free-form unguided improvisation, guided improvisation through conducting, traditional, graphical and computer-guided scores."[61] In this second unit of the class students work on generating their own instruments, and work in pairs to compose a piece that uses their newly built instruments.

3.3.5 Visual Communication

During improvisation a group may stumble on a combination of sounds that is particularly effective, and will seek to replicate it again for the concert. When these 'happy accidents' occur, the group typically has to stop and ask each other who made what sound.[62] This becomes particularly difficult if there is no special consideration made to add a visual component to represent audio data, or if all sounds from multiple players funnel through a stereo speaker image. With mobile phones visual information can be disseminated through the displays, with messages transmitted wirelessly between devices.[63]

Visual clarity is needed between the audience and performers as well, and poses different challenges in performance strategy. Watching performers stare at mobile phones can be very dull from an audience perspective. In laptop ensembles the same symptom—commonly known among laptop ensemble enthusiasts as the 'email syndrome'—has been addressed in scholarly

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[60] Essl, "The Mobile Phone Ensemble as Classroom."
[61] Ibid.
[62] Tim Merritt, Weiman Kow, Christopher Ng, Kevin McGee, and Lonce Wyse, "Who Makes What Sound? Supporting Real-time Musical Improvisations of Electroacoustic Ensembles," in *Australian Conference on Computer-Human Interaction (OzCHI)*, Brisbane, Australia, 2010, 112-119.

[63] Jorge Herrara's mobile phone instrument *interV* uses OSC messages to send and receive display instructions. See Oh et al., "Evolving the Mobile Phone Orchestra," 85-86.

discourse.[64] Likewise, Essl notes that audience communication is a crucial aspect of MiPhos concert planning, and is highlighted throughout the course:

> We spend a lot of time worrying about communicating pieces. There are [at least two] reasons for this. One is that we cannot lean on audience expectations. Almost anything we do is likely new and needs to stand on its own in terms of conveying its point. The second is that just moving around a multi-touch screen does not have a strong performative character from the audience's perspective. That a performance looks no different than checking email is a concern for laptop ensembles and it is certainly a concern for mobile phones.[65]

This attention to audience communication is reflected in *There Is No I in Guitar* (2011), a MiPhos piece by Lizzie Paris, Ricardo Rodriguez, and Scott Wagner.[66] Six performers act as fingers on a guitar neck while a seventh performer acts as the guitar strummer. The instrument is distributed among these performers, where the six 'fretted' performers determine the pitch for the seventh performer to strum. The performers likewise move over a grid taped to the floor and form visual representations of fingers on a guitar fret to form chords. Though the choreography and physical position does not have an acoustic bearing on the music played, the visual formation of standard guitar chords is integral to communicating what each performer is contributing to the sonic results.

4Quarters addresses the issue of visual communication for both performers and audience by allowing all performers (and audience members) to see a visual representation of any performance gesture at all times. During jam sessions when honing desirable sounds is the primary focus, the ability to isolate events visually increases the efficiency in determining who

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[64] Timothy Edwards and R. Benjamin Sutherland, "Eyes Off the Screen! Techniques for Restoring Visual Freedom in LEO Performance," in *Proceedings of the 1st Symposium on Laptop Ensembles & Orchestras (SLEO)*, Baton Rouge, 2012, 33-40.
[65] Essl, email interview with the author, January 29, 2013.
[66] Lizzie Paris, Ricardo Rodriguez, and Scott Wagner's "There is no I in Guitar" (2011). See EECSatUM, "There Is No I In Guitar – Michigan Mobile Phone Ensemble," May 2, 2011, video clip, accessed January 30, 2013, Youtube, http://www.youtube.com/watch?v=5Omiskx-iFA&feature=share&list=PLCDF596A40CF11DA2.

makes what sound. This is especially helpful because of the acoustic dislocation that naturally occurs with all players sharing the same sonic output through stereo speakers.

3.3.6 Ensemble coordination

For ensemble works that use mobile phones as standalone instruments, traditional methods for coordination apply. Using a conductor is a logical way to give performers visual cues and assist in the coordination of gestures. Nevertheless, one advantage that both laptop and mobile phone orchestras can have over their acoustic counterpart is that a networked internal clock can ensure synchronization of musical events.[67] This can circumvent normal performance limitations created by the time it takes to react to other instruments (particularly in large ensembles, where space and the speed of sound become relevant). The conductor can then take form in a synchronized laptop display.[68]

In some cases the role of conductor can be irrelevant, or at least elude a clear definition. In *Glow Music* (2011) by Robert Alexander et al., the conductor has a flashlight with color filters.[69] The performers have control over timbral content but otherwise hold their phones in such a way that the conductor can shine a light on them. The phone's light sensor is mapped onto volume, thus allowing the conductor to conduct but also partly perform the piece. In *Shepard's Escher*, the conductor is performer as well, and provides visual cues to allow the group to coordinate movements.[70]

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[67] Trueman, "Why a Laptop Orchestra?" 175-76.
[68] Devin Kerr and Eric Lapointe, *The Infinitesimal Ballad of Roy G. Biv*, (2009). See "The Michigan Mobile Phone Ensemble @ Premiere Final Class Concert 2009," December 9, 2009, accessed February 7, 2013, http://mopho.eecs.umich.edu/events/finalclassconcert09.html.
[69] EECSatUM, "Glow Music – Michigan Mobile Phone Ensemble," May 2, 2011, video clip, accessed March 1, 2013, Youtube, http://www.youtube.com/watch?v=ujlPORoZJGY&feature=share&list=PLCDF596A40CF11DA2.
[70] *Shepard's Escher* is the first piece on this concert-length video: um, "iPhone Premiere Public Concert," December 11, 2009, video clip, accessed February 7, 2013, Youtube, http://www.youtube.com/watch?feature=player_embedded&v=Qp3dMbI94_Q.

Other mobile phone ensemble configurations can demand coordination, but in ways where timing must be choreographed rather than synchronized through visual cues or an automated clock. This is especially true for 'distributed' instruments, where sonic output is brought to pass through the coordinated efforts of multiple players, as is the case in *There is No I in Guitar*.

3.3.7 Popular Growth of Mobile Phone Ensembles

With the institutional model of creating ensembles that focus on defining the mobile phone as an instrument, there is an inherent conundrum in trying to popularize and expand these efforts. Mobile phone ensembles that require complex networking, multi-channel speaker arrays, and/or speaker gloves are not likely to be replicable outside of an academic setting. For the sake of argument, if we call the Stanford MoPhO and Michigan MoPhO the 'professional' versions of mobile phone ensembles, it would be difficult for low-tech amateur ensembles to replicate the same setup and access the same repertory of works. It is also possible that wearing speaker gloves will never catch on. In spite of its pragmatism in terms of sound dispersal, speaker gloves may be viewed as too outlandish to gain widespread social acceptance.

A second challenge facing mobile phone ensemble development is creating a central access point for the growing repertory of works. Oh et al. states:

> With the ease of software development comes proliferation of instruments, and consequently these "soft instruments" have become more or less disposable items: often times, an instrument gets written for a specific piece and gets abandoned thereafter.[71]

This problem of instrument 'one-offs' has been documented elsewhere, and in some ways the problem is endemic to any software instrument, since both hardware and software evolve so rapidly.[72] Stephen David Beck and Chris Branton (2012) at Louisiana State University have attempted to address this issue of accommodating the growth of both mobile phone ensembles

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[71] Oh et al., "Evolving The Mobile Phone Orchestra," 86.
[72] See Lansky, "A View from the Bus," 108; Perkis, Brown, and Bischoff, "Bringing Digital Music to Life," 28-29.

and laptop orchestras by creating the Laptop Ensemble Library & Archive (LELA).[73] The project is still in its infancy, as to date there are only seven items archived.[74]

3.3.8 Conclusion

If one looks to the evolution of the chamber orchestra for comparison, it is clear that developments with mobile phone ensembles are only in an early stage. Various ensemble sizes, formats, and configurations will likely evolve as the technology changes and the strengths and weaknesses of the instruments become clear. Essl states:

> My attitude is that we do not know what we are doing just yet and we need to explore and explode the frame. That this can be misunderstood or not always lead to the most amazing results is part of the equation. Symphonic orchestral music had some 200 years to refine itself; we are now in the fifth year of working on this and I think it is getting richer and more refined. I hope we stay as broad as possible for as long as possible. We are in a non-canonized field and now is the time to go crazy.[75]

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[73] Stephen David Beck and Chris Branton, "LELA: Laptop Ensemble Library & Archive," in *Proceedings of the 1st Symposium on Laptop Ensembles & Orchestras (SLEO),* 2012, Baton Rouge, LA, 27-30.
[74] See "Laptop Ensemble Library & Archive (LELA)," Louisiana State University, accessed January 9, 2013, http://lela.cct.lsu.edu/lela/items.
[75] Essl, email interview with author, January 29, 2013.