

Sound Art on the Move

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Introduction

This paper explores the intersection of sound art and mobility.¹ The emerging fields of locative art and wireless art experiment with the ever-changing geographical and social context of digital landscapes, mainly with a visual or textual focus. I would like to shift the focus from the visual to sound and discuss some emerging topics of mobile sound art. This discussion revolves around two examples, "IMPROVe" and "Tactical Sound Garden [TSG] Toolkit." I chose these examples from a growing number of works of sound art that experiment with everyday mobile technology, such as mobile phones. The examples propose different approaches to mobile sound art, the first one is concerned with mobile recording and remixing the urban soundscape, the latter is dealing with the collaborative spatialisation of sound in digital landscapes. Both illustrate how traditions of public sound art can work in the context of ubiquitous mobile technology.

IMPROVe

The mobile phone has been a recording device for some time, but this functionality is rarely used. The industry tried to market it as 'record-your own-ringtones' feature, but this never became popular. I don't think the quality of the recordings is the reason for this because ringtone quality was dreadful for a long time, but that didn't stop them to flood the market. Using the mobile phone for recordings is usually a one-off activity, people record a message for their voice mail of their new phone. Then, they don't think about the recording function any further, they don't connect it to the idea of soundscape recordings, for example. That's why it is interesting to explore this in sound art.

Helsinki, 1 April 2006: A person is standing in the train station, holding a mobile phone up into the air. Another person is crouching down, edging closer towards a bunch of shrieking pigeons, inching a mobile phone towards the birds. About an hour later these two people meet up with some others in the same train station. They are pressing keys on their mobile phones whilst being surrounded by the sounds of pedestrians, phones ringing, an argument between birds, sirens, urban bustle. Familiar station sounds, but in unusual combinations, volume and loops. The group is using their mobiles to collaboratively remix the sound recordings they made with the same devices earlier on. They are participating in "IMPROVe" by Zeenath Hasan and Richard Widerberg (Hasan, 2006).

1. This paper does not talk about ringtones or using the mobile phone for conversation.

IMPROVe

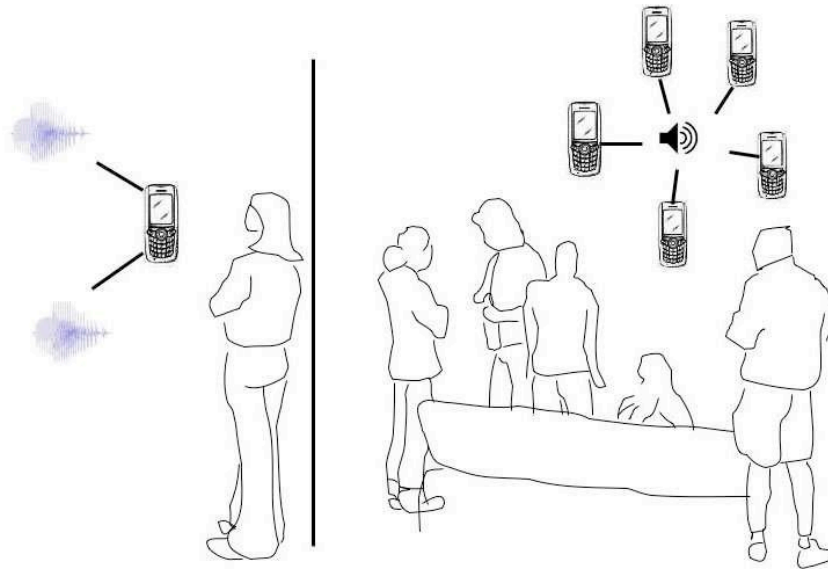


Fig 1: "IMPROVe" by Zeenath Hasan and Richard Widerberg, 2006.

The project works in two stages: In the first one, the participants use the existing recording feature of their mobile phones to record sounds in their surrounding soundscape, at their own pace, and in locations of their choice, and then upload them to a central computer that runs "Pure Data" (PD). In the second stage, all the participants (about 4-25) come together and collaboratively remix these sounds via mobile phone; the resulting sound is emitted via a sound system. The participants use the four-directional button on the phone's keypad to play a randomly selected sound file and to control its volume, speed and loop length; the mobiles are remote controls for PD. This distinguishes "IMPROVe" from most other (mobile) recording projects that tend to work towards some kind of sound archive, "Mobilescout"² or "[murmur]"³ are examples.

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2. 'In this project, the phone is an interface for creating voice annotations that are linked to a playful real-world "scouting" scenario. [...] Their recordings are presented as a public collection that anyone with access to the web can browse and playback the recorded audio' (Bleeker, 2005).
 3. Signs with phone numbers invite people to call and listen to a story a local is telling about the specific location. The artists explain that 'the details will come alive as they walk through, around, and into the narrative' (O'Donovan, 2003).

Mobile Experience and Soundscape

How does "IMPROVe" relate to our everyday experience of mobile technology and the city? Initially, the most obvious impact of mobile phones on the soundscape appeared to be ringtones.⁴ But ringtones quickly became habitual, we don't hear them anymore and vibrating alert has become hugely popular. More interestingly seems to be how the mobile phone introduced remote private sounds to the urban soundscape and the fact that not everyone can hear the same soundscape because parts of it became private and personalised. Everyone has his or her own soundscape, depending on the use of mobile technology: listening to music on earphones? Phone ringing? Voice of someone on the phone? This private soundscape is partly shared though; you can overhear snippets of phone conversations or music spilling out of headphones. All these new sounds are mixing with the existing urban soundscape. Private, remote sounds and local, mostly public (of some sort) sounds form the mobile soundscape. What strategies might emerge in sound art to explore this mobile soundscape?

The mobile soundscape is embedded in various activities of producing space by using mobile technology. Using mobile phones in public, for example, making a phone call in the street, creates a "bubble" of private space in public. Many people using mobile phones in a public space create a lot of bubbles of private space in public and at the same time they also change the nature of this public space. In everyday life we tend to create private spaces when using mobile technology. Artists explore how mobile technology can be re-appropriated to create public spaces. In addition to the spectrum of private and public spaces that can be created, there is also a spectrum of individual and collective spaces that can be created by using mobile technology. In everyday life we are mainly creating individual spaces, by texting or listening to music on the iPod, for example. The common use can thus be described as private and individual. Of course, there are exceptions where mobile technology such as mobile phones is used in a public and/or collective way, showing photographs on the screen of a mobile phone to others or playing music to friends using the phone as speaker would be examples. Still, the dominant way of use creates private and individual spaces. Artists attempt to create different spaces, public and/or collective ones. IMPROVe, for example, features a group of people collaboratively remixes sounds and thereby creating a collective space; the created space is also a public one, as the resulting sound is broadcast via a soundsystem in a public space.

It is not only the soundscape and practices of producing space that change with mobile phones, but also our patterns of activities and attention alter and shape the way we experience urban space. Everyday life with mobile phones is characterised by fragmented activities and attention. Mobile phones are often used while doing something else, with our attention shifting back and forth between various layers of activities, e.g. between walking along a street and sending a text message. Bassett (2003:348) describes this as a constant shifting between 'attention/inattention'. She describes everyday mobile attention in an auditory way: "Mobile spaces tend to be prioritized over physical space, in a sense that it tends to be given more immedi-

4. When ringtones were still relatively new to the urban soundscape and an increasingly frequent nuisance during concerts they were more frequently used in mobile sound art, for example in Levin's "Dialtones. A Telesymphony" or in "Telephony" by Thomson and Craighead (Behrendt, 2004).

ate attention. [...] To turn the attention away from the sensory rich environment of the streets and towards the thin thread of talk is to prioritize the auditory at the expense of the embodied and visual world.' How is that different if the mobile attention is not occupied with a 'thin thread of talk', but a work of sound art that engages with the surrounding environment? Does sound art need the audiences full attention? Or could it also be one of several activities? Could participation in sound art be part of everyday life, as opposed to visiting designated spaces and spending a set time?

