Sonic Boundary Objects
Negotiating Disability, Technology, and Simulation

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by
Dr. Florian Grond and Dr. Piet Devos

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Abstract

In this article we present the concept of *sonic boundary objects,* which we illustrate by discussing the case of binaural sound recordings as a tool, which helps to negotiate between blind and sighted experiences of an urban soundscape. We begin with developing the theoretical underpinning of the concept of a *sonic boundary object* by briefly elaborating on the relevance of the concept of the *boundary object* in the context of disability and technology; we then explain the special properties of binaural recordings and revisit the musicological concept of the *sound object,* whose relationship with technology partly inspired the work in this article. After introducing these concepts and related practices we proceed by proposing the term of a *sonic boundary object*. We discuss the relationship of the sonic boundary object with the concept of simulation in the context of disability studies and we then elaborate on its potential impact as a complementary practice to blind ethnography and to participatory design approaches. We will demonstrate its ethnographic potential with an account of the authors' experience using binaural recordings to exchange on what blind navigation is like in Montreal. The article concludes with a first person reflection on this experience and possible fields of application.

Keywords: disability studies, urban soundscapes, assistive technology, participatory design, blind ethnography.

Introduction

Texts from the field of science and technology often adopt a writing style that suggests an objectively shared reality and objective knowledge built thereupon. Contrary to this objectifying practice, in this article we try to preserve both our voices, one sighted and one blind. This does not mean that we want to promote a radical solipsistic view but by diversifying the voices and views, we are showing the narrowness of the established discourse. We also want to highlight that beyond the tendency of technology to reduce the lifeworld to the often-smallest common denominators, technologies can also have the potential to negotiate between various experiences and can help making their differences tangible and valuable.

This is how we believe that the creative use of technology can be beneficial for moving towards a more inclusive society. More specifically, we suggest in this article the creative use of binaural recordings for autoethnographies as suggested by Florian Grond in order to share creative techniques for blind urban navigation as recorded and reflected upon by Piet Devos. For the exploration of the potential of binaural recordings, we followed a research creation approach. The research process was guided by theoretical considerations and validated through a practical

exercise, where we put the ideas to an informal test. The structure of the article might suggest clearly defined roles of the two authors and an orderly process leading to the idea of the sonic boundary object. What started out as the development of an autoethnographic method is however the result of the entangled activities of thinking, doing and writing in this case of two people and felt occasionally like an artistic project.

Blind navigation

As sociologist Siegfried Saerberg points out in his autoethnographic account "Just go straight ahead" (Saerberg 2010), asking for directions can be difficult for the blind when talking to the sighted. Although the communication can be easily initiated, the problem is that it quickly comes to a dead end when concrete directions or waypoints need to be communicated, since those are very differently experienced and remembered by the blind and by the sighted.

In an attempt to foster understanding for those and other differences between persons with different abilities, simulations have for a long time played a contentious and often debated role (see Siebers 2008, 28-29).

Simulations of disability have so far focused on the artificially imposed sensory restrictions by using technology, for instance in the case of visual impairment and blindness by simulating a restricted field of view, an artificial blur, or by blindfolding.

The problem of simulation, as an attempt to understand disability, can be coarsely summarized with the difference between impairment and disability. The first describes the functional restriction or loss of certain senses corresponding with the medical model of disability. The second corresponds with the experience of restrictions imposed by the society as a whole and the predominant culture of ableism, i.e. the social model of disability.

The criticism of an artificial impairment for instance is twofold: first, it does not allow for the experience of the full impact and consequences of an ableist social context and second, it does not allow the person who performs a simulation to appreciate the inventive and creative potential of persons with disabilities who compensate their impairment with other senses and skills in order to accomplish their everyday life. Saerberg, for instance, not only gives a autoethnographic account *of* the challenges (Saerberg 2010) but equally *about* this creative approach towards understanding the lifeworld of a blind person in what he calls the *sensorification of the invisible* (Saerberg 2011). Similar (auto)-ethnographic insights can also be found with Tony Stockman (Stockman 2010) and Arseli Dokumaci (Dokumaci 2016).

Boundary Object

Inspired by Saerberg's notion of the *sensorification of the invisible,* we like to propose a fresh look at technology: more specifically, we will investigate binaural recordings and their relationship with simulations through the lens of the *boundary object*, a concept from sociology.

The notion of the *boundary object* was first conceived and described by Star and Griesemer in the context of Berkeley's Museum of Vertebrate Zoology, where maps where used to negotiate between amateurs in the field and professionals in the

museum to locate and contextualize found objects (Star and Griesemer 1989 and Star 2010). Maps were here described as *boundary objects* in that they did not have the same meaning for amateurs and professionals but helped to structure and organize the activities of both groups and - as we speculate - might have led over time to increased mutual understanding of what mattered to both.

Here we find similarities with the problem of simulating disabilities, in that groups of mixed abilities are unlikely to gain an essential understanding of what a certain disability means or feels like. Yet we might find tools such as maps or apply existing practices like binaural sound recordings, which (despite this fundamental limitation) enable interaction and promote understanding. With the notion of the boundary object, which we transfer to the discourse of disability and simulation, we hope to show that a definitive model-based understanding of disability as encountered in simulations can rather get in the way of appreciating what a certain disability is about and that we should rather focus on how we can use existing technologies in order to mobilize thought processes through meaningful shared experiences between persons with different abilities. In the context of blind ethnography, we will discuss the use of binaural sound recordings and re-conceptualize them as boundary objects, proposing the specific term of a *sonic boundary object*.

Binaural Recordings

Binaural sound recordings are two-channel recordings with the microphones placed as close as possible to the ears of the recordist of the soundscape. Ideally, the microphone sits in the ear canal itself, but this is not feasible if the recordist relies to a large degree on his or her sense of listening for navigation. Even if not ideally positioned, this technique leads to a very realistic recording of the sound scene as perceived by a human being. This realism, to be precise, only exists in terms of the acoustic properties of the recording. Hence only listeners of similar head shapes and ears perceive these acoustic properties as close to realistic. (For for an overview on binaural recording methods see Hammershøi et al. 2002)

For most others, however, it still captures and separates horizontally distributed sound sources fairly well. Important for the context of this paper, binaural recordings capture many aspects of an embodied listening experience such as body and head movements and associated changes in the auditory scene, all of which contribute to the efficient sonic exploration and navigation of the environment. Although proprioceptive cues are not directly present as such in the sound recording itself, listening to the recording has the potential to evoke their presence, as we will discuss in the autoethnographic section of this paper.

The Sound Object

We briefly recapitulate the concept of the *sound object*, since it partly inspired the concept of the sonic boundary object. The sound object was introduced by Pierre Schaeffer in the context of *musique concrète* (Schaeffer 1966). The concept of the sound object owes its existence largely to the rapid development of sound technology and the possibility to record and manipulate sound playback through the tape recorder in the 60s. In particular the possibility to focus on the perception of

acoustically exactly repeated sounds led to the liberation of everyday sounds from being fixed and immutable signifiers.

This promoted the idea that what was proper to sound beyond its first layer of individual signification could be accessed through repeated listening.

It was technological progress in the end that supported the idea that the meaning and potential of sounds depend on how we listen to them. It is worth noting that listening sessions, which tried to outline the shapes and structures of sound objects, were joint practices, tried to overcome idiosyncratic descriptions of sonic experiences and aimed at providing a general descriptive framework. This in turn led to the critique of the sound object as an attempt to fix an ahistorical essence of sound, depriving sound of its embodied meaning (compare (Kane 2007) and (Kim 2010)).

This tension describes well the potential and perils of the relationship between technology and the senses. Technology can highlight that what is perceived is intrinsically tied to perceptual intention. However, if technology leads to generalization attempts, it can, even if meant to be descriptive (as in the case of the sound object) be experienced as normative. While there have been recent developments that formalize embodied listening modes (see Tuuri 2012), the danger that technology enforces normative tendencies is particularly relevant in the context of the relationship between technology and disability.

As far as the link between creativity and technology is concerned, we want to promote the view, that technology can be conceived such that it supports the joined explorations of different individual experiences, rather than reifying them in order to subject them to algorithmic operationalization. As much as technology has helped to fix sound in a recording and hence has helped to bring forth the concept of the sound object, the sound object remains a listener category and is not to be confused with the sound recording itself.

The Sonic Boundary Object

In a similar way, we believe that binaural recordings are not in themselves *sonic boundary objects*; a confusion similar to the one that a recorded sound is a sound object. *Sonic boundary objects* are equally tied to repeated listening and are a specific and shared listening practice between two listeners, the blind person who made the binaural recording and a second person with the intention to participate in listening skill sharing. Here technology serves two purposes: It allows the blind listener to revisit sonic experiences, in a form that preserves many of the unique acoustic properties of the listener's perspective. Hence it is possible to localize sound sources and engage fully in this part of the indexical listening mode. In this function, the binaural sound recordings of soundscapes can take on the role of a photographic image, in that it carries direct traces from the recorded sound environment. Non-binaural recordings also have an indexical relationship to sound sources but as Piet Devos has mentioned, binaural recordings strongly invoke memory traces of the experiences made during the moment of the recording in the past. These traces do not need to be exclusively of sonic nature but can also evoke haptic memories or potentially smell too.
For the sighted listener, binaural recordings offer the opportunity to experience soundscapes in part embodied listening characteristics such as body and head

movements, this includes sounds intentionally made with the cane, which gives information about the ground and about the extended environment through acoustic reflections. Binaural recordings, hence mean different things for the blind listener who recorded them and the sighted person, still they offer the opportunity to experience a shared sonic reality.

Shared reality

Experiencing binaural recordings as sonic boundary objects means that both listeners need to wear headphones in order to experience the recording similarly. We suggest that they do this together at the same time and use this as an opportunity for listening skill sharing, i.e. to have a conversation about what they hear in the recording and what that means. This conversation can then be recorded and mixed with the original binaural recordings.

This simultaneous listening approach is inspired by teaching practices as Melissa Van Drie described for medical auscultation developed in the late 19th century (Van Drie 2013). In order to develop auditory diagnostic skills the doctor in training listened together with an instructor through collective teaching stethoscopes with multiple earpieces attached to one bell, so that they could experience the same sound simultaneously and hence had the possibility to discuss and learn from a shared experience.

Whilst the binaural recording on its own remains only partially meaningful for the sighted, it is the shared conversation about it that can potentially bridge the differences in sonic experience between a blind and a sighted listener. Further, this practice enriches the communication by strengthening the voice of blind listeners and can thereby help to challenge normative assumptions by the sighted.

As we have speculated in the beginning about the boundary object, we believe that increased mutual understanding can come from the conversation facilitated by listening together to a sonic boundary object.

Ethnography

Binaural recordings have a great potential for blind ethnography. They occupy a space between autoethnographic approaches and video ethnographic works. Saerberg uses for instance a pocket recorder to dictate his thoughts during moments of increased awareness about how he navigates his lifeworld (Saerberg 2010). Dokumaci documented her ethnographic field works of the daily navigational affordances of a blind person living in the greater Montreal area by video (Dokumaci 2016). Binaural recordings can be on without interruption, they remain autoethnographic, and allow for reflections later on.

Binaural recordings particularly respect ethnographic principles, (see Blomberg, Jannette and Giacomi, Jean and Mosher, Andrea and Swenton-Wall, Pat 1993):

a) ethnographies need to be done in a *natural setting*. The small microphones and a portable recorder interfere minimally with everyday routines, and since the recorder can remain switched on for a long time and be stored away in a bag pack, the act of recording does not interrupt with daily activities.
b) ethnographies need to be *holistic*, which is that action needs to be understood in relation to the social context. Since the binaural microphones

are barely visible, they do not greatly alter the context when interacting with sighted members of society. Video recorders however typically attract a lot of attention.

c) ethnographies need to be *descriptive*, i.e. that judgment of the perceived actions should be avoided. Although the recording of the listener's perspective gives only partial access to what was perceived in a sense that its meaning is tied to listening intentions and skills, it does not introduce information from a third party perspective, which might lead to judgment. Additionally the conversation session can help to clarify the experience.
d) ethnographies need to respect the *member's point of view*, which in the case of blind ethnography means respecting the sense of listening as the primary sensory modality equal to touch.

Beyond its function as documentation, binaural recordings can also be a simple but effective mnemotechnic device. Binaural recordings take on this function not only in that spoken comments are part of the recording, but also in that the recording has a strong indexical relationship with the sound sources and additionally also with their configuration in the environment. As Piet Devos points out, this particularly strong indexical link with the environment has the potential to invoke sensory memories such as textures sensed through the tip of the cane or the feet. While this is only true for the blind recordist, listening to the a binaural recording can be a valuable complement to participating observation, particularly since it can be revisited with the conversation recorded from a joint listening session.

Revisiting the recorded document and the conversation links back to the repeated listening experience of the sound object. This element of repetition has the potential to add a new dimension to ethnographic work: It opens up the possibility to postpone comments and hence removes the pressure to gain instant understanding by the ethnographer or meaningful feedback by the member while accomplishing a task or following a daily routine, which might occupy all available perceptive and cognitive resources.

Participatory Design

One important trend in design processes in the context of disability is to apply participatory design approaches, which are related to rapid ethnography and evaluating ethnographic methods. Participatory design means not to develop *for* but rather *together* with a target user group. Participation of all stakeholders however only works if the design process is recorded and mediated in a way that is accessible and meaningful for all. A typical video-recorded ethnographic session produces audiovisual footage with a camera position that is unique and not coincident with the viewing and listening perspective of the group member but the one chosen by the ethnographer.

The visual footage is hence very much about the ethnographer's gaze onto the blind person and the related power dynamics (see Hammer 2013). Here, despite the need for assistance during the recording – sound recorders tend not to have accessible user interfaces – binaural recordings offer to the blind and visually impaired the possibility of authorship and provide thereby more of an autoethnographic approach.

In the two ethnographic walks of about 40 minutes that we conducted in May 2016 in Montreal, Piet Devos also carried a camera, which was in the first walk mounted onto a baseball cap and in the second attached to a chest harness. We moved the camera to the chest because it would not interfere with what is known as *facial vision*, a sensory faculty that informs about the presence of mid-range objects beyond immediate reach. The purpose of recording video was mainly to support the sighted audience of the footage, who might otherwise very quickly lose all sense of orientation and positioning in the environment. We wanted to avoid a common problem of disability simulations, which often tends to highlight the loss of one sensory faculty and falls short in emphasizing the increased skill level in others. Listening only to the sound remains always possible by closing one's eyes and is strongly encouraged in order to increase the sighted listener's auditory attention level.

Simulation

With respect to the topic of simulations and disability, we want to briefly discuss *sonic boundary objects* through the lens of simulation to better understand its role and potential. Sonic boundary objects do not simulate impairment but rather creatively use technology to emphasize the sharing of different experiences and help create opportunities to exchange skills between people of different abilities.

What simulations try to achieve is similar to ethnographic approaches, namely an increased understanding of people's and communities' actions and routines. Simulations are however a contentious issue within the field of disability studies. The general critique is that simulation of disability is not possible and rather highly problematic in terms of politics. In the context of science and technology however, simulations have a fixed place for evaluating software, products and systems.

As Hinterwaldner elaborates in her dissertation (Hinterwaldner 2010, 32), the term simulation has various meanings in different contexts. It ranges between two main concepts:

The first is the notion of simulation in a scientific context, which crucially depends on a defined relationship between the simulation and what is simulated, both being linked by one or several models. Building a model is not problematic in itself. However what is necessary from a scientific and explanatory point of view is at the same time inevitably a reduction of reality. This reduction tends to enforce stereotypes, which people with disabilities constantly are confronted with. Rather than their condition being explained or even being reduced to their condition, people with disabilities as every individual want to be understood. But even beyond this simple ethical argument, the complex repositioning of the material environment, the senses and memory that disability brings about does not lend itself to a simplistic reduction.
The second notion of simulation as Hinterwaldner point out is rooted in medical psychology and criminal law. Here simulation is a synonym for pretending and deception by assuming a certain role or position in society (Hinterwaldner 2010, 39).

In Tobin Siebers' book on disability theory (Siebers 2008), we find examples for *both* types in the context of disability simulations: the first would be the critique of blindfolding sighted subjects, which reduces blindness inadequately to not seeing. The similarity between the medical model of disability mentioned in the beginning

and scientific simulations is to reduce sensory experiences to a model, in this case sensory experience being modeled by a set of functioning or non-functioning sensor. Siebers also discusses an alternative approach, which corresponds to the notion of simulation as pretending. He suggests that sighted people who want to experience the stigma associated with blindness, put on sunglasses and sport a cane in order to be able to experience the reactions of bystanders.

The scientific simulation approach as discussed by Hinterwaldner, which we have compared with the medical model, has been criticized by Siebers as problematic since most of what it does is to leave people performing a simulation with the impression of how dreadful it is to live with the impairment experienced through the simulation (Siebers 2008, 28).

The second approach also has its shortcomings, which we can understand when looking at how time is experienced during a simulation. Sighted people who are blindfolded are likely much slower in accomplishing everyday tasks as they lack the necessary skills. On the other hand, by putting on sunglasses, sighted people might operate too fast, and hence do also not experience adequately what blindness entails.

To illustrate this for the case of urban ethnographic walks: a blindfolded sighted person might never dare to cross the street and wait forever for a safe moment to step into the street based on listening to the traffic alone. On the other hand because of this lack of skills, simulating blindness behind sunglasses will likely make the pretender cross the street when the traffic light turns green.

Binaural recordings can certainly not make up for all shortcomings. However we believe that particularly with time relived when listening to binaural recordings with comments, they can occupy a place in-between as a boundary object. By avoiding some of these problems, binaural recordings can deliver as sonic boundary objects where simulations and possibly also orthodox ethnographies might fail.

With respect to simulations and scientific models, binaural recordings respect the objective knowledge about acoustics and perceptual laws by placing the microphones close to the ear. On the other hand binaural recordings leave individual and idiosyncratic traces, which we believe are first valuable and second can possibly lead to more general insights during the course of the joint listening and discussion session.

Recording the sonic boundary object

During the recording of the ethnographic walk and the joint listening and conversation session, we used the following equipment: the soundscape was recorded with a pair of SP-BMC-12 Deluxe miniature binaural microphones – a pair of high quality MT350 Omni-directional microphones by Audio Technica. These were fixed with lapel style clips on a baseball cap close to the ears.

The microphones were connected to a Zoom H4 recorder, which provided 2.5 volts of plug-in power. The recorder was hidden in the back bag. We recorded uncompressed audio with 44100 Hz and 24-bit sample depth. The video was recorded with a GoPro camera using a resolution of 720 * 1280 at 60 Hz and an

aspect ratio of 16:9. After the recording, the video files were merged and synchronized with the audio files, giving us the first level of documentation. For the conversation session, the audio file was played back together with the video through a patch coded in the multimedia software PureData. The binaural recording was distributed with a stereo splitter to two Sennheiser HD 280 closed dynamic headphones. The comments were recorded with the same microphones as above, attached with their lapel clip to the chest of Piet Devos and Florian Grond. The original binaural audio file rendered through the headphones was also streamed to disk in a 4-channel file where channel 3 and 4 were connected to the input of the microphones that recorded the conversation. This automatically synchronized the footage from the binaural field recording with the recording of the conversation. As a document of the sonic boundary object we mixed the conversation to the center between the 2 binaural channels and combined it with the video footage, so that no spatial listening attention needs to be paid to the dialogue and most of the auditory attention for localizing sound sources remains with the binaural recording.

Two ethnographic walks in Montreal

In this section I, Piet Devos, will provide a brief autoethnographic account of the binaural recordings. To put the concept of binaural recordings as *sonic boundary objects* to the test, I performed two ethnographic walks in Montreal. I chose to document the trip from my apartment on 777 Boulevard Robert Bourassa to my office in the Hall Building at Concordia University, on 1455 Boulevard de Maisonneuve and back. Since it is my daily commute to and from work, I am very familiar with this route. The journey starts in my office at Concordia on the 11th floor where it leads through several hallways. Then it goes down the elevator, heading out to Bishop street. On the way south there were several street crossings: two two-way streets, de Maisoneuve and Saint Catherine, and one big artery, René Levesque with 4 lanes of traffic. All street crossings had a traffic light but none of them had an auditory pedestrian signal. Then I took two stops with the Montreal metro from the station Lucien L'Allier to Square Victoria and continued my way through parts of the underground shopping and food courts leading to the building of my apartment. This journey took about 40 minutes one way. Florian Grond was following me at a distance of about 5 to 10 meters. Selections from the recording can be accessed online: https://vimeo.com/album/4120513.

Before analyzing the useful meta-reflections, which these recordings rendered possible in respect to my own navigation practices, I would like to make a few remarks on the recording process itself.

Let me for instance stress that the choice of the appropriate medium for every ethnographic research project is far from gratuitous, as any chosen recording device comes along with its socio-political and socio-cultural implications that might either affirm or rather subvert the existing norms. I may speak here from my personal experience since, back in 2007, two anthropology students from the University of Leiden *The Netherlands) – where I was myself studying at the time – asked me to be the subject of their first ethnographic documentary. The students were likely interested in my navigation routines, so they followed me with a camera on a short distance of about five to ten meters – sometimes coming to shoot close-ups – while I was traveling back home from the arts faculty. Although the resulting short film of approximately 20 minutes gave some general idea of "the blind style of

perception" [2], showing for example how my cane follows a curb as to locate the slight ramp leading to the zebra crossing or how I crossed the street relying on the sound signaling of the traffic lights, I was rather disappointed when it came to the depiction of more subtle sensory skills. Given that I had not worn any microphone, the distant camera had only captured the wider circle of my soundscape, as a consequence of which the most crucial auditory cues from my immediate surroundings had been completely left out. Moreover, the very recording had caused quite some turmoil, at the Leiden railway station most notably, where the student had been angrily called to account by another traveler who believed that they were filming me without my consent and – even worse - without my being aware of their presence. It is clear that such mistakes were mainly due to the students' inexperience, but this introduction to ethnography convinced me all the same that a meticulous sound recording would be key to leave behind the objectifying third-person perspective of the camera and, to some extent, gain access to the blind person's embodied subjectivity. This last consideration made me therefore very eagerly accept Florian Grond's recent invitation to participate in an experiment with binaural microphones.

This does not mean however that the use of a camera or any other visual medium should be altogether excluded from blind ethnography. This would only reaffirm the prevailing stereotype that blindness equals the total darkness of absent vision. Not only does a vast number of legally blind people still have recourse to some remaining light or color perception while finding their way in a city, others like myself who lost their entire eyesight at a later age also often continue to form mental pictures of the world. More concretely, in my own case this constant and spontaneous mental picturing is a most helpful tool for spatial orientation; while I am walking down a street, sensory information and eventual knowledge about the area acquired during earlier visits are being integrated into a scenery which gradually unfolds before me, as though I see it. In spite of this mental scenery being less detailed than a photograph and quite unsteady – an unexpected obstacle might suddenly arise and change the picture in a split second -, it helps to draw an imaginary map of the neighborhoods I frequent. Obviously, no medium can ever realistically record this mental 'seeing', but I agreed to wearing a camera on my body during the experiment with Author1, as our recordings would thus at least suggest – so I reasoned - that the blind subjective perspective is not necessarily situated outside visuality. Moreover, the visual input could facilitate the intersubjective dialogue between the blind and sighted listener of the primary auditory data, considering that, thanks to the imagery, the latter would be able to directly relate the heard sounds to specific locations.

Yet, the first walk taught us that we had better not fix the camera on top of the baseball cap vizor, because it weighed down unpleasantly onto my forehead thereby hindering my so-called 'facial vision'. This faculty, reported by many blind people, consists of the tactile awareness on the forehead (hence the faculty's name) of nearby large volumes and surfaces. The blind French author Jacques Lusseyran (1924-1971), for example, described facial vision as follows: "I discovered (…) that every object and every living being reveals itself to us at first by a kind of quiet yet unmistakable pressure that indicates its intention and its form." (Lusseyran 1999, 32) To be sure, this tactile awareness of presence does not result from any active echolocation technique, given the fact that the blind navigator does not need to produce any kind of sound as to undergo its effects. This does not

necessarily mean that facial vision is distinct from passive echolocation, but it emphasizes that the presence of objects “manifests itself” as a tactile sensation to the blind observer.

I personally rely on facial vision in order to get round bigger obstacles as well as to follow distant walls as guiding lines, within a range of two to fifteen meters around my standpoint. Consequently, I noticed the disturbance caused by the camera on the cap when, having stepped out of the elevator in the Hall Building (Concordia University), I turned twice to the right into the open space of the foyer which leads to the exit. Within this space I did not ‘feel’ the opposite wall to which I usually direct my steps as to turn sharp left just before reaching that wall and to find the exit door in the corner. This time I turned too early to the left, so that I ran into unforeseen obstructions towards the exit. This practical problem was however successfully solved as soon as, during the second ethnographic walk, we attached the camera onto my chest thus leaving my forehead free for its usual perceptual tasks.

To listen together to the binaural recordings, thereby transforming them into our sonic boundary object, was undoubtedly the most fascinating and fruitful part of our experiment. Thanks to the very realistic reproduction of my own auditory experiences, I felt for the first time capable of giving a very accurate autoethnographic account of my blind navigation style to a sighted person, in casu Florian Grond.

I could for example explain and audibly demonstrate how I manage to cross a busy street where, as is unfortunately very often the case in the center of Montreal, traffic lights are not equipped with any sound signaling system. The microphones had neatly registered the fact that I not only need to wait until the cars on the street to be crossed – say Ste-Catherine – have come to a halt, but also until the traffic on the side-street - e.g. Bishop – have set in motion. Similarly, when entering the food court in the underground city close to the place where I live, an untrained listener will be overwhelmed by the cacophony of music, chatter and machine noises. In the comments to the recordings I can make it clear, however that I focus on the spatial configurations of the sounds to find my way through this apparent chaos, by paying attention to the clients’ and vendors’ voices in the food stalls on both sides of the central corridor as well as on the loudspeakers above my head which, like lanterns in the dark, indicate the route to follow.

One could object that the binaural recordings are but a partial, selective rendering of complex, embodied experiences. From an acoustic standpoint for instance, it would be difficult if not impossible to judge if the recorded sound sources or oneself was moving because the cues related to proprioception and facial vision are not preserved in the recording. All the same, this objection underestimates the intense realism experienced by the recordist, when listing to his or her own recordings, which -just like a photograph or a video- brings other, not directly captured observations back to mind. Our sonic boundary object thus constituted a memory trace for me, re-activating the tactile and proprioceptive sensations which had accompanied particular sounds. The cane’s audible scraping on a metal plate not only recalls the feeling of the rough surface indicating the beginning of an escalator, it also reminds me of the fact that it is always wise for a blind person to put his or her hand on the rubber rolling belt before actually stepping onto the

escalator. This is to prevent getting on an escalator which goes in the wrong direction; even in a familiar space like a metro station which one frequents, it is advisable to do so because the direction of the escalator is sometimes changed for reasons of maintenance.

As we will point out in the concluding section of this article, the use of a sonic boundary object could find concrete applications in mobility training sessions, as it would allow trainer and trainee to virtually explore or (re)visit the route to be acquired. While carrying out this experiment with Florian Grond, I was moreover struck by the aesthetic and theoretical possibilities, which the practice of listening together to binaural recordings can open up in the future. Whether integrated in an artistic or a scientific context, the sonic boundary object could enable both the blind and sighted listener to better understand the self-conscious and self-analytical mode of navigation typical for the visually-impaired city dweller (see Saerberg 2010). The latter is constantly aware of the fact that even the most familiar routes which he or she walks daily might undergo changes by the hour: obstacles like scaffolds or bikes might suddenly pop up and disappear; a sidewalk that was smooth and clear in the morning, is completely broken up in the evening, etc. During our first ethnographic walk, we came across such an example, when I was listening to locate the escalator somewhere on the right in the Lucien l'Allier metro station; I believed to have found it, until I came closer to the source and identified what I heard as streaming water behind a door, so I had to adjust my hypothesis and course again. In short, if binaural recording became easily available for the blind user, it would mean a new phase in blind autoethnography enlarging the hitherto highly text-based approach to multisensory self-observation.

Future applications

The experience we gathered by applying sonic boundary objects to the area of blind ethnography, suggests that the conversation about blind navigation is at first more unidirectional in that the sighted listener is mostly learning and profits together with the blind recordist from the opportunity to jointly revisit lived experiences. It is only after this learning experience that a true dialog can emerge for the future. While it was definitely an instructive exercise for Author1, it also demystified the widespread prejudice of superhuman listening skills of the blind, and emphasized amongst other things that increased sound levels in urban noise, for instance, are serious obstacles. An immediate result of this is increased awareness and will hopefully help to articulate requirements for accessible urban spaces.
The overall positive experience with binaural recordings as sonic boundary objects, suggests various further applications. Having the option to integrate comments on the binaurally recorded soundscape opens new possibilities in the context of orientation and mobility instructions. In addition to what Piet Devos pointed out, the – in many cases sighted – instructor, for instance, would get the opportunity to empathize with the listening perspective of the trainee. The instructor could also record comments and mix them with the binaural recording, which could then be used by the trainee to revisit difficult passages. The possibility to revisit the recorded material from the comfort of home could take the stress away from actually having to orient and navigate oneself. By using other people's recordings and comments to explore unknown areas and to get familiar with new routes, these recordings could take on yet another dimension of what simulation could mean in the context of disability. Also, these recordings could possibly be integrated in

existing way finding and navigation application as user-generated content. Here, for instance, it would be worthwhile investigating how interchangeable these sonic boundary objects are, and how listeners will deal with the various styles of blind navigation captured with binaural recordings together with the accompanying and individual comments.

Conclusion

Based on theoretical reflections on disability, technology, and simulation, with a special focus on soundscapes and blindness, we have formulated the concept of the sonic boundary object. For the case of blind ethnography, we made first steps into putting the sonic boundary object into practice by using binaural recordings. Piet Devos's autoethnographic accounts highlight their potential and point to different application areas, which we hope will stimulate further research.
As sonic boundary objects, binaural recordings apply technology creatively to occupy a place in between: between the individual sonic perspective and shared soundscapes, between the necessary requirements for an acoustically realistic recording and the openness to individual embodied experiences; between lived experience and its re-experiencing and remembering. Hence they allow the involved to learn more about the blind style of perception and navigation without the need to build models that enforce stereotypes. As such, sonic boundary objects open the door to gain a partial understanding of the reconfigured relations between the material world, the senses and memories that blindness brings about.

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