Becoming Listening Bodies: Sound walking as a pedagogy of sensation

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Introduction

This paper explores the potentials of biosensing technologies in the construction of new methods and conceptualisations of sound walking as an arts-based research practice. We draw on our collaborative research project the *Listening Body*, which has involved a series of sound walks with children (aged 6-10) attending an after-school visual arts program in Hulme, Greater Manchester, UK. The sound walks have enabled children to develop creative listening practices through playful experiments and sonic interventions within a range of local environments and public spaces. In order to research the affective and embodied dimensions of the sound walks with children, we collected data from wearable biosensors (Empatica E4), body-mounted GoPro cameras, and high fidelity sound recording equipment. Rather than taking a clinical or reductive approach, our use of these technologies is aligned with creative, critical, and socially-engaged applications of wearable biosensors in the fields of contemporary art (Umbrellium, 2017; Nold, 2009), participatory design (Coenen, Coorevitz, Lievens, 2015) and human-computer interaction (Schnadelbach et al, 2014). We believe that the *Listening Body* is one of the first projects to explore the creative and pedagogical potentials of biosensing technologies through collaborative arts-based research with children.

In the following sections, we begin by contextualising the *Listening Body* project within the fields of sound art and sound studies, while also making connections with recent developments in bioart and biosocial research in the social sciences. We then conceptualise our use of biosensing technologies as creative media for sound walks that contribute to an expanded environmental awareness and sensibility. In conversation with Mark Hansen's (2015) "radically environmental" theorisation of 21st century media, we suggest that biosensing technologies provide access to sensory data beyond the narrow bandwidth of human sense perception and consciousness. We develop these ideas further through the analysis of a "micro-event" from the *Listening Body* project, drawing on synchronised biological, audio, visual, and geographical data collected during the sound walks. This micro-event forms the basis for a discussion of the pedagogical implications of biosensing technologies, with a specific focus on how these technologies might contribute to an understanding of sound walking as a "pedagogy of sensation" (Ellsworth, 2005, p. 27).

The Art and Science of Listening

The *Listening Body* project has emerged from a series of experimental research initiatives currently underway in the Biosocial Research Laboratory, a new research centre housed within MMU's Education and Social Research Institute. The Biosocial Research Lab provides a transdisciplinary space for developing new research methods and theories of learning through projects that work across the arts, social sciences, life sciences, and (post)humanities (BRL, 2018). As members of the Biosocial Research Lab, we have a shared interest in sound walking as a method for arts-based research that brings together our collective experience in the fields of sound art (Wright, 2017), sound studies (Gallagher, 2016), and arts-based methodologies and pedagogies (Rousell, 2017; 2015).

Sound walking is a practice often used by artists and researchers to explore the sonic aspects of environments (e.g. Berglund and Nilssen, 2006; Hall et al., 2008; Jeon et al, 2013; Gallagher and Prior, 2017). In its simplest form, it involves a group of people walking along a pre-planned route through

an environment, paying close attention to whatever sounds can be heard along the way. Sometimes sound walks include additional instructions, interventions or technologies designed to elicit responses from participants. These methods have been in use since the 1960s (e.g. Drever, 2009), but there is surprisingly little research on *how* soundwalks operate, and more specifically, how they affect learning and behaviour. Within school curricula, sound walks are sometimes used to teach children basic concepts about sounds (e.g. that sounds have sources, can be loud or quiet and so on), but Gallagher et al. (2017) suggest that listening walks can have a more radical function to expand practices of listening. They present interview data in which early years practitioners reported that a listening walk had fostered multisensory awareness, created productive experiences of discomfort, and led to greater empathy for young children faced with the sensory overload of a nursery environment. These findings suggest that sound walking is pedagogically valuable not so much as a way to single out the auditory for special attention (as opposed to ocular modes of knowing for example), but rather because of how a focus on sound can provide a point of departure for embodied, multi-sensory, more-than-sonic encounters and affects. Yet there has been little investigation of these non-conscious, affective, and somatic dimensions of sound walks as they take place.

The *Listening Body* addresses the need for this more embodied and affective approach by bringing sound walking into conversation with bioart (Mitchell, 2010) and biosocial research in education (de Freitas, 2017; Youdell, 2017; 2016). Mitchell (2010, p. 11) describes how the field of bioart has linked "artistic goals and techniques with biological technologies", while also framing participants and audiences "as themselves media for transformative powers of life". Bioartists often experiment with the ethical, aesthetic, political, and social implications of biotechnologies by reconfiguring the "ecology of innovation" that surrounds them (p. 61), while also posing broader philosophical questions regarding the changing nature of "media", "technology", "life", and "the human" (p. 11). Biosocial research has pursued a coeval route within education and the social sciences, but with a more focused engagement with how life processes and social processes are co-implicated in the emergent phenomena of learning (Youdell, 2017, p. 12). This biosocial turn in education has blurred traditional boundaries between qualitative and quantitative research methods, while also supporting posthuman theorisations of learning as a dynamic, multi-sensorial and environmentally distributed process (de Freitas, 2017).

The *Listening Body* project has forged new connections between sound art and biosocial research through a series of experimental sound walks in collaboration with 30 children (aged 5-11) attending an after-school visual arts program (see figure 1). Rather than framing the project in terms of specific research goals or objectives, we have allowed the project to be guided by a series of "interests" that have informed the co-production of sound walks through collaborative research with the children. Our *first interest* involves exploring the use of wearable biosensors as creative media in the production of sound walking events with young children. We are interested in developing and testing new methods of co-production that combine walking, listening, and biosensing as ways of making art and doing research with children. Our *second interest* is in the use of biosensing technologies to "plug into" and "crack open" the sound walk as a pedagogical event that produces new potentials for learning. This interest is aligned with biosocial research in education, as it questions the nature of sound walking as a "sensational pedagogy" that co-implicates somatic, social, and environmental processes. Our *third interest* is in how sound walks can enable children to think and work through the "sonic imagination", and how this affects their sensorial engagement with the more than human geographies of their everyday environments. This interest leads us to explore how sound walking can open up a more nuanced understanding of children's sonic worlds, including an awareness and concern for the nonhuman agencies, elements, and forces that populate children's urban environments and communities.


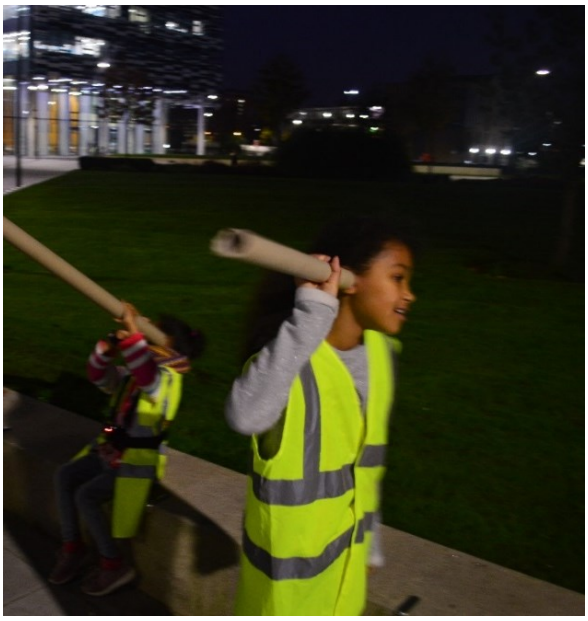
Figure 1: Listening to the more-than-human environment through earplugs (left) and paper tubes (right)

More-than-human Senses and Sensors

The *Listening Body* project has explored these three interests through a series of sound walks that integrate the use of biosensing wristbands with GoPro body cameras and high-fidelity sound recording equipment. The recent development of clinical-grade wearable biosensors offers unprecedented potentials for plugging into site-specific patterns of affective, sensory, and somatic interactions as children move through time and space. To date our project has focused on exploring the potentials of the Empatica E4 wristband, a product developed by MIT's Affective Computing Lab in conjunction with the companies Empatica and Affectiva. The E4 uses unobtrusive wearable sensors to collect and transmit biological data in real time, including electro-dermal skin activity (EDA), heart rate, body temperature, and rates of motion, acceleration, and activity that are associated with changes in affective responses and emotional intensity (Pijeira-Diaz et al, 2016; Sano & Picard, 2013). The mobile and non-invasive nature of the E4 wristbands means that they can be seamlessly integrated into walking-based artworks, fieldwork and learning situations, opening up new possibilities for participatory art and research events that are responsive to the sensory and affective experiences of bodies in real time and space.