I suggest there are two main approaches for sound artists to deal with these fragmented mobile activities, attention and soundscape: Blend-in and disrupt. "Blend-in" projects invite the audience to interact via normal phone activities such as texting or making a phone call. It seems to be quite a successful strategy for getting people to participate precisely because it enables them to blend-in: nobody can tell whether they text to participate in sound art, or to communicate with a friend. The familiar phone activities used in these projects are used to unfamiliar ends e.g. texting but as a result hearing a loud sound from a nearby speaker in a public space. These type of projects might be more suited to blend in with the everyday use of mobile phones, participating can be one of several fragmented activities, not needing the participants full attention for a long time.

The second approach does not allow the participants to blend in, it asks them to use their mobile phones in an unfamiliar way, disrupting familiar patterns of phone use. "Mandala 3 and Mandala 4" by Schiemer, for example, involves spinning a mobile phone on a string above your head in the middle of the street (Schiemer, 2006) and in "Cellphonia"⁵ the participants sing their lines of the libretto into their mobile phones to contribute to a mobile opera. Projects at the disruptive end of the spectrum are more likely to demand the participants' full attention, they do not work as one of many fragmented activities while being on the move in town.

The remixing part of "IMPROVe" is more likely to blend-in, for the recording part this depends on the way people use their devices while recording. The remixed sound certainly is at the disruptive end of the spectrum because they are emitted via speakers. Headphones on the other hand, are more likely to blend-in.⁶ Interesting combinations occur if the activity is disrupting but the sound is blending-in, as in the recent phenomenon of mobile clubbing.⁷ Disrupting sound with blending-in behaviour can often be observed with more activist projects such as the "Tool for Armchair Activists", where participants' text messages are broadcast onto a public urban space via a bullhorn that is strapped to a lamppost.

5. 'Cellphonia: In The News is an open source cell phone karaoke opera with a mixed final performance delivered to the participant as a podcast and online as a web based mp3. The ever-changing current state of the opera will be continuously available as an online stream-cast' (Bull, 2006). The participants are asked to 'sing into the cellphone responding to the song lyrics provided by a robot voice prompt.' See <http://cellphone.el.net/listen/>

6. Combinations with traditional broadcast media, such as radio are another possible output for sound art on the move, and have been deployed in "Text.FM" and "Wählt die Signale!", for example.

7. See (Dyer, 2006) and <http://www.mobile-clubbing.com/>

The Tactical Sound Garden Toolkit

This example works not with existing sounds of the city but adds sounds to the digital urban landscape. I'm walking along the streets, headphones on, looking like all the other ipod users around me, but I'm not listening to music of my choice, I'm listening to sounds other people have planted in the streets. As I approach them they get louder, I can walk around the sounds, and, I can decide to prune them. These sounds are plants in a "Tactical Sound Garden [TSG]", by Mark Shepard. The project 'draws on the culture of urban community gardening to posit a participatory environment where new spatial practices and social interactions within technologically mediated environments can be explored and evaluated.' (Shepard, 2006).

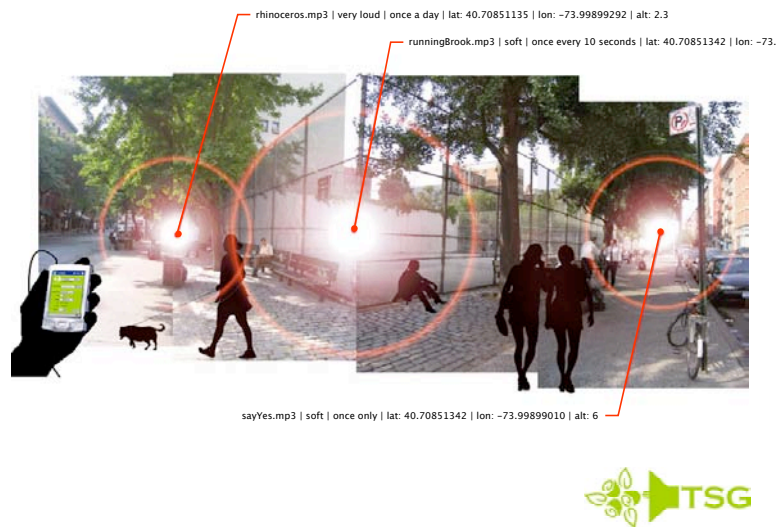


Fig 2: Tactical Sound Garden Toolkit [TSG] by Mark Shepard, 2006.

Shepard's virtual sound gardens are a 'parasitic technology' using existing wireless networks that need not be owned by the person that is opening a sound garden by installing a "TSG" server (Shepard, 2006). The positioning of the participants works by a triangulation of wireless nodes and therefore this project only works in areas that have a high density of wireless networks. When entering a sound garden, participants download a client software as well as the sounds already planted in the garden onto their mobile devices, such as phones, PDAs or laptops. Participants can then plant their own sounds and set attributes such as volume, repetition and altitude. They can also prune someone else's sound by changing the attributes of it and optionally leave a message for the planter. A 3-D (gaming) audio engine maps the sounds onto the physical environment.

Digital Landscapes

"TSG" draws on various traditions of exploring the spatial qualities of sound, both in everyday life and in sound art. On one hand it works with traditions of the relation of sound and physical space; sound installations and headphone walks for sound art, Walkman or iPod for the everyday context. On the other hand the project draws on traditions concerning the relation of sound and virtual space, for example on the Internet

or in Computer Games. Physical and virtual space are increasingly converging as 'continuous fields of network presence [have] begun to blanket public spaces' (Mitchell, 2003:156). These hybrid spaces are often referred to as 'digital landscapes' (Cater, 2005).

Connected mobile devices that are our constant companions enable use to navigate physical and virtual space at the same time. GPS, wireless, RFID and ad-hoc-networking are some of the buzz-words of the locative media and ubiquitous computing industry that is largely dominated by commercial interests and neglects surveillance and security issues. There is also an emerging field of artists using these technologies and projects exploring their social and artistic potential, such as "sociallight"⁸, "Yellow Arrow"⁹ or "Urban Tapestries"¹⁰. In the tradition of graffiti and street art, these projects tend to focus on the visual aspects. Even sound projects like "TSG" tend to be discussed in this context, paying little attention to sound. But this project draws clearly on a tradition of sound walks in sound art and this provides an equally important angle to understand the work.

The tradition of sound art relevant for "TSG" and many other mobile sound art pieces is one of stationary sounds and a mobile audience. In sound installations the audience walks around between various sound sources, such as speakers that are distributed in the installation space. In headphone walks the sounds are not emitted by a speaker in a physical location, rather the physical location of the participants triggers the playing of a sound via headphones, only giving the impression of the sounds being located in physical space. Other, often older examples of headphone walks used different technologies and strategies, for example the Walkman (Schätzlein, 2001) or magnetic induction (Kubisch, 2000). "TSG's" closest predecessor in sound art are GPS soundwalks such as Teri Rueb's "Drift" (Rueb, 2004) where participants also walk around to find and explore sounds that have been placed in physical space. The main difference is that in sound gardens, the participants don't listen to the artist's sounds, they plant their own ones.

In the tradition of public sound art (Föllmer, 1999), mobile technology enables new ways for sound art to move into spaces that are a part people's everyday life, such as streets or train stations. But even if participants don't need to visit a dedicated art space, they still need to devote some time to explore a piece. This temporal aspect of locative media (art) and public sound art is often neglected. Current media (art) debates are often heavily locative and space-centred, exploring the properties of the "new" hybrid spaces or digital landscapes. Equally, many discussions of sound art are heavily biased towards space - and not time. As Bandt (2005:132) criticises: 'While the spatial features of sound art are often discussed as they are so easily perceivable, the temporal design is often much less obvious, as it demands substantial listening time and

8. 'create virtual sticky notes' anywhere in the city and 'share them with others' on your mobile phone. 'Connect words, photos, sound and videos with real-world places and find them when you're actually there.'
<http://sociallight.com/>

9. Stick a yellow arrow with your code printed on it to a physical place. Anyone can then text that code to the Yellow Arrow phone number and receives the message you left at that very location.
<http://yellowarrow.net/>

10. 'Urban Tapestries is an experimental software platform for knowledge mapping and sharing - public authoring.'
<http://urbantapestries.net/>

effort for it to be understood.' Time and space need to be discussed together. You need time to explore space. How long is an audience willing to spend in a concert, a gallery sound installation, to participate in mobile sound art? Coming back to "TSG", I would argue that the temporal qualities of the work are equally important as the spatial ones. How much time do you need to explore a Tactical Sound Garden? How is a garden changing over time? Are plants/sounds growing, decaying and dying? Are people actually pruning their own or other's sounds over time? People taking the same route every day would hear a sound evolving over time, decaying, growing, pruned; thus focussing more on the temporal aspects of the project. The one-time visitor, on the other hand, might be more focussed on the spacial qualities.

Conclusion

Concluding, the observations of analysing "IMPROVe" and "Tactical Sound Garden" are combined to illustrate how traditions of public sound art can work in the context of ubiquitous mobile technology. Both examples put emphasis on the audience, or rather participants, with the artist providing a platform and the participants using this platform, creating the work by interacting. Three key aspects of sound art on the move deserve some concluding remarks. First, the context of the audience and how to 'find' an audience, second, the creation of public and collective spaces via sound and mobile technology, as opposed to the private and individual ones we create in the everyday use of the technology; and third the two main artistic approaches of blending-in and disrupting, for both the action of creating these spaces and the resulting sound.

First, what can the two examples tell us about the audience in a mobile context? The audience inhabits digital landscapes, navigating physical and digital space at the same time. There might be various layers of information in digital landscapes, for example, digital information that has been tied to physical space ("geo-tagging") by various parties such as friends, shops owners, artists, musicians or politicians. The use of mobile technology is also deeply woven into our everyday life, we habitually listen to music or talk on the phone as one of several activities on our urban journeys. A constant shifting of attention and inattention (Bassett, 2003) between these various activities characterises the mobile context. Is sound art happy to be one of several activities with the participant's attention shifting back and forth between them?

Building on the tradition of public sound art, the audience of mobile sound art does not need to visit dedicated art institutions, but is "found" in the everyday urban environment. At first sight the "anywhere and anytime" promise of mobile media seems to make the finding of an audience much easier. But at second sight this poses unique problems: How do you get people's attention, how do you invite them to participate in sound art? Mobile technology, such as mobile phones, are often used while waiting or on journeys. A possible strategy for mobile sound art might be to catch the attention of passers-by in these "waiting" spaces like train stations or while on their journeys, on a busy road crossing, for example. Artists and curators need to find a way to inform people about the work and how they can participate/interact, e.g. with public signs or via text messaging. Both presented works are very aware of their potential audience. "IMPROVe" aims to reach to two different audiences; the first scenario is a group of friends that record sounds in their daily life and then meet up in a pub to remix them and play them on a soundsystem in that

location. The second scenario aims at professional musicians using the platform as part of a live concert performance (Hasan, 2006). The artists give no further information of how they would inform people about the piece in the first scenario and how they would invite them to participate. "Tactical Sound Garden" is quite clear about the communities it would like to work with but does not give any details of how they will be approached either: 'The idea is to work with communities defined by the shared use of a specific public location – an airport, a park, a street, a plaza – rather than ones defined primarily by common property, place of residence, shared interests or beliefs' (Bull 2006). This issue of how to actually address this imagined audience is not covered in the concepts of the two presented examples – possibly because they have only been presented in the context of media art festivals so far. How are they going to address this issue in the everyday context, the urban reality?

The second key aspect concerns interaction and the creation of collective and public spaces. Although the shifting attention in the mobile context might suggest otherwise, mobile interaction can provide meaningful forms of engagement with the urban environment and soundscape as well as with other people. Sanio's (2003:14) definition is a useful starting point for thinking about interactivity, she defines sound art as interactive where 'the recipient can actively engage with the event, becoming part of the aesthetical process'. This engagement with the aesthetical process takes place in different ways for both examples, hinting at the variety of possible scenarios for mobile sound interaction: from playful to improvising, from interaction with sounds and the city to interacting with technology, networks and other people. The use of familiar, intimate technology, such as mobile phones, might make it easier to overcome inhibitions to interact with sound art. Also, this might make it easier for people to interact with strangers. This is interesting in relation to the collective interaction that takes place in both examples. In "IMPROVe" the participants use their mobile phones to remix sounds in collaboration with people they don't necessarily know and in "Tactical Sound Garden" people plant a community sound garden together with anonymous passers-by.

What kind of space is constituted by these interactions? As described earlier, the everyday use of mobile technology is typically producing private and individual spaces. Artistic use challenges this dominant use and explores how public and private spaces can be created by using mobile technology. Sound artists do so with a focus on sound. Private and public as well as individual and collective are not regarded as dichotomies, rather they open up a spectrum. They are useful as terms even when describing blurring and shifting contexts such as the use of mobile phones for private communication in public spaces. If we imagine a graph with private and public at the far ends of one axis and with individual and collective on the other axis, we have a spectrum of various degrees and combinations of public, private, individual and collective to describe examples of mobile sound art. The recording part of "IMPROVe" creates a rather private and individual space. It is the second part, the collaborative remixing of the previously recorded sounds that creates a collective space. This space is also a public one, as the resulting sound is broadcast into public space via a sound system. "Tactical Sound Garden" creates public space in a different way, it is only audible to those who visit the sound garden equipped with mobile devices and headphones thus creating a less public, more private space than the first example. "Tactical Sound Gardens" provide a collaborative planting and listening experience, thereby creating a collective space. This collective space enfolds more over time

than in "IMPROVe" as people plant and listen to sounds over time. The capacities of sound for creating public and collective spaces has been explored in music and sound art for a long time; the two examples show how this tradition can work in digital landscapes and by re-appropriating mobile technology.

Creating these unfamiliar, public and/or collective spaces - unfamiliar in respect to using mobile phones in public - can work in two modes, two artistic approaches, blend-in and disrupt; this is the third key aspect. And once more, this is not a dichotomy, I am talking about a spectrum, with blending-in on one end and disrupting on the other end. It might be useful to imagine a graph with the action of creating these spaces on one axis, from blending-in to disruptive; and with the resulting sound space on the other axis, also from disruptive to blending-in. This enables us to further describe and compare the examples. For "IMPROVe", the action of participating, of creating a collective and public space, is pressing buttons on a mobile phone - rather at the blending-in end of the spectrum of the action axis. At the same time, the resulting sound is at the disruptive end of the scale with the public speaker system. The action in "TSG" seems to be a rather blending-in one as well, with the participants of "TSG" walking along the street with headphones, just as anyone else. But the very same activity might become more disruptive if the participants starts to walk in circles for no apparent (visual) reason. The resulting sound can only be heard via headphones, thus positioning the work at the blending-in spectrum in terms of the resulting sound. Overall, the proposed reading of examples situated at the intersection of sound art and mobile technology shows how public and collective sound spaces can be created when ephemeral sounds meet fleeting audiences.

List of Examples

All websites have been last visited on 24 October 2006

CELLPHONIA: In The News by Steve Bull, Scot Gresham-Lancaster, Tim Perkis, 2006.

<http://cellphone.el.net/listen/>

Dialtones. A Telesymphony by Golan Levin, 2001.

<http://www.flong.com/telesymphony/>

Drift by Teri Rueb, 2004.

<http://www.terirueb.net/drift/index.html>

IMPROVe by Zeenath Hasan and Richard Widerberg , 2006.

<http://mlab.uiah.fi/improve/about/>

Mandala 3 and Mandala 4 by Greg Schiemer and Mark Havryliv, 2005-2006.

<http://www.uow.edu.au/crearts/staff/schiemer.html>

Mobilescout by Julian Bleecker, Scott Paterson and Marina Zurkow, 2004.

<http://www.mobilescout.org/>

[murmur] by Shawn Micallef, James Roussel, Gabe Sawhney, since 2003.

<http://murmurtoronto.ca/>

Oasis 2000 by Christina Kubisch, 2000.

http://www.christinakubisch.de/english/klangundlicht_frs.htm

Tactical Sound Garden [TSG] Toolkit by Mark Shepard, 2006.

<http://www.tacticalsoundgarden.net/>

Telephony by Jan Thomson und Alison Craighead, 2000.

<http://www.thomson-craighead.net/docs/teleph.html>

Text.FM by Graham Harwood and Matthew Fuller, 2001.

<http://interface.t0.or.at/projects/project04.html>

Tool for Armchair Activists by Troika, 2005.

http://www.troika.uk.com/armchair_activists.htm

Wählt die Signale! by Ligna (Michael Hüners, Torsten Michaelsen und Ole Frahm) and Jens Röhm, 2003.

<http://www.transmediale.de/04/page/detail/detail.0.projects.111.html>

http://www.hamburger-kunsthalle.de/sammlungav/html_sammlung/r/roehm_2003_01.html

Bibliography

- Bandt, R. (2005). Designing Sound in Public Space in Australia: a comparative study based on the Australian Sound Design Project's online gallery and database. *Organised Sound*, 10(2), 129-40.
- Bassett, C. (2003). How many movements?. In M. Bull, & L. Back (Eds.), *The Auditory Culture Reader*. (pp. 343-55). Berg Publishers Ltd.
- Behrendt, F. (2004). *Handymusik : Klangkunst und "mobile devices*. Osnabrück: Electronic Publ.
- Bleeker, J. (2005). Design for Public Interfaces: Mobile Phones as Civic "Intermediaries". Paper presented at the CHI05. Conference on Human Factors in Computing Systems. Workshop "Engaging The City: Public Interfaces As Civic Intermediary", New York.
- Bull, S., Gresham-Lancaste, Scot, Perkis, Tim (2006). CELLPHONIA: In The News. Paper presented at the Third International Workshop for Mobile Music, Brighton.
- Cater, K., Fleuriot, Constance ,Hull, Richard, Reid, Josephine. (2005). Experience Design Guidelines for Creating Situated Mediascapes. Technical Report HPL-2005-181. 20051021. HP Labs.
- Dyer, G. (2006). An explosion of delight. Mobile clubbing is more than a fad: it delivers a joyous mirror image of a terrorist attack. *The Guardian* [online].
- Föllmer, G. (1999). Klangorganisation im öffentlichen Raum. In H. d. I. Motte-Haber (Ed.), *Klangkunst : tönende Objekte und klingende Räume*. (pp. 191-227). Laaber: Laaber Verlag.
- Hasan, Z., Widerberg, R. (2006). IMPROVe. Mobile architecture for sonic socio-cultural exchange. Paper presented at the Third International Workshop for Mobile Music, Brighton.
- Kubisch, C. (2000). Oasis 2000. In D. Toop (Ed.), *Sonic boom : the art of sound*. London: Hayward Gallery Publishing.
- Mitchell, W. J. (2003). *Me++ : the cyborg self and the networked city*. Cambridge, Mass. [u.a.]: MIT Press.
- O'Donovan, C. (2003). Murmurings: An interview with members of the [murmur] collective. YEAR ZERO ONE FORUM, *Summer 2003*(12).
- Rueb, T. (2004). Drift. In K. Kwastek (Ed.), *Ohne Schnur : Kunst und drahtlose Kommunikation*. (pp. 210-19). Frankfurt am Main: Revolver, Archiv für Aktuelle Kunst.
- Sanio, S. (2003). Klangkunst – eine reflexive Entdeckungsbewegung. *Neue Zeitschrift für Musik*, 1/2003, pp12-15.
- Schätzlein, F. (2001). Mobile Klangkunst. Über den Walkman als Wahrnehmungsmaschine. In D. Toop (Ed.), *Radio-Kultur und Hör-Kunst : zwischen Avantgarde und Popularkultur 1923 - 2001*. (pp. 176-95). Würzburg: Königshausen & Neumann.
- Schiemer, G., Havryliv, Mark (2006). Pocket Gamelan: tuneable trajectories for flying sources in Mandala 3 and Mandala 4. Paper presented at the 2006 Conference on New Interfaces for Musical Expression (NIME-06), Paris, France.
- Shepard, M. (2006). Tactical Sound Garden [TSG] Toolkit. Paper presented at the Third International Workshop for Mobile Music, Brighton.

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