Choreography and Sounding Wearables

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ABSTRACT

This paper explores the role of 'sounding costumes' and body-worn technologies for choreographic composition, with real-time interactional elements (such as microphones, speakers, sensors) potentially integrated into movement and expressive behaviour. Sounding garments explore the interactions between dancer/performer, the costume and the environment in the generation & manipulation of sonic textures. Briefly discussing historical precedents of integrated composition, the article will mainly refer to sounding prototypes in DAP-Lab's latest production, for the time being [Victory over the Sun] (2012-14), for which I designed the wearables, highlighting new methods for building sensual wearable electro-acoustic costumes to create kinaesonic choreographies. The paper analyses the multi-perspectival potentials of such conceptual garments/wearable artefacts to play a significant part in the creation process of a performance, focusing on how wearable design can influence and shape movement vocabularies through the impact of its physical material presence on the body, distinctive design aesthetics and sound generating capabilities. Choreographically, garments and body-worn technologies act as amplifying instruments as well as sculptural constraints or conversely enablers of new movement and ways of sounding/listening that affect different kinetic and acoustic awareness (both in the performers and in the audience).

KEYWORDS

Costume, body, movement, choreography, sound, wearable and interactive performance.

INTRODUCTION

The dancer Vanessa Michielon enters the space, immediately drawing attention to the visual and felt presence of her red weighty neoprene dress with black leatherette trim, square shoulder-line, narrowing sleeve (elbow to wrist) and circular cut skirt. Integrated into the dress is a wireless microphone system, transmitter at the waist and tiny mic located on the left back shoulder (Figure 1). The palpable sensations of the materials and recording capacity of the RedMicro Dress begin to guide her body extending beneath the surface to form a compound body of interacting physical entities. New potential energies for *kinaesonic* choreographies emerge as body and dress combine in a state of becoming one in motion, and at the same time becoming open to sound that will enter it from the outside – the dress a receptacle, the dancer a receiver.

Figure 1: for the time being, Sadler's Wells, 2014. Vanessa Michielon in RedMicro Dress with 'Futurian' Aggeliki Margeti in background wearing sounding chest plate, Act II. (Photo © Hans Staartjes).

This personal state of experiential wearing in relation to the multi-sensorial qualities of the costume, specifically sounding and tactility, is expressed in Michielon's response below, when

I asked her about the sonic potential of cloth, tactility and motion, and how tactile sound and fit contribute to the movement process.

> In a still position I feel the subtle pressure of the costume around my waist, and it invites me to contract my abdominals and keep a straight position in my back, concentrating on my verticality. When I bend or extend the elbows, the fabric makes sounds and this suggests me to perform this task more often than I usually would do.
>
> Furthermore, the fact that the costume is tight fitting on the elbows suggests to keep the arms straight, to minimize the pressure, or to bend them to feel the strongest tension. Since elbows are the focus, I use them as motor and I try to maximize their distance pulling them outside, thus opening the back and also using the space behind me. Sometimes the movement propagates through the whole body; sometimes it just remains in the elbows, thus isolating the rest of the body.
>
> (Michielon 2014b)

The location of the small microphone on the left shoulder renders it unintentional for the wearer in the conventional sense. Rather, it is there to encourage interaction from another performer, since RedMicro Dress is a wearable designed for a duet, a dynamic amplificatory sound-capturing device for extended partnering. Enter Helenna Ren, a second dancer, performing her role of 'Man with Bad Intentions' with a humorous and mischievous twist, wearing a masculine cut suit, moustache and carrying a small, wired speaker. The two dancers begin to move, drawing up close and then retracting, exploring the amplification of Ren's breathing, grunts and menacing words (together with the tiny radio sounds emitted from her small speaker) via the wireless microphone system integrated into the RedMicroDress (Figure 2). This is a partnering on more than one level, since it involves bodies dancing with technologies and at the same time bodies dancing with bodies in a duet driven by sound-capturing, manipulation and amplificatory potentials.

The scene described above was created with the DAP-Lab[i] during rehearsals for our latest production, *for the time being [Victory over the Sun]* (2012-14). Inspired by the experimental Russian Futurist opera, *Victory over the Sun* (1913)[ii], our choreosonic performance[iii] is a free adaptation of the original libretto but also an experiment in its own right, exploring the sound of movement. The costume design concepts for the work incorporating sound-generating technologies to be activated by the performers in motion are fully integrated into the sonic movement scenarios. In some instances, they are also responsible for initiating the types of

movements that emerge in a design-led performance making process. RedMicro Dress was conceived as provocation for the dancers and choreographer Johannes Birringer alike, and as vehicle for transmission of sound data to be taken up and synthesised by our sonic art collaborator Oliver Doyle.

Figure 2: for the time being, Sadler's Wells, 2014. Vanessa Michielon and Helenna Ren as 'Man with Bad Intentions' performing 'RedMicroDuet in the 10th Country,' Act II. (Photo © Hans Staartjes).

In the following article, I will investigate the impact of wearables on choreography, based on my design practice and methods of working with prototypes as described in the opening paragraphs. The role of sounding in particular provides the critical angle from which I want choreographic design to resonate with sound design. At DAP-Lab, we conduct experiments in the relations between movement, wearable design, sounding, space and the body within digital or mixed-reality performance contexts. Our explorations examine how the performing body behaves with or through media within programmed environments that can affect multiple sensory perceptions. In my role as costume designer, when devising the wearable-as-audible in performance, my attention is shifted to the costume as a medium. Wearing becomes a performance technique that draws the digital back across into the visceral, into a collective behavioural environment where we listen and follow the smallest movement, the exhalations,

the rattling of metal chains dropping against the floor, the whisper of rustling fabric, the pleated sigh, the whirring of a tiny speaker worn on a wrist. The design methods I will sketch out in this article bridge costume design and performance choreography, and also have implications for the intimately resonant relationships generated in (computational) environments that touch the performers in multi-sensorial ways.

WEARABLE PERFORMANCE BEHAVIOUR IN INTERACTIVE ENVIRONMENTS

Sound creation through the design of wearables in performance challenges assumptions about musical composition for performance as well as about a notion of choreography reserved for the creation and organisation of physical movement in space. The new mobile, wireless performance technologies and sensing systems also present provocations to theatrical conventions, as real-time processes favour improvisational techniques rather than through-composed choreographies. First, I want to suggest that the integration of body-worn technologies into costuming for interactive narrative dance/performance alters the role of costume within the performing arts. Second, I argue that performers and audiences alike are challenged when the focus of aesthetic design is directed at the creation of particular sound characters that subtlly redefine the idea of an 'instrument', leaving us to wonder about the source of the sound and the persona embodying the wearable instrument. New mediator technologies (sensors, microcircuits, motion tracking), incorporated into the very textures of a garment design concept, locate the potentials for real-time interaction directly with the body of the performer-wearer. Gestural movement data can be captured and transmitted to interactive design patches for live performance, and alongside small electro-acoustic and electronic sounds generated and amplified on the body, they actuate audio-visual phenomena in real-time on stage, thus offering new capabilities and expressive potentials to the performer in costume.

With such *wearable* scenarios of bodily augmentation through micro-electronic circuitry and human computer interfaces, the design work I have developed over the past years has opened up provocative new avenues for our understanding: how such wearables mediate the relationship between the dancer/performer and the performance space; and what specific dynamic affordances emerge through interactivity to engage a dancer in activating the garment for *affective* wearing and sound generation, thus adopting the costume as an *instrument.* In the

following, I will situate *wearable-performance* within a narrative performance context, which is extended through the aesthetics of design and has become centrally important for the choreographic practice of my ensemble. I will also examine the sensorial impacts of the costumes on performers' bodies and their techniques of performance, sketching some new ideas about how movement behaviour is influenced by such palpable and digital tactilities.

Generally, in professional productions costumes are not explored in relation to the moving body in the early stages of a performance-making process, nor do dancers have the opportunity to acquaint themselves with the *touch* of a costume or rehearse with it as a work is shaped. In my studies of Western contemporary dance[iv], I have noted as a designer of costumes that many choreographers prefer dancers to wear garments that do not impact on the nature of their movements but rather facilitate them, opting for close to the skin body contouring pieces with stretch-ability or minimal surface coverings, partial nudity or in some cases complete absence of a costume. On the other hand, with devised and physical theatre, design is sometimes present at the outset of a process. Improvisation may derive from the objects and costumes on offer to the performers at rehearsal whilst at the same time being limited by these very material forms (Bicât 2012: 55). According to Aoife Monks: 'Costume is that which is perceptually indistinct from the actor's body, and yet something that can be removed. Costume is a body that can be taken off' (2010:11). She is suggesting that in theatre contexts, it can be difficult for the viewer to distinguish actors from their costumes on stage as costuming makes possible the actor's body.

In the work I do with dancers and costumes integrating technologies, I shift the emphasis away from the perceptions of the viewer to encompass the sensorial sensations of the wearer in order to advance my knowledge of how these wearables, through multisensory means and especially through tactile sound and vibration, can be used choreographically. Whereas Monks reflects on 'costuming as indistinguishable from the actor' (2010:12), I imagine the wearable to operate very specifically in relation to the dancer's body and perceptional as well as technical processing, and therefore the particular technological functions of electro-acoustic or digitally interactive costumes require a rather distinct awareness. Intimacy of the wearable experience, and a unique partnering with the constructed technological performance potential becomes a significant factor in wearable performance. Birringer, in his chapter on 'Digital Performance' in *Performance, Technology, and Science*, posits that meaningful applications of wearables within artistic and social contexts are contingent on 'affective experience' in human-computer

interactions extending beyond 'actuators' to more expressive modes involving sensorial qualities such as touch, sound, taste and smell (2008: 219). I have worked with Birringer for a number of years in this shared field of research, where our disciplines converge, conducting experiments at DAP-Lab on wearables in performance.

SOUNDING WEARABLES

In the work we create at DAP-Lab, *sounding wearables* with real-time interactional elements (such as microphones, speakers, sensors) are used choreographically within narrative dramaturgies. The wearables are present from the early formative stages of a new work. Sometimes these wearables might also emerge through a rehearsal process, depending on the narrative subtexts and the performance characters we are developing. Either way, it is the *practice of wearing* that becomes fundamental to the performance-making process where an intimate interrelationship between dancer and costume emerges to generate design-led performance, to stipulate the 'technogenetic' processes that Erin Manning seems to be thinking about when she criticises the lack of attention to the moving/becoming body in interactive dance-technology systems seeking to map the performance gestures to 'predefined parameters' (2009: 71, 63). Our practice is based on the continuous opening up of a partnering dialogue between emerging movement, performance character, the hardware we build and the software we program. The iterative process of development and testing of our prototypes involves musicians, programmers, choreographers and the intelligence of dancers' bodies in technology equipped workshops, studios and rehearsal spaces. The questions I bring to the design-in-motion rehearsals address the kinaesthetic and technical potentials of sonic technology, the functionalities of the equipments we build, their sound generating characteristics, and the methods of integration. Primarily, my prototypes are to enable compositional and real-time interaction potentials of the wearables in 'kinaesonic'[v] performance, and the emphasis is on the potential of processes, not the calculable results of parameterisation.

My designs, which I will describe in the second part of the article, aim to be both visually distinctive and also *audible* when activated through wearing by the dancer/performer in motion. This idea of audible costumes is quite new in the contemporary dance context but interdisciplinary design research in this field is emerging.[vi] In the stage productions of the DAP-Lab, the concept of audible costumes emerged through an evolutionary trajectory of

working with body-worn sensors and interactive digital performances (often focussed on the manipulation of visual digital media output) over a number of years.[vii] Gradually, subtle gestural movements of the body and new choreographic techniques revealed that we could release sounds from material textures, which would ordinarily be silent in their static state. The distinctive slapping sound for instance of a leatherette cloth, or a metal coil rotating at different speeds controlled by a dancer can become new material for generative composition. Each small sounding was scrutinised for inherent sonic possibilities, re-mixed, magnified and re-emitted in real-time through technological systems in the performance space (using directional and condenser microphones, speakers, laptops and software). Thus, generative techniques of digital corporeal engagement for sound compositions with body-worn technologies, directly impacting on the surrounding scenographic and projected (digital) visual environment came to release a new form of 'audible choreography.'[viii]

HISTORICAL PRECEDENTS: CHOREOGRAPHIC GARMENTS

As I have already implied, costumes – designed for the study both of movement and sound which are then expanded into choreographic ideas – need to make their entrance early on in the compositional process. They become entwined with the body and the dance, intrinsic to the process of constructing movement that elicits and captures sound, and that interconnects audible spaces and the movement of others on stage. Drawing on Merleau-Ponty's phenomenological philosophy of intercorporeality and embodied perception (especially his chapter on 'The spatiality of one's own body and motility' where he delves into sensory surfaces, tactility and bodies in movement, Merleau-Ponty (2005: 112-70), I briefly trace this idea of responsive partnering, looking at historical examples of performance design that illuminate the permeation of costume, physical movement, sound and light projection. This permeation is critical if we think of cloth and sensors and cloth *as* sensor touching the skin, and thus the membrane of bodies connecting outside and inside, not only as 'connective tissue' (Kozel 2007: 34) but as vibratory surfaces or fluid conductors, as audiotactile interfaces for electricity conductivity and energies that mobilise the electromagnetic spectrum.

Early physical transformations of the modern dancing body through the use of technologies and costume are credited to dancer Loïe Fuller, a pioneer of electrical lighting whose technological additions or extensions integrated into costume coalesced body and wearable.

Most notable were her *Serpentine Dance* (1896) and *danses lumineuses*/dances with light such as *Fire Dance* (1896), which used under lighting techniques for her billowing silks that she manipulated with wands to create the effects of spiraling, swirling fabric. Through these dances, Fuller presented new and innovative amalgamated movements of body and technologies so powerful that she is reported to have left her audiences at the Folies Bergère breathless. The captivating affect was attributed to her specific way of moving with her tools and materials, and as Rhonda Garelick puts it, to 'the creativity and force she exhibited as she wielded the enormous costumes; the power of her technology, the innovative stage-craft that she had designed and patented herself; and the oneiric, ephemeral landscapes evoked by this combination of body and machine' (2007: 4-5). Ann Cooper Albright observes that Fuller's own notes on her use of colour lighting and motion reveal a keen awareness of how movement and the vibrations of light generate 'reverberations of sensation' in the audience (2007: 75). Her audience's attention was gripped by the visual dynamism of dissolving shapes, her body's torque nearly hidden but sensuously translated into vibrant undulations of fabric. Fuller's *Serpentine Dance* and *Lily Dance* (1895) are early examples of interactive costume design where the design features of the garment are developed in direct relation to the movement and resultant forms of the dance. The dancing body's relationship to such technological additions or extensions is the precursors to my work. The sensorial aspects in particular – tactile sensations of cloth, luminosity, waves of light or sound vibrations – point to an expanded concept of corporeality and choreography. The affective reverberations I am interested in when building a sounding costume are of course relational: the wearable connects through its conductivity.

The Bauhaus dances of Oskar Schlemmer in the early part of the twentieth century also emerged through a direct partnering of body and design prototype in motion. His sculptural costumes and padded body suits extended as well as constricted, and in some cases hid or masked the body. Unlike the costumes of Fuller which seemed to set her body in motion demanding a highly physical and fluid spiraling performance in order to animate the large expanses of cloth, Schlemmer's Constructivist costumes were designed more to constrain, or slow down, the movements of the performing body. The aim was to limit movement in order to focus on his particular interest in the mechanics of moving joints and limbs and the abstract geometries of lines created by body movement in space. Schlemmer's quest was to seek a new *Gestalt* of the body in an exploratory and analytical process implicating performer and audience and a shift away from mimetic action. The following quotation from Melissa

Trimingham highlights the complexities involved and the body-centric and experiential aspects of his work:

> The concentration on action rather than mimetic action is rooted in philosophical concerns, namely phenomenology, but, to steal Schlemmer's own words in relation to mathematics, not the sort of philosophy we 'sweat about in school' but an embodied philosophy 'where everything begins with a feeling that slowly becomes form and where the unconscious and the subconscious enter the clarity of consciousness.'
>
> (2011: 78)

From his early figurative drawings of bodies with objects 'that invite movement' and his sculptures, to his explorations with costumes and objects aiming to remove everyday action, Schlemmer's trajectory of investigations into more abstracted motion and gestural performance can be mapped. The stage-space-architecture movement pieces such as *Form Dance*, *Pole Dance, Glass Dance*, *Space Dance* scrutinised the motion of performers' bodies as they engaged with material forms in space. Dance works such as *The Triadic Ballet* (1922), and *Mechanic Ballet* (1923-4) analysed the motion, namely the restricted movements of the performing body in relation to sculpted costume – garment shape and physical material form.

This notion of encumbering or constraining the body inspired me to test various prototypes of sounding wearables that entail particular movement constraints, diverting the dancer's habitual movement patterns and requiring attention to different kinaesonic 'notes' and scales, i.e. playing with the parameters of a sensor (e.g. its pitch bend), the feedback of a microphone, with gesture controllers and crackle boxes, the intimate vibrations of small speakers, the massive reverberations of amplified electronic oscillators, the frequency shifts of radio noise generators, crunched shortwave static, hyper extended shrieks and birdcalls, gramophonic loops. The playing can involve the full body and costume, but it can also require dexterous movement of shoulders and of the beak of a bird mask, gestures without arms or hands, elaborate footwork, careful touch of fingers or use of muscle and flesh, dilations of the upper body, silent screams.

Other examples in more recent history of dance where new movement techniques must be found for the dancing body are the 1990's collaborations of Japanese fashion designers Rei Kawakubo and Issey Miyake with choreographers Merce Cunningham (*Scenario* [1997]) and William Forsythe (*The Loss of Small Detail* [1991]) respectively. The bulging padded and

deforming costumes of Kawakubo radically altered dancers' proportions and movements as they shifted the balance and relations of bodies in space (Carpenter 2012). More recently, the experimental costumes of Italian choreographer Sonia Biacchi, produced for avant-garde forms of contemporary theatre and ballet performances, offer sculptural silhouettes that limit the dancers' movements with their specific structures and, according to Biacchi, enforce 'mechanizing and robot-like effects' (2013). When I interviewed one of the dancers who had worn them, she mentioned the very 'rigid materials' she had to learn to inhabit and to 'take off', at some point, to leave them standing alone onstage like sculptural tents (Danjoux 2014: 38).

SOUNDING GARMENTS AND ENTWINED BODY INSTRUMENT

In this next section, I turn to the phenomenon of sounding through wearing, addressing the issue of performing the wearable instrument. Using more recent examples from music and sound art, I illuminate the idea of the instrument worn on the body and the ways in which musicians have interpreted the possibilities of wearables.

The notion of activating sound through wearing and simple gestures or everyday motions was explored by composer Ellen Fullman in her *Metal Skirt Sound Sculpture* (1980). *Metal Skirt Sound Sculpture* was designed and built by Fullman as performance wearable in the form of a pleated skirt constructed out of metal as the name suggests. An integrated system of wearable sound, the sculpture was activated through the simple act of walking, the resultant sounds simultaneously generating a soundtrack for her performance. Fullman expands on her motivations and the particular technique of sounding:

> In 1979, during my senior year studying sculpture at the Kansas City Art Institute, I became interested in working with sound in a concrete way using tape-recording techniques. This work functioned as soundtracks for my performance art. I also created a metal skirt sound sculpture, a costume that I wore in which guitar strings attached to the toes and heels of my platform shoes and to the edges of the 'skirt' automatically produced rising and falling glissandi as they were stretched and released as I walked. A contact microphone on the skirt amplified the sound through a Pignose portable amp I carried over my shoulder like a purse. I was fascinated by the aesthetics of the Judson Dance Theater in their incorporation of everyday movements into performance, and this piece was an expression of that idea; the only thing required for me to do was walk.
> (2012: 3)

Fullman used the wearable sound sculpture skirt in a street performance in downtown Minneapolis during the 1980 New Music America Festival, and a documentary video that exists of the event demonstrates the simple and straightforward execution she had imagined; yet the unexpected sound of the garment creating perplexed reactions from the passers-by. In the context of sound art, the building of sound costumes is rare, but one well-known practitioner is Benoît Maubrey, director of *Audio Gruppe.* Displayed in public spaces, the costumes Maubrey created for characters such as the *Audio Guards* (1983), *Guitar Monkeys* (1986), *Audio Ballerinas* (1989) and *Audio Geishas* 1997) were worn by members of the *Audio Gruppe* who developed solos with particular instrument-costumes (often with built-in amplification). His electro-acoustic clothing integrating speakers and other sound devices and recording technologies explore the body as dynamic sound source and playback system. Certain costumes have mutated into highly individualistic and self-contained sound units or 'phonic' bodies producing sounds and movements in intimate, close-to-the-spectator performances.[ix] *Audio Ballerinas*, which later became a group rather than a project, included dancers, choreographers, engineers and Maubrey as director. Like the previous Fullman example, the performances took place on the streets but in this case, the physical act of walking was not used to generate the sound but more to transport it. Dancers now moved in specially formed weighty Plexiglas tutus equipped with various devices for sampling and sounding real-time in the outside space. Body movements could be translated into sound via the tutus, which with their receivers 'render audible the radio waves travelling through the air' (Maubrey 2010: 134).

Vocalists and musicians have also experimented with interactive sensor suits and accessories, e.g. composer/performer and audio artist Pamela Z with BodySynth®,[x] and Julie Wilson-Bokowiec with the Bodycoder System.[xi] A more incidental example of the performative and sounding potentials nestled within garments can be seen in musician Bjork performing one of the dresses from Alexander McQueen's Spring/Summer 2001 *Voss* collection. The particular dress in question utilised glass microscope slides, 'blood plasma slides' and ostrich feathers in its construction. There were two thousand blood plasma slides painted red and hand sewn onto gauze (Loschek 2009: 57). One can immediately imagine the sounding potential of such a design, an aural quality of rattling glass slides that extends beyond the visual and tactile elements and adds to shaping our aesthetic perception. Ingrid Loschek describes this transformation of the dress to percussion instrument when worn in a one-off performance by the musician Bjork, explaining that: 'Her dancing movements caused the glass slides to rattle against each other, and this gentle jingling was integrated as a component of Bjork's music:

The "blood plasma slides" mutated into percussion instrument' (2009: 57). Subtly, the emphasis is shifted away from the realms of the visual and tactile in this wearable-performance to embrace the sonic dimensions of the dress-in-motion, presenting the dress as a form of instrument worn by the body expanded through the practice of wearing. It can be argued however that it is not purely the dress that becomes instrument but the body coupled with the dress-in-motion, in an entwinement of body-instrument or instrument-body where body and dress exist only as implicated in each other, 'body and thing are extensions of each other' (Massumi 2002: 95). Massumi is here addressing the extended operational architectures or prostheses (exoskeletons) Stelarc has worn in his performances, suggesting that the object can be considered a prosthesis of the body if we remind ourselves that the body is equally a prosthesis of the object.

Examples such as the aforementioned ones demonstrate how the act of sounding can be seen to be the direct result of the way a body might move and be extended by design. This phenomenon is acknowledged by musicologist Deniz Peters who states:

> Whenever someone uses her of his body to make music, the act of sounding is determined by the way in which the body is used, with the actual sound being a consequence of the acoustic causation. Acoustic instruments are artefacts whereby part of this causation is extended by design, but it is still within the continuum of natural causation, and *palpably* so – by means of *touch*.

> (Peters et al. 2012: 4, original emphasis)

Dancers may not have the technical virtuosity or musical sensibility of musicians who play sound-instruments; kinaesonic choreographies invite dancers to perform expressively with the sounding wearable based on their movement knowledge and intelligence. A dancer requires an additional unfolding of attention to the sonic dimension, understanding the body as 'listening organ,' a receptacle for sonic experiences (Kozel 2012: 63). Furthermore, the performer will develop techniques that are specific to the wearable, a skillful object/instrument handling using her 'tactile-kinesthetic intelligence,' as well as a touch-movement knowledge that emerges through engagement with the artefact/object or instrument and thus leads to an intimate binding of body, instrument, movement and resultant sounds developed through the interactions (cf. Parviainen 2012: 71-79).

AUDIOPHONIC DESIGN PRACTICE

Audio technologies and wearable technologies converge in my audiophonic design practice, which takes key inspiration from the developments in sound art practices and electro-acoustic music of the twentieth century. Exposing my costume ideas to the influences of experimental music techniques and live electronic processing led to audiophonic wearable designs that are more akin to electro-acoustic instruments worn by experimental musicians than bio-monitoring devices for health and well-being or spectacles emitting expressive light displays of instantaneous tweets. One could say that my prototypes do not conform to the standard contemporary wearable models of technology as defined in recent publications such as *Fashion Futures* (Bradley Quinn 2012) or *Fashionable Wearables* (Sabine Seymour 2008), nor do they fit easily with contemporary discourses on the subject since they do not necessarily aspire to be state-of-the-art inventions involving the latest engineering and intelligent materials but rather suggest a retro-futuristic design practice incorporating both the analogue and the digital, wireless and wired, miniaturised and oversised technologies. Interfaces and aesthetics might thus be less about integrating new microelectronics and emerging technologies seamlessly into design and more about adopting and foregrounding visually and sonically certain technologies in narrative performance contexts. In addition, rather than always striving to offer high performance and maintenance-free characteristics, dysfunctionality and malfunction may become desirable, offering unexpected richness for a process-orientated composition strategy of working with sound, where any sound might contribute to an overall musical structure. In our work, 'the wearables draw attention to materials and thus to tactility and discrepancies between body and cloth that can be felt as discordance, or that are rendered—processed electroacoustically— as noise, as if the twisted cloth rippled the whole environment' (Birringer and Danjoux 2013: 234).

for the Time Being

Having reviewed the context for the work, in the last part of the article I will now describe and interpret some of my design prototypes in greater detail and in relation to the libretto.

Structurally, the original *Victory over the Sun* opera had a prologue by Khlebnikov and was divided into two parts, Act 1 and Act 2. Act 1 reflected the old order and mode of existence, a time before the revolution culminated in the 'killing of the sun.' Paradoxical and contentious in nature, the opera subverted Russian folk culture (which venerated the sun) through doing battle with the sun, whilst sharing the rich and visual extravagances of Russian folk theatre. The opera had a cast of many characters, some relating to the old order and others to the new. Kazimir Malevich created the idiosyncratic visual designs for these characters. My own ideas for the costumes and characters for our work, however, do not correspond directly to Malevich's visual sketches nor seek to reproduce his particular aesthetic or design characteristics.

After visiting the exhibition 'Building the Revolution: Soviet Art and Architecture' (Royal Academy of Arts, October 2011 – January 2012), I became fascinated by the linear and geometric elements of early twentieth century Russian avant-garde art. In particular the visionary (yet unrealised) slanted spiraling Tower (*Monument to the Third International* [1919-20]) by Vladimir Tatlin, as well as El Lissitzky's abstract Suprematist artworks and Proun series with their multi-perspectival dimensions. Additionally, Lissitzky's *Victory over the Sun Portfolio* of Cubo-Futurist lithographs of his series of strange object-human forms proposing machine-driven characters with titles such as Announcer, Globetrotter, New Man and Gravediggers for an unrealised mechanical version of the opera (1923) provided key design stimulus. Whilst it was immediately apparent that there could be no visual comparisons made between the abstracted design aesthetics of Lissitzky's characters and the more cumbersome costume-bodies of Malevich from a decade earlier, I found it nevertheless stimulating to explore both as design inspiration. Sketching some initial ideas, I imagined the tower to be a transmission instrument worn by a dancer (Figure 3) and wondered what sounds it could generate, while the killing of the sun, an eclipse and a reversal of time and space, suggested to me a virtual and hypothetical dimension to be explored through digital interactivity and a 3D/infrared sensing system. In our opera this iconic scene is performed by dancer Helenna Ren in GraveDigger (Figure 7) costume interfacing with a Kinect camera that track her gestures and enables her to manipulate the virtual sun on screen. For the opening scene of our opera, I emphasise the strange irony to be found in a *wearable* Tatlin Tower placed on the dancer's head, which sounds and transforms the New Woman into a radio transmitter and symbol of the revolution (Figures 5 and 6), restricting her movement whilst amplifying her sonic presence in the space. Likewise, the digital sun is captured by a 'sun-catcher' in the real world who

traverses the line to the virtual realm; without seeing the sun or looking at it, her gestures perform a kinesthetic dialogue with an object she can feel and hear. *For the time being* is filled with these strange ambiguities, and this extends to performance with costume design.

Figure 3: Design sketch for the TatlinTower Headdress © 2012 Michèle Danjoux.

The Russian painter and textile designer Varvara Stepanova believed that close connections between art and modern industry were imperative for aesthetic transformations in life. In brief, she promoted the notion of 'costume in action,' clothing that was fit for purpose, a particular work task or social action rather than as 'artistic product' (Stepanova 1987: 173). My design-in-motion, rather than 'costume in action,' looks to costume design that might stimulate dancers to develop certain actions or interactive gestures that become part of a larger choreography and imaginary world. The TatlinTower Headdress and GraveDigger prototypes,

which I discuss, next, present two distinctly different case studies from this wearable design research. Whilst both explore the tactile-kinesthetic intelligence of the dancers becoming expanded instrument-bodies, generating their own sounds and sonic textures on stage, each presents its own way of working with technologies.

TATLINTOWER HEADDRESS: PROTOTYPE 1

The TatlinTower Headdress is a wearable electro-acoustic instrument realised in collaboration with musician John Richards who created the circuitry (Figure 4) and designed the sound for this audiophonic prototype. The design for the headdress follows the double helix formation of Tatlin's iconic unrealised tower and is constructed in spring metal. The instrument design integrates a metal coil attached to a small motor/vibrator at its apex to rotate the coil, and a bend sensor for the dancer to control the speed of the motor and subsequent speed of rotation of the coil thus altering sonic output. A small piezo (contact mic) picks up (converting to volts) and amplifies the rotating spring which beats against the main construction of the tower, translating the mechanical activity to electrical signals that can be sent via the small circuit and jack to jack connection to a black box speaker worn on the stomach area of the dancer for amplification and performance with the wearable sound.

In the opening prolog to the performance, dancer Ren, wearing white productivist suit and white gloves, sits static downstage left, wearing the TatlinTower, legs outstretched, the digital sun rising onscreen. As the audience enters to take their seats, her barely perceptible hand gestures begin to subtly manipulate the bend sensor she is holding, and as the coil rotates in response to her micro movements, a tiny resultant strange metallic mechanical beating sound, amplified by the black box, becomes audible in the space. The only onstage sonic textures in these opening minutes originate from the dancer wearing her instrument. As Ren transitions from prologue to Scene 1, Act 1, the weighty presence and vibrational touch of the wearable instrument extending her body can be sensed more clearly in her movements. She rises slowly and skillfully to standing, her centre of gravity held low, exploring her body movements in relation to the instrument; head twisting, manipulating the sensor, stopping and starting her sound, shifting it into the space, moving the black box away from her body, arms outstretched (figure 5).
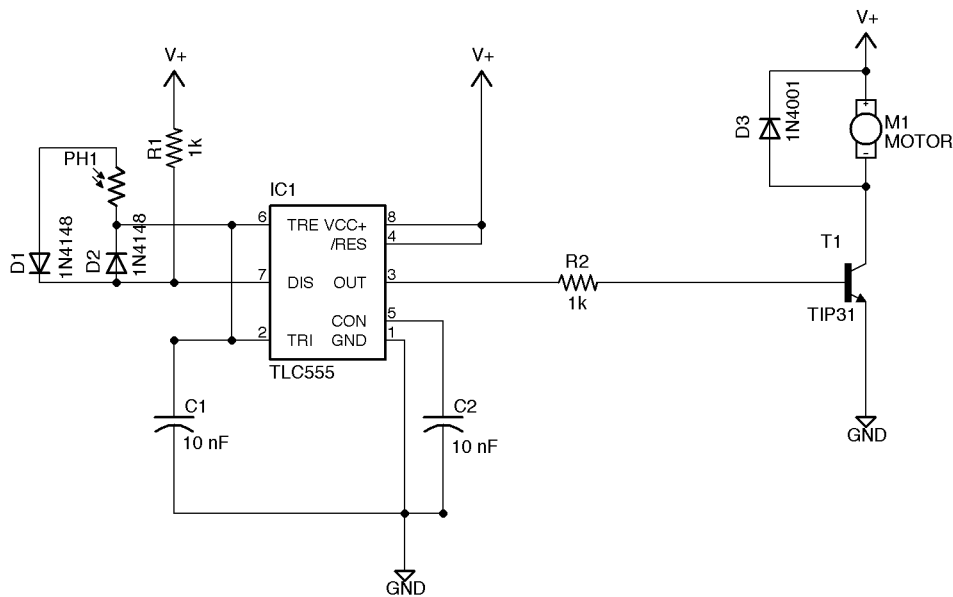
Figure 4: Circuit Diagram for Tatlin Tower Headdress, 2012 (© John Richards).

As she repeats a soft rotational movement in space, raising and lowering her body and shifting her weight from left to right, she enacts a very delicate dance of (dis)equilibrium. A static onstage microphone begins to detect her rattling sonic presence as she moves within its range and her sounds are recorded, processed through various effects of reverb, pitch, timbre and frequency shifting and re-emitted for a richer more encompassing sound. The wearable draws attention to its material tactility, making the dancer move her body in certain ways, shifting weight as she propels herself, but preventing her from tilting her head at any moment, as she bends and releases the sensor in her hand, stopping, starting, stopping then re-starting the sound. She taps the metal of the TatlinTower with her fingers releasing more sounds. Exploring the extended head, and manipulating the sensor, she begins again to move the black box that lies against her stomach suspended – first from left to right – head following in the same direction, then from holding it away from her stomach to pressing it against it. Her right leg bends, her left leg bends, as she begins slowly and skillfully to come to knees; still moving left to right and back, she now stands again and bends low down, body kept vertical, weight centrally held. Her focus shifts once more to the black box, holding it away from the body.

Figure 5: for the time being, Sadler's Wells, 2014. Ren wearing productivist suit with TatlinTower and black box, Scene 1. (Photo © Hans Staartjes).

Figure 6: for the time being, Sadler's Wells, 2014. Ren performing radio transmissions in TatlinTower, Scene 1. (Photo © Antonio Pagano).

She has learned through practicing with the design that she must move in a particular way. The vibrations from the rotating spring start on the head and move through the entire body. On further exploration of the experiential aspects of wearing the tower, a different dancer, Vanessa Michielon, in her reflections on the wearing experience particularly noted the vibrational qualities and how these coursed through her body from her head to her stomach, and how she felt extended by this new black box organ. She wanted to allow the vibration to take the longest route through her body so that its somatic touch might circulate for longer inside of her thus impacting her movements. Regarding the impact of the black box and TatlinTower Headdress, Michielon explains:

> I'm working with two distinct objects, which are connected but possess a specific identity. This makes me play with the idea of distance between these extremities. Since the head acts as a receiver and the box as an emitter, I improvise thinking about the path of an invisible signal traversing my body. So, I vary the distance between hands and head and I play with the idea of disconnecting these body parts.
>
> (2014a)

According to Michielon, wearing these objects on her body heightened her sense of proprioception and rendered her focus more acute. Crucially, her attention shifted to the subtle changes of the orientation of her head in respect to the vertical axis. There was an associated extension of her spine with each head movement. These experienced sensations, she acknowledges, relate to the weight of this particular wearable and how it alters her body-balance. Michielon expands further on the sensorial aspects of the design for her, noting how the physical presence of the instrument on her body, its tactility, weight and sounding caused her to move in certain ways whilst creating other affects and imaginary scenarios that acted as further motivations to her movements:

> The tower forces me to move slowly because of the fragility of the construction and to use my head to explore the space: sometimes in my improvisation the head becomes the motor of the movement or the only part moving… The weight of the box positioned on my center gives me a sense of grounding in the floor. Especially when I bend my knees and the box reaches the same level of my pelvis, it reminds me of some dance exercises where a partner holds the other's hips to suggest the feeling of being anchored to the floor to get more stability. This is why I probably tend to stay in a middle-low level, always bending my knees, while the head is somehow separated from the rest of the body and projected towards high levels. The hat covers my eyes slightly, so it guides me to an inner focus, which is counterbalanced by the idea of the emission suggested by the black box. From a choreographic point of view, I shift between an inner and an outer focus, the first happening mainly when I control the bend sensor (I have to keep my head a bit bent forward to make sure the spiral works) and the second happening when I hold the box in my hands.
>
> (2014a)

Regarding the presence of the sound she generated and manipulated through her movements, Michielon commented on reaching an almost hypnotic state with what became her own monotonous sound loop which in turn impacted on her movements and a tendency to move slowly, avoiding accelerations. The body in motion transports its kinesphere with it but a certain prosthesis might inhibit or restrict the capability of a body to reach (upward, downward, backward, sideways and so on) or cause it to reach differently so potentially also impacting on the rhythmical movements of the body in space, the *space-movement.* Prosthesis extending a body might also enable that body to reach yet further into the space, redefining the kinesphere surrounding a body. The extended body of Michielon was slowed down rather than accelerated by its extensions and therefore the dynamics of the movement shifted.

In addition to the physical impacts that might shift a dancer's movements and habitus, there are also those other effects of wearing on our cognitive processes that might involve embodiment of a certain notion or idea of becoming. Cultural dress is perhaps one of the best example of this where the multi-sensory aesthetics of garments, weight, sound, colour and so on serve to connect and transform bodies: 'The use of dress to activate the different senses congruently during rites of passage ceremonies instigates the event, heightens the experience of the observers, and completes the transformation of an individual from one stage in the life cycle to the next' (Becker 2007: 72). I extend these impacts on the psychological state to wearable instruments which I propose can serve not purely as a part of our functional movement but can moreover be a part of the movement of our bodies as a whole. Polanyi argued over fifty years ago for this kind of physical and sensual extension, implying a form of internal as well as external touch 'We use instruments as an extension of our hands and they may serve also as an extension of our senses. We assimilate them to our body by pouring ourselves into them' (1958: 31).

GRAVEDIGGER: PROTOTYPE 2

According to Malevich and Mikhail Matiushin, *Victory Over The Sun* was 'devoid of any developing plot. Its idea is the overthrow of one of the greatest artistic values – the sun in this case' (Kruchenykh, Malevich and Matiushin 2009: 22). 'Heliomachia' or sun-struggle was a leitmotif for the Russian Futurists, symbolic of an uprising against traditions of the established orders (Böhmig 2012: 112). In our opera, the GraveDigger character (Figure. 7) explores these very notions for the creation of a *solntselov* (sun-trapper) and iconic 'Killing of the Sun' scene. For my design concept, I combine elements of humour with futurist metaphors to enact the capturing of the sun. A sarcophagus garment form constructed from heat-resistant fabrics denotes both a final resting place for the sun and protective wear for the sun-trapper. Gloves with singed fingertips, special protective eyewear with UV shield and straw hat add to the comical textures of this prototype. State-of-the-art technologies crucially combine with historical textures of Russian art namely Lissitzky's previously mentioned *Gravediggers* lithograph to generate a costume concept that integrates real-time interactional elements.
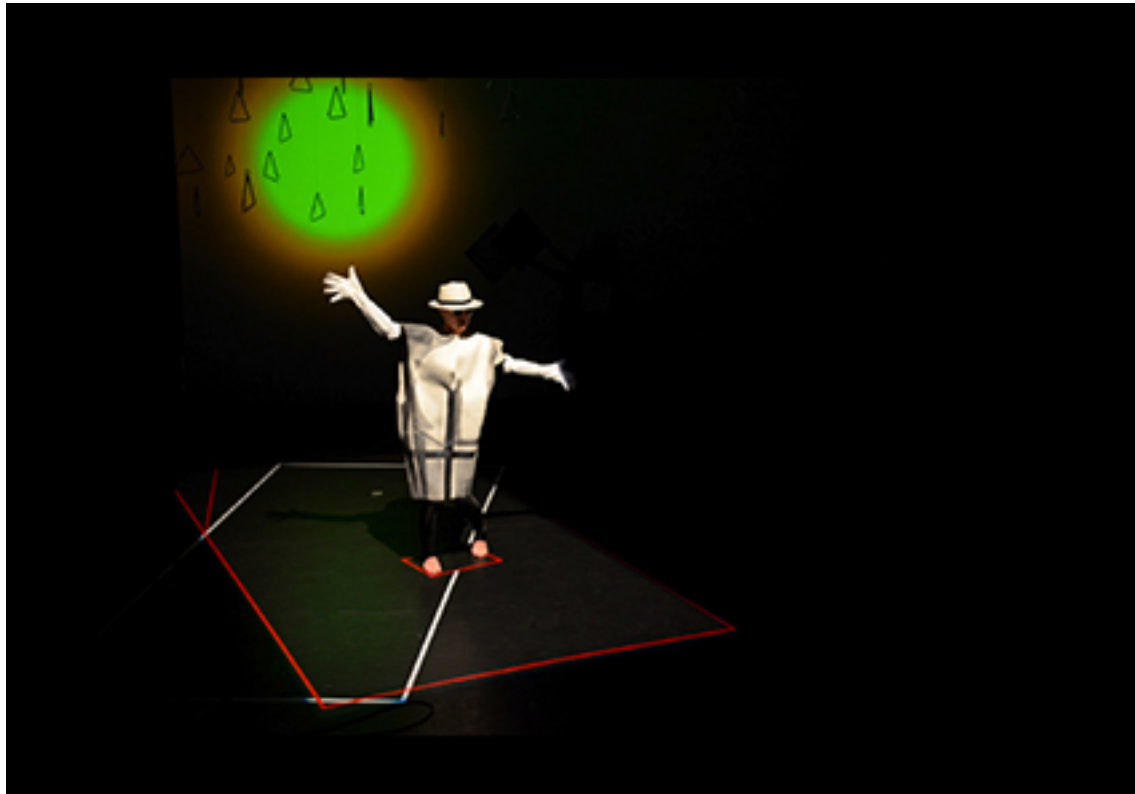
Figure 7: for the time being, Sadler's Wells, 2014. Ren wearing GraveDigger enacts the role of sun-trapper, in 'Killing of the Sun' scene. (Photo © Antonio Pagano).

In terms of the historical perspective, Lissitzky achieved his compositional effects through minimalist and reductive means. All decorative features were stripped away in an attempt to eradicate the excesses of an older regime. Geometric shapes, letters and the use of reduced or monochromatic colour palettes all rendered his artworks clean, energetic and new in the context of the time. My design of the GraveDigger costume employs these same artistic techniques. From a technological point of view, the costume is paired with a Kinect system, a commercial X-box 3D infrared camera, connectible to Quartz Composer, Blender, and other OpenSource 3D software. The scene is programmed by interface designer Cameron McKirdy. Towards the end of Act I, Ren who has previously performed the TatlinTower radio transmissions, returns as the GraveDigger to commence battle with the sun. Dressed now in her sarcophagus shaped garment, with hat, gloves and glasses, she enters stage left. The restrictive nature of the garment around her knees necessitates a shuffling of tiny steps to transport her diagonally across the space. After a few moments, she stops, turns ninety degrees and then carