**Hacking the Body 2.0: Dancing Between Commercial and DIY Wearable Technology**

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This paper features the creative practice from the long-running collaborative research project, *Hacking the Body* and *Hacking the Body 2.0,* between media artist/ researcher Camille Baker and media artist/choreographer Kate Sicchio. It focuses on our ongoing concerns to combine, rework, reconstruct and evolve our performative research on the use of wearable technology and smart textiles in performance. By exploring both the technologies that are commercially available and those that are custom made, we have developed improvisational dance performances that use biosensing and haptic feedback to influence the performers, and also structure choreography around interactive affordances that may be embodied or sensual. This practice is part of a long heritage of work that explores not only the possibilities of sensing technologies, but also the effect of wearable technology on movement and choreography.

Keywords: wearable tech and e-textiles, performance, choreography, DIY electronics

**Extending the Body/Mind Through Wearable Technology**

The more we learn about the wisdom and distributed intelligence of the body and mind, highlighted through neuroscience and biology, the more we see how all wearable and mobile technology act as 'bodily extensions' which blur the boundaries between the skin and the external world. Distinctions can be made between physical corporeal engagement and interactions between bodies in space and conceptual bodies, with the notion of extending the body beyond our physical boundaries using digital networks. The body can interact with technology and other bodies and become engaged with others, facilitating virtual extensions into real and actual embodied presence using a variety of techniques and tools. This can be achieved using simple ubiquitous technology tools - such as mobile phones - as a bridge across the ‘spaces between’ the body and networked technology. To embody technology in order to traverse space, and to minimise the experience of absence and physical distance, Paul Dourish, in *Where the Action Is: The Foundations of Embodied Interaction,* defines space as that which is,

… largely concerned with physical properties (or metaphorical physical properties). It concerns how people and artifacts are configured in a setting; how far apart they are, how they interfere with lines of sight, how actions fall off at a distance, and so on. (2001: 89)

It has been argued by numerous philosophers and performance practitioners (for example, Merleau-Ponty, Massumi and Manning, and Kozel), that space is not always or necessarily an absence or void of presence or activity. Rather, it is felt by the perceiver, as a transition or transmission, a conduit, medium, or channel to move from one place to another, much like an alley or passage. The virtual spaces which exist both between people, and between people and technology, may also be understood as breathing space, thought space, meditation, imagination, dream space, being ‘in limbo’, and ‘negative space’ (although this does not necessarily point to negativity). The space between is a sense of sustain, floating, suspension, or nowhere-ness; the ringing before answering, or waiting before arriving. It is falling asleep or trying to wake, the process rather than the attainment, the longing for an experience rather than the experiencing itself.

Merleau-Ponty addresses this issue:

Bodily space can be distinguished from external space and envelop its parts instead of spreading them out [... and] the body image is [...] a way of stating that my body is in the world [...] By considering the body in movement, we can see better how it inhabits space (and possibly time) because movement is not limited to submitting passively to space and time, it actively assumes them, it takes them up in their basic significance […] (2002/1962: 100–102)

This observation references his concept of the ‘here-body’, which becomes a recurring motif for him and others, such as Don Idhe, who in *Bodies in Technology* (2002), uses ‘here-body’ in terms of placing the integrated conscious flesh within space and time, in contrast to the notion of the untethered, yet embodied ‘there-body’ or extended mind-body, which leaves the confines of the material flesh encased by skin. Of significance to such notions of presence and virtual space between is Merleau-Ponty’s concept of ‘body-image’, as well as ‘body space’ or ‘body in space’ and the space between [bodies].

In the domain of the body image, Idhe also tries to place the ‘floating’ or ‘out of body’ into some sort of framework of here-body, now-body, which also brings in the element of time, important in terms of thinking of technology and the multisensory body in action, as well as the experience of liveness, […] *here-body in action that provides the centered norm of myself-as-body* […] (Idhe, 2002: 6) Idhe categorises ‘here-body’ and ‘now-me’, as the physicalised body state versus out-of-body and virtual body states. In a related way, Kozel writes briefly of ‘leaving ourselves’ existentially and conceptually (corporeally also), in that our consciousness has the ability to roam or extend literally outside the boundaries of our skin and bodies (Kozel, 2008). It could also be argued that we leave our bodies temporarily while we are thinking and daydreaming, or while our minds are simultaneously multi-tasking with numerous ideas, plans, worries, emotions and preoccupations.

Idhe puts forth notions on the permeability of the body outline or skin boundaries, which supports a now a more accepted view of the extended body:

[...] the sense of her here-body [... is] extended beyond the outline of the wearer's body. (2002: 7)

 ‘Here-body’ is relevant not only to the construction of consciousness and its elasticity, but it also applies to the digital body through virtual connections between bodies and people, facilitated by wearable technology, mobile phones, and most recently virtual and augmented reality technology. This creates further body-mind extensions beyond the boundaries of flesh, but also necessitates by conscious corporeality and sensual perception, beyond what Idhe may have previously envisaged.

The main thrust of Idhe’s argument is his concept of a human-technology hybrid or ‘cyborg’ as the intersection where technology and the body meet to extend corporeal senses. He suggests that this is the only way to extend the mind beyond the physical body using technology. Further, he suggests that connecting the body to technology, directly on or under the skin, is a means to reach out into the open world through a symbiotic form, as a superficial outward reaching. One might suggest that the extension of the conscious experience then rebounds back to the corporeal flesh of sensations and perceptions, even if perception is beyond the skin (as in the case of out-of-body or near-death experiences). In this sense, therefore, these out-of-body experiences ‘out there’ are felt and still embodied ‘in here’ in the fleshy body. In the realm of the ‘in and out’ of bodily experiences, Idhe adds that the, ‘[...] *nontechnologized virtual body experience* [...has] *some floating perspective* [...]’ (2002: 5).

Elizabeth Grosz in *Volatile Bodies* (1994) adds to the debate, by emphasising the intertwinement of dualities within notions of the corporeal.

The concept of flesh is [...] not the union or compound of two substances, but ‘thinkable by itself’ [... it is] the condition of both seeing and being seen, of touching and being touched, and of their intermingling and possible integration, a commonness in which both subject and object participate, a single ‘thing’ folded back on itself. (Grosz, 1994: 95)

This seeing and being seen curiously points to the possibility of being both subjective and objective, as well as having the body having the capability for two simultaneous perceptual experiences, yet still be able to distinguish the differences. This notion of embodiment suggests a process, which takes place both inside and out, crossing the boundaries of the senses. Therefore, we might consider that the perceived and the perceiver are one. The notion of the permeability and flexibility of consciousness brings the discussion full-circle, returning to and embracing the idea of an elastic embodiment (Grosz, 1994: 96), which again reiterates the concept of an extended mind. As such, permeable boundaries between perception and the body suggest that the body can function separately, entirely outside of the mind (and *vice versa*); but can only do so in an elastic sense – not detached entirely from the physical body but, as Varela *et al*. suggest, informed by it (Varela et al., 1991: 27). As for the boundaries of the body, Massumi explains:

Brain and skin form a resonating vessel. Stimulation turns inward, is folded into the body, except that there is no inside to be in, because the body is radically open, absorbing impulses quicker than they can be perceived, and because the entire vibratory event is unconscious, out of mind. (2002: 29)

As such, the unconscious is a means to move out of the mind (body)

[[1]](#endnote-1), but also this notion of the body being radically open suggests that there are no boundaries, no inside/ outside, just the visible, corporeal body absorbing impulses from an invisible, extended, vibratory mind. All of this sets the stage, if you will, for virtual, and technological embodiment within performative events, for experiences that take advantage of this open, extended mind of the audience/ participant.

Grosz (2001) expands on the concept of extension and the ‘in and out’ when discussing Deleuze’s theory of in-between states:

‘[…] that we are asked to question the very ideal of ‘constructing an identity’ …that any identity is always riven with forces, with processes, connections, movements that exceed and transform identity and that connect individuals (human and nonhuman) to each other and to worlds, in ways unforeseen by consciousness and unconnected to identity.’ (2001:94)

Even though she is discussing the ‘in-between’ state as it relates to personal and cultural identity with regards to space, time and architecture, and this statement may seem contrary to the position here, it does point to the notion that identity is always changing, transforming, becoming.

**Bodies, Technology and Performance**

The authors, who have spent over fifteen years of developing digital media and performance practices incorporating mobile media, wearable sensors and devices embedded in garments for interactive and participatory, have witnessed numerous substantial changes unfold, bringing wearable devices into the mainstream corporate, sports, fitness and medical technological development. Researchers since late 1990s have been developing wearable technologies for fashion, sports, entertainment, science and medical purposes, for emergency services, the military, space exploration, as well as in media arts. Yet, as S.E. Ryan noted in her book *Garments of Paradise* (2014), few have explored the full potential of wearable technology in performance, let alone the other related issues of digital identity and data ownership in performance. Ryan writes,

‘Wearables in the context of performance present opportunities for exploring our relationships with our bodies and how we move them… [Or how] communications interfaces, and other soft and sensory technologies allow us to experience or transcend our bodies, and how the concept of theatrical performance can be expanded in virtual space’. (2014:8)

*Hacking the Body 2.0 (HTB2.0)* by media artist/choreographer/researcher Kate Sicchio, and media artist/curator/ researcher Camille Baker, isan ongoing investigation which explores issues of personal data collection through wearable devices. Looking to the history of technology and performance, as outlined by Salter (2010)*,* and Dixon (2004)*,* wearing sensing devices within performance is by not a new artistic practice. *HTB 2.0* explores issues of data identity and data ethics that are adding new dimensions to the evolution of technology. This is achieved through using wearable electronics and smart materials that connect us to the cloud and Internet of Things (IoT), as well as hacking corporate fitness tech, for performance. We are interested in examining and exploring this transformation of extending the senses and ever becoming, but rather as a means of unique expression of bodies and individual people, as a mode of creativity and resistance to corporate ownership of personal data.

Conceptually, *Hacking the Body and HTB 2.0* started by examining the rhetoric around concepts of code, hacking, networks, the quantified self, and data, as an approach to examining states and sensations of the human body using sensing devices for use within performance. Through this exploration we became suspicious of rhetoric that considers the information from the body as ‘code versus body knowledge’ and have thus expanded our work to develop new parameters of revealing this hidden body knowledge as part of the greater social, political and technological networks. Body data can be hacked, repurposed and re-visualised. With a focus on understanding the ethos and methods of the hacking community, we educated ourselves in the hands-on practical making processes of DIY electronics, soft circuits, and smart materials.

Frustration from lack of funding resulting in limitations on progress can often lead to more creative solutions, and while waiting we became increasingly concerned about the new generation of corporate wearable devices in the sports and technology market that collect the wearer’s data without their knowledge (or permission), that then sell that data onto marketing agencies, medical insurance companies, and to employers to monitor their employees. These concerns, as well as the curiosity about how biofeedback data might be used to create a personal signature or personal identity based on body activity and movement, fuelled the new direction in the work, leading us to put greater emphasis on performance development and production outcomes.

*HTB2.0* was thus born of a need to explore and critique how wearable technology extends our senses, but also how personal data identity and privacy issues can be revealed and understood through Zizek’s layers of ‘known-ness’[[2]](#endnote-2) (2006:52-53). In our research we observed how self-monitoring and the quantified-self activities have led to new forms of narcissism and encourage corporate and government spying and exploitation. The focus for us, however, has become about interpreting inner states and processes in order that they can be seen or interpreted as one’s personal identity, which may (or may not influence) one’s movement and interaction with others. As Ridgway (2015) stated in her online article for APRJA Datafied Research,

‘…we govern ourselves through our ‘behaviours’ being captured and cultivated in ‘personalised’ machines, sharing everything we do as huge amounts of data, surrendering our privacy for free services and participation in the attention economy. This state of discipline is reflected in the logistical capture of our data, preferences, intimacies and search queries as our subjectivity is exploited in these deterritorialised spaces.’ (Ridgway, 2015)

The *HTB2.0* collaboration has been evolving since 2011 and its the approach was initially influenced by and draws on existing projects that use biofeedback and physiological data in a similar vein, such as that of the work by Thecla Schiphorst and Susan Kozel’s *whisper(s)* project from 2002-2005, not to mention the haptic, biofeedback and wearable music performance works of Loke, Donnarumma, Khut and Tanaka, and many others now working in this field since. However *HTB2.0* extends and builds upon these works, particularly in that we use both hacked commercial and bespoke handmade wearable devices in the prototyping of the wearables used in the costumes worn by the dancers in our improvisational dance performance works. We have developed participatory performance activities and choreography that is informed by the physiological code of the body measured as data by sensing technologies and processes used in such as way that performers can interact with their own body data: an intention being that the public might also one day also be able to, and incorporating tactile and haptic, audio, and mobile actuation on the body and in the performance space. This approach enabled actuation or responses for input and output, or ‘call and response’ behaviours and nonverbal dialogue to occur. Our processes necessitated us to develop our own techniques and novel uses of the body data emanating from the sensing devices for our performance experiments. The aim was to enable the performers/audiences to experience sensual, haptic engagement through the custom-made garments on their bodies, and through this act of choice of action become co-creators in the participatory performances in which they engage.

**Hacking the Body and HTB 2.0 iterations**

In practical terms, *HTB 2.0* is as much an investigation into the body as ‘creative material’ as a conceptual research endeavor, examining the ethics of data ownership. The instantiations of the project have helped us to develop our own hands-on skills in making and using DIY electronics, soft-circuits and smart textiles, as well as unearthing greater understanding of the unethical data collection activities undertaken by corporate entities that make wearable devices. Through this ongoing research, we have created technology garments that do not keep data on participants, but instead trigger expression and portray personal identity with movement responses and haptic interaction. Within our iterative design process, performers are asked to express their own body code through movement through our various experiments during the many performance 'hacks' we have conducted, based on these concepts of what it means to own your own physiological code rather than the companies which may own it.

In one of the iterations during a ten-day artistic residency, commercial devices were used together with DIY wearable-tech garments that we had constructed, and both were tested and workshopped with two dancers in various improvisation exercises.  This intensive period allowed us to immerse ourselves more deeply and practically in the conceptual dimension, enabling us to develop two approaches when working with performers. One approach was that of revealing information, based on the former US Secretary of Defense Donald Rumsfeld’s infamous quote[[3]](#endnote-3) on invading Iraq.  We called this ‘the unknown unknowns, known unknowns, known knowns, unknown knowns’ formula[[4]](#endnote-4). As such, we focused on what was known about the commercial biosensing products we chose, and correspondingly devised methods for the dancers to develop movement, based on what is known (or not) about the data types collected from the body by these devices. We revealed information to the dancers in layers, to determine whether having more or less knowledge and awareness might change, help or hinder or influence the dancers’ responses to the technology in their movement and gestures during improvisational sessions.

As part of our workshopping method[[5]](#endnote-5), the dancers were asked to reflect on their experiences after each improvisation – first individually on paper, and then more openly within the group – as a means to ensure that their reflections did not influence each other. Our exploration of the known-ness of data, and how that could be used to initiate movement, involved us asking the dancers to:

* *listen:* to the personal/ internal/ intimate/ inner focus
* *interact*: experience the shared/ connected/ interpersonal/ emotional
* *visualise:* the community/ audience/ choreographic/artistic
* *think:* about the corporate agenda/ impersonal/ disconnected/ abstract

This first approach became very complicated for the dancers to implement in their movement, as we were asking them to interpret each layer of information directly through their bodies, interaction and movement.  As more information was revealed to the dancers – about the devices/garments, the data collected and the nature of our research, as well as ethical issues of corporate practices of selling data from our bodies – the more their movement changed from free-flowing dance to smaller, more intense exercise-like movements. They transitioned from a movement duet with one another, with a responsive, expressive body, to a confused, individuated, over-analytical movement phrases, with less connection to each other and each with less engaged bodies. It was not the devices themselves, and what they were sensing that triggered this change in the dancer’s movement response, but rather the concept that the data from the body was being collected and used by us (the artists) and the corporations which make and sell these devices. The dancers had trouble seeing these devices beyond being technologies collecting numbers, but they were changing their bodily expressions based on the knowledge and concepts they were asked to explore, and the perception of what they thought we wanted from them, rather than the physical experience of the devices/garments themselves, which they soon forgot they were wearing. This was the most fascinating outcome of this iteration, and changed our thinking on how this knowledge had disempowered each dancer and it became obvious how contextual knowledge changed the movement vocabulary of each dancer. This became an important factor for us in developing movement criteria about, and from, body generated personal data around ethics and identity.

The second approach focused on the use of DIY handmade tech garments. When wearing these, the dancers reported much more affinity towards these garments and more interest in how each caused impulses within them to move. These handmade tech garments were more sensual, delicate, playful and elicited more tactile, intimate responses. Each of the handmade sensors were unique and personal in design, style and required close-up interaction, touch and engagement that the dancers responded more readily to. It was determined that not only were the nature of garments responsible for changing the movement, but also the dancers’ perception of the garments. Rather than viewing the devices as corporate tools for stealing data from them, the DIY prototypes changed the dancers’ reported responses to using wearable technology.

[Insert Image 1]

Image 1 ©2015 *Hacking the Body 2.0* (photo by Camille Baker) Dancers performing with DIY wearable sensing devices created by the authors.

For our second investigation seven months later, there was more of a focus on garment aesthetics, design, used as a housing for the electronics, together with a focus upon interaction design of the sensing and actuation of the electronics, as well as a focus on the movement vocabulary and gestural responses of the dancers triggered by the actuation and how this could be made into dance performance phrasing. The goal was to allow dancers to interact or respond to touch and biosensors and their actuation or output through vibration, to instigate new movement ‘dialogue’ or interaction between performers.

[Insert Image 2]

Image 2 ©2016 *Hacking the Body 2.0* (photo by Kate Sicchio) Image from a rehearsal at Access Space in Sheffield, UK of the dancers interacting with the textile touch sensors embedded in the pink pleated fabric.

#### **Staging discoveries**

For our second investigation seven months later, there was more of a focus on garment aesthetics and design, used as a housing for the electronics, and a focus on interaction design of the sensing and actuation of the electronics, as well as a focus on the movement vocabulary and gestural responses of the dancers triggered by the actuation and how this could be made into dance performance phrasing. The goal was to allow dancers to interact or respond to touch and biosensors and their actuation or output through vibration, to instigate new movement ‘dialogue’ or interaction between performers, and to explore their identities.

A few months later, we took the work to the performance stage. We hacked into off-the-shelf devices to enable the dancers to interact directly with the embedded electronics in the garments on their bodies, to trigger the dancers to move in conversation with each other, with an added feature that allows the choreographer, or indeed the audience, to intervene directly with the dancers’ bodies and their movement responses. Two pieces were developed for the performances: 1) *Flutter/Stutter* – costumes with haptic garments and motor actuation ‘tickles’; 2) *feel me –* costumes with custom e-textile breath sensors and vibe actuation. A third piece is still in development at the time of writing: *move me -* costumes with a mix of hacked off-the-shelf wearable tech garments, with custom vibe actuators and a custom iPad interface for choreographic and audience interventions or ‘live coding’.

[Insert Image 3]

Image 3 ©2016 *Flutter/Stutter* live performance by Hacking the Body 2.0 February 2016 in London, UK (photos by Ceri Issac)

*Flutter/Stutter* and *feel me* staked out a singular new terrain in their exploration of ways to address ethical issues of data collection, the use of the technologies to represent personal identities of dancers. These two interactive dance pieces created an evening of performance. They also developed non-verbal communication interaction methods by incorporating live coding of the dancers by the choreographer into the work, who changed the parameters of the interaction remotely by manipulating the custom-made interface by controlling the responses and actuation felt on the body of each dancer. Each piece had two dancers and bespoke electronics in the form of wearable garments. The first piece, *Flutter/Sstutter* explored a combination of soft circuit electronics (using a mix of conductive fabrics and threads) and contact improvisation. For these performances, our electronics collaborator Becky Stewart created an innovative technology configuration for our performance using new soft circuit construction techniques, which allow for the costumes to communicate with each other over Wi-Fi and allow each dancer to trigger haptic feedback on each other’s costume. We also collaborated with fashion designer Tara Baoth Mooney to create not only the sensors, but the overall costuming for the performances using reused and sustainable fabrics and design techniques. The second piece, *feel me*, achieved our aims of working with biosensing technology and dance. This piece used breath sensing technology from reworked fitness wearable tech garments and a custom-made app (made by artist Peter Todd, with permission of the fitness company OM Signal), that accessed the company’s development tools, and was used to communicate from the garment’s sensor to its actuator (a vibration motor), which buzzed when the dancers exhaled. All the technology was developed over a several months, then integrated into the final garments and performances during an intensive three-week period running up to the performances in February. An earlier R&D residency was held in November to test prototype smart costumes and technology with dancers as well as devise movement ideas.

The aim of these works was to enable dancers to interact with worn sensors and actuators, to instigate new movement ‘dialogue’ or interaction between performers, and to explore their identities through their movement expressions. By using the technologies developed for gathering personal data but circumventing corporate data collection, we facilitated direct communication between each body/dancer to create a conversation. At the same time, the choreographer could also intervene directly with and participate in the dialogue between dancers’ bodies and their movement responses, by intercepting the sensors and triggering the chimes from the computer, to take over control of the interaction. In this way, the performers reclaim the data sensing and collection by using the technology as another tool to enable them to improvise movement and co-create or choreograph performance works.

In *Flutter/Stutter*, there is a system of communication that has been developed through triggers and haptics. The score for the performance became based upon the different possible interactions, including dancers triggering sensors with their hands, the choreographer live coding the haptics and triggering the interactions without the dancers, and the dancers finding ways to activate the sensors with other parts of their body or the other dancer’s body. In *feel me*, the choreography had a much more traditional structure in that it was composed of a set movement phrase and had a set pattern in the space in which it was to be performed. However, the timings of the execution of the movement was determined by the breath of the other dancer. This meant that a dancer only moved when the other dancer was inhaling. To fully play with this dynamic, there were sections of the piece that were solos, while one dancer stayed lying down and really focused on control breath, as well as sections where both dancers were moving dynamically. As much as the movement was driving the technology, the technology was driving the composition of movement.

The choreography focused on two technological aspects, used as methods for both developing movement as well as a structure for improvisation. Firstly, the dancers were responding to actuators on their costumes and to each other through movement. By moving in reaction to these impulses on their body, the rhythm, timings and dynamics were modified in a feedback loop. The dancers took a subtler approach to movement, to reflect the sensation of being tickled on the neck by a ribbon on a motor triggered by the other dancer. The relationship between data and subsequent reactive movements by the performers was a touch on the shoulder pieces and the subsequent actuation responses were meant to initiate movement by the dancer receiving the vibration or tickle, as the response in the “call and response” non-verbal dialogue. Each dancer also had to take into consideration how to initiate the trigger of the actuation on the other dancer, as part of the “conversation” between them.

The second manner in which the technology was repurposed into the choreography, was through the structure of the interaction design. The system was developed to adapt and provide several opportunities for user interactions by the dancers. The score for the dance improvisation was then structured around a timed sequence and a variety of dancer interactions. Each one led to a distinct moment in the piece and allowed the overall composition to build over time. The audience was able to understand the interactions not only through the expressivity by the dancers and the way in which they had a ‘call and response’ behaviour when activating the devices, but also by the sounds the garments also triggered, to create a improvised soundtrack of variously pitched reverberant chimes. The operating modes of the sensors and actuator may not be clearly discerned by the audience through these pitched chimes, as the intention of the piece is not to make improvised music, but to allow the audience to understand that the interaction and the actuation is live and created by the haptics. We chose to restrict the system to use a single sensor and actuator at this point in the research due to funding and time limitations, but intend to introduce more sensor/actuators as the project progresses, in order to increase the performance potential in future iterations.

**Reflections and directions**

The human body and mind are interwoven and elastic, shaping and responding to the world around them. As each new dimension of the project was introduced, with new information about the technology’s rigid design parameters, the more expectations were formed in the dancers’ minds of what we might be collecting the data for, and this cognition radically influenced and changed their movement responses (or what they thought we were looking for in their movement): from fluid, expressive movement to rigidly defined, mechanical, exercise-like movement. This became part of the choreographic process in the final performances. *feel me*, using hacked corporate devices, was a very structured piece of choreography with a strict form of repetition. When one dancer exhaled, the other dancer had to stop moving for the duration of that breath; their movement was forced to become stagnant rather than follow the expected patterns. This was a direct reflection of the responses we saw from dancers during our R&D research with wearable fitness devices and directly opposite of the responses we observed from dancers wearing hand-crafted devices. Dancers’ movements flowed and were gentle when working with our DIY creations.

Through these performance works we have refined our methods of working with those who wear and perform with, and within the tech-enabled garments, to aid   the performers  to   control   how   they   use   their own physiological data, from their own bodies or the body of another performer, as direct expression of personal identity in movement and gestures. The vocabulary for movement as well as the interaction between performers still requires further development, explored through the dancers’ responses to the sensing and haptic actuation on the body, and the technical iterations of the devices and smart interfaces of the garments. In this way, the performers were enabled with another way to directly reclaim their own data collected from their sensing, expression and the technology itself. This could be seen as another tool, technique or collaborator to help performers and choreographers devise movement and co-create performance works. This puts ownership of personal body data back into the hands of wearables users, and creates a performative challenge to surveillance and data control. The ultimate goal of the project is that performers engage with their own and other’s body code to create new forms   of ‘live   data   performance’, with   the performer initiating the interaction, using these interfaces to aid their performance interaction.

The long-term direction for this investigation has always been to refine our methods of working with performers wearing bespoke wearable technology enhanced garments. The performers interact or respond to the smart garments and each other through movement, enabling code-based movement phrases or ‘dialogue’ to emerge, reacting to each other’s unique gestures representing their data identities. This then allows them to interact or respond to biosensing to create new movement ‘dialogue’ or interaction with other performers. In this way, the performers have a mode by which to directly reclaim their data sensing, expression and collection and the technology.

From these discoveries, more questions have arisen: How does the mind/body change its responses to conform to the technology used? Does the design of the technology with its embedded biases give us less (or more) creative control over our responses to it? Or has the technology we use (in general) been made purely to serve technocratic and corporate control? Do people lose their identities and become data?  Are we slowly becoming ‘the ideal human’ from the inside out? How or why do playful handmade devices elicit different responses and interaction from users (in this case dancers)? Is it because the technology innately imbues aesthetics, individuality, corporeality, craft and imperfection built into their design?

Manning makes a relevant observation for our findings,

“...the technology soon situates the dancing body on the techno-dance stage as a preformed organism onto which the technology is grafted. The question shifts from ‘what can a body do’ to ‘what can technology do’. (2009:63)

We are more concerned about what a body can do, but first we must sublimate the technology rather than conform to its inherent limitations. This is part of our aim in *Hacking the Body 2.0*: to explore the body, movement, nonverbal communication, with the collaboration of the technology as a resistance to the modes of working with wearable technologies and electronic textiles through making, performing and public debate. This exploration recognises that we cannot actually reclaim the ownership of our private physiological data automatically or on a substantial global level through performance experimentation and its debate alone, but with additional interventions and the development of disruptive technologies we hope to add to the increasing voices and resistance to such control. This work sheds light on the ethical issues of corporate ownership, by giving ownership back into the hands of the user, or dancer in this case. It in turn may be considered a critical act of making and confrontation of the issues of surveillance and data control. This confrontational activity will involve engagement with small and large technology companies, government representatives, as well as facilitating public debate in critical symposiums, festivals and conferences that are focused on big data, wearables, Internet of Things, skin interfaces, surveillance, privacy, data harvesting, and corporate profiteering of personal data, in contrast to an ever growing movement of radical grassroots activities opposed to these practices to empower people to directly confront the issues on a greater scale [[[6]](#endnote-6)]. We can also initiate more collaboration between artists and performers with wearable technologists and companies, to find a mutually satisfactory way forward, demonstrating how art and performance can influence the research and development of Human Computer Interaction, interfaces and data collection, not to mention creating more ethical, environmental and sustainable technologies and interfaces for the future.

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**Endnotes**

1. [] To clarify: when I speak of consciousness I include the unconscious as part of the range of states of consciousness, just as there is a wide range of states of corporeality. (there are two authors – why therefore ‘I’?)

[2] “*There are known knowns. These are things we know that we know. There are known unknowns. That is to say, there are things that we know we don't know. But there are also unknown unknowns. There are things we don't know we don't know*.” See the video of him making tis statement on YouTube here <https://youtu.be/GiPe1OiKQuk> (accessed November 13, 2017) [↑](#endnote-ref-1)
2. [3] This concept is unpacked well by Slavoj Zizek in his book *How To Read Lacan*, especially his concept of unknown knowns*,* where he states, *“…Lacan’s claim that the subject is always ‘decentred’. His point is not that my subjective experience is regulated by objective unconscious mechanisms that are decentred with regard to my self-experience and, as such, beyond my control (a point asserted by every materialist), but rather something much more unsettling: I am deprived of even my most intimate subjective experience, the way things ‘really seem to me’, deprived of the fundamental fantasy that constitutes and guarantees the core of my being, since I can never consciously experience it and assume it.”* (2006:52-53) [↑](#endnote-ref-2)
3. [↑](#endnote-ref-3)
4. [↑](#endnote-ref-4)
5. [4] Our methods are based on those of Thecla Schiphorst which Baker learned working for her as a research assistant in 2002-2005 on her wearable performance project *whispers* in Vancouver Canada. [↑](#endnote-ref-5)
6. [5] Such as *Transmediale Festival 2015 Capture All* in Berlin, where the topic for the festival was focussed on critically examining these issues.

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Zizek, S. 2006. *How To Read Lacan*. London: Granta Books, Granta Publications. [↑](#endnote-ref-6)