Drawing on ideas from Hansen (2015) and de Freitas (2017), we are interested in how biosensing devices like the E4 operate at microtemporal processing speeds that exceed the thresholds of human sense perception. Rather than seeing the wristbands as prosthetic extensions of human perception and consciousness, we are interested in how these technologies *physically* and *directly* mediate the "sensory continuum" in ways that alter the "concrete texture of experience" (Hansen, 2015, p. 48). By giving us access to sensory data beyond the limits of human language and cognition, biosensing technologies operate within a vibratory continuum of "worldly sensibility" that is, quite literally, *more than human* (Hansen, 2015, p. 2). Electro-dermal skin activity (EDA) sensors are particularly interesting in this context, as they register unconscious changes in the electrical conductivity of the skin that are associated with affective engagement, attention, and arousal of the sympathetic nervous system (Pijeira-Diaz et al, 2016). As de Freitas (2017, p. 297-298) argues:

> Skin conductance is a way of attending to the neurological periphery – the far-flung electrical activity of the body- rather than what is assumed to be the centre and

> administrator of that system- the brain… The EDA skin data is thus perfect for showing how the bounded individual is always being broken down, dissembled, remade, intensified, and charged… The EDA data points to our biochemical relationality, our bioaffective dispersal.

In advancing EDA data as an indicator of the "dispersed nature of affect and thought" (p. 298), de Freitas calls for researchers to experiment creatively with biodata in order to study and participate in "the distribution of more than human sensation" (p. 284).

Biosensing Practices

Our work on the *Listening Body* project has taken up this call, as we have endeavoured to explore the use of Empatica E4 wristbands as creative media in conjunction with other sensory technologies, including wearable GoPro video cameras and sound recording devices. The use of clinical wristbands like the Empatica E4 has recently received critical attention from education scholars. Researchers have questioned the bio-ethical and biopolitical implications of capturing data from children's bodies (Williamson, 2016), and the normative utilisation of this data to reinforce pathologising discourses of childhood (de Freitas, 2017). Instead of harnessing biometric data to a clinical view of the bounded individual subject, we have used wearable biosensors as vital media that operate within a sensory ecology that is distributed across multiple scales, degrees, and intensities of experience. In doing so, we have adopted an expanded understanding of the term "biosensing" to describe "any *practice* that uses information technology to understand something about bodies or the environments in which they live" (Nafus, 2016, p. xiv, emphasis in original).

Thinking about *biosensing as a practice* allows us to approach the event of a sound walk as a network of "sensing bodies" that mutually affect one another within an ecology of sensation. We understand this sensory ecology to propagate through an economy of vibrational affects, in the Spinozan sense of bodies simultaneously affecting and being affected by one another (Gallagher, 2016). This allows us to think about E4 wristbands, GoPro cameras, children, and ourselves as sensing bodies, each capable of affecting one another through biosensing practices that exceed human perception and consciousness. Even a sensing body as ubiquitous as a digital camera is capable of capturing and rendering the sensory data of a sound walk in ways that elude conscious, human perception. Similarly, we found that extremely sensitive microphones were able to capture sonic layers and elements of the walks that exceeded our human capacities to hear at the time. We can of course expand this further, and imagine the vast and teeming networks of sensing bodies that both surround and interpenetrate our bodies as we go about our everyday lives. It is in this sense that we see biosensing practices contributing to an expanded environmental awareness and sensibility that both exceeds and includes the human within a vibratory continuum of affective resonances, attenuations, and reverberations (Rousell & Cutter-Mackenzie, in press). This "radically environmental" (Hansen, 2015) theoretical approach has been a touchstone for our collaborative work with children, as well as our emerging understanding of sound walking as a sensational pedagogy that connects children with a "sonic imaginary". The following section describes the *Listening Body* project in more detail, including the description of a "micro-event" which provides a glimpse into the layers of sensory data and creative material that were produced over the course of project.

Becoming a Listening Body

The Listening Body project took place over six months in collaboration with 30 children and 3 arts educators at the Z-arts community arts facility in Hulme, Greater Manchester. Z-Arts occupies a historic building only four blocks from the Biosocial Research Lab at MMU, and provides a diverse and

inclusive program of arts education activities for children and young people in the local area. The *Listening Body* project involved four phases of artistic co-production and participatory research. In the *first phase* we introduced children to the process of sound walking as an art form, and aimed to develop different ways of listening through the body in conjunction with various materials, objects, and spaces. Children were introduced to the GoPro body cameras and E4 wristbands, and we explained that these biosensing technologies would be used as creative media for making art over the course of the sound walks. In the *second phase*, children explored the sonic properties and qualities of their everyday environments around Hulme, including the sonic geographies of their homes, schools, parks, and neighbourhoods. They also worked closely with us to analyse the data collected from the initial series of sound walks, including biodata from the E4 wristbands, GoPro video, photographs, and sound recordings. This work served as the basis for the *third phase* of the project, which involved children designing their own sound walks around Hulme using a variety of media and performative interventions. These walks included child-generated activities such as rattling the metal fences surrounding a nearby school, listening to the sounds of Z-Arts through a bowl of Jell-O, and disrupting the sonic texture of the university building with balloons (see figure 2). Then, in the *fourth phase* of the project, we created a series of multi-sensory cartographies with the children, which included layers of video, sound, biodata, and geographical data collected from satellite images of places in Hulme we had visited. This final phase also involved discussions with children regarding their experiences of connecting with the sonic imaginary, and how their engagement with the project had affected their understandings of sound, art, technology, learning, movement, environment, and place.

Figure 2: Children engaging with listening practices and interventions that they designed for the second series of sound walks

In our ongoing analysis of sensory data and artistic material generated over the four phases of the project, we have teased out certain “micro-events” that have emerged through the layering and synchronisation of multiple data types. This approach involves a relational and diagrammatic approach to data analysis that focuses on creating thick blocs of data with multiple layers and dimensions that are mutually affecting. We are also dedicated to keeping (at least) one foot in the world of sound art and the aesthetic production of sensory experience, as we endeavour to maintain an open space for working with the project material in ways that can equally be exhibited, performed,

or published. In other words, we are not yet sure where the determining *cut* between the art and the research will fall in each of these micro-events, of if this cut will even fall at all.

Micro-Event: Sound as Vibrational Affect

This micro-event is situated with an initial series of environmental sound walks that introduced children to the idea of thinking and making art through creative listening practices. These walks began by exploring the historic inner architecture of the Z-arts building, which has numerous galleries, performance spaces, meeting rooms, spiral staircases, cinemas, theatres, and a café. We used one of the gallery spaces to explore the nature of sound as vibration as it passes through different bodies, materials, and acoustic spaces, and discussed how children experienced these vibrational qualities of sound in their everyday lives. Children were invited to place the ends of a length of cotton string into their ears, hang a metal coat hanger on the string, and then explore the vibrational qualities of the room and each other through playful interactions.

Figure 3: Children experimenting with coat hangars and string in the Z-Arts gallery space

One of the interesting renderings to emerge from this micro-event was the vibrational nature of the photographs that were produced as children experimented with the coat hangars and string (see figure 3). These images reveal a blurred "technicity" of the sensing body in motion, a process of becoming-vibrational that in many ways "transduces" the sensation of sound as it passes through, and re-arranges, bodies. These photos alerted us to the ways that a sound walk could become multi-sensory and performative, as the children's bodies, gestures, and expressions became vital media for the production of sonic artworks. Rather than viewing the images as visual documentation and discursive representations of the walks, we see them drawing out unexpected sensory and aesthetic potentials from a vibrational field of environmental sensibility. These images gesture towards what it feels like to become a listening body, to use your body to think viscerally through sound.

We have also analysed this micro-event from the perspective of EDA data collected from the E4 wristbands, in conjunction with GoPro video data from cameras worn by children during the walk. By synchronising the EDA data with video data using a software package called Chronovis, we are able to see the fluctuations of skin conductance as children engage with various phases of the sound walk event. Figure 4 shows a 5-minute section of biodata collected from one of the E4 wristbands which obtained a clean and uninterrupted signal[1]. We have annotated and narrated several phases in the data as it proceeded in order to demonstrate our present thinking about this data in relation to the sound walk event.

Figure 4: Screenshot showing annotated GoPro video data synchronised with EDA data from the Empatica E4 wristband

[1] There are a number of technical issues associated with the collection of EDA data, including "noise artefacts" generated by excessive movement or an irregular fit of the bracelet around the wrist of the child.

While we lack the space here to give a full account of this micro-event, Figure 4 reveals a number of interesting resonances and contrasts between the sound walk activities and the EDA data collected from the Empatica E4 wristbands. If we follow the movement of the EDA data from left to right, we can see a steady and relaxed increase in bodily engagement as Mark engages the children in an initial discussion of sound's vibrational qualities. We also see minor fluctuations in the EDA signal when the children offer their own examples of sounds that they had heard during the day, and collectively voice the sounds of wind. When Mark asks them to pick up the string and coat hangars there is a further increase in the intensity of the EDA signal. This is followed by a distinct shift to a much more dynamic and fluctuating vibrational reading from the EDA signal, as the children place the string in their ears and begin to explore the sonic potentials of their bodies and the space. We also note a particular "burst" of EDA intensity when the children discover an auto-affective practice that involves rhythmically bouncing the coat hangar against the walls of the gallery. The children described how this practice generated a "weird" sound, which they variously characterised as "vibrational", "like a drum", "a clock", "a bell", "a body", and "a heartbeat".

Conclusion: Soundwalking as Sensational Pedagogy

What becomes apparent through this brief micro-analysis of the EDA data is the embodied and affective nature of the sound walk as a pedagogical event that registers, quite literally, on the surface of the skin. We would like to move beyond reductive readings of such data, which would figure these fluctuations as individual somatic responses to external environmental stimuli. Rather, we would like to read this data as fundamentally bio*social* and bio*aesthetic* in its connection with the distributed pedagogical force of the event as it unfolded. This is a question of how the listening body participates in the event in ways that are imperceptible, and yet *sensible* at the "quivering periphery" of the "electric body" (de Freitas, 2017, p. 298). In focusing on the environmentally distributed nature of learning as sensation, we maintain a distance from cognitive and phenomenological orientations towards learning that rely on a cohesive individual subject and its representations as the units of analysis. As Ellsworth (2005) argues, "such notions are underwritten by assumptions that there is an identifiable self, a locatable point of view or subject position from which meanings are made and through which experience is organised and held together" (p. 7). Such phenomenological assumptions have the effect of capturing the experience of learning within an all-too-human image of thought, in which "the personal is prefigured or 'prereflected' in the world, in a closed loop of 'intentionality'' (Massumi, 2002, p. 191). Rather than reducing learning to "personal experience" driven by the intentionality of a bounded subject, we are interested in developing new concepts of learning as a transindividual process that emerges from within an ecology of sensation. The EDA data, for instance, suggests that children are somehow "learning" on the surface of the skin in ways that are unconscious, imperceptible, and yet *sensible* through wearable technologies.

Our focus on the sensibility of learning also raises questions about how pedagogy comes to compose and, in certain ways, *orchestrate* the relations between sensing bodies in the production of a learning event. This is to decouple pedagogy from the intentionality of the teacher, artist, or other facilitator of learning, and realign it with the distributed ecologies of sensation through which learning emerges. Ellsworth (2005) describes this in terms of "sensational pedagogies" which operate through embodied and affective engagements with works of art, media, and architecture. For Ellsworth, a sensational pedagogy is nothing less than the "orchestration of forces, sensations, stories, invitations, habits, media, time, space, ideas, language, objects, images, and sounds [that] move the materiality of our minds/brains and bodies into relation with the other material elements of our world" (p. 24). Sensational pedagogies are distinguished by their capacity to disrupt and reconfigure the sensorial

relations between body and environment, individual and collective, feeling and thought, matter and meaning. They do so by operating through a logic of sensation that redistributes the possibilities for sensation and affective engagement. As Ellsworth (2005, p. 7) further explains:

> Pedagogy, like painting, sculpture, or music, can be magical in its artful manipulation of inner ways of knowing into a mutually transforming relationship with outer events, selves, objects, and ideas. Or, it can used to simply manipulate, through congealed forms, unresponsive shapes, and derivative logics.

Pedagogy becomes an artful, curatorial process when it sets up the possibility conditions for the emergence of new ecologies of sensation, movement, participation and belonging. This artfulness is always more-than-human in its capacity to express "the force of becoming that is singularly attendant to an ecology in the making, an ecology that can never be subsumed to the artist or to the individual participant" (Manning, 2015, p. 63). This also means that the effects of a sensational pedagogy can never be specified or even knowable in advance, but must be left open, pragmatically, to the relational play of affectivity and movement in the emergence of the ecology itself. Our use of biodata in this project is aligned with this speculative pedagogical approach, as we continue to experiment with how biosensing technologies can expand the "sensory confound" of a sound walk through the event of it's occurring (Hansen, 2015). This openness to sensory difference and noncompliance with expectation is crucial to understanding pedagogy as an ecological, aesthetic and multi-sensory process. Rather than being the art or philosophy of a teacher who teaches, pedagogy comes to reside in the force of an environmental sensibility that activates the potentials for learning through sensation.

Acknowledgments: We would like to acknowledge financial support from the Biosocial Research Laboratory, MMU, as well as valuable contributions to these ideas from Lab members Elizabeth de Freitas and Maggie Maclure.

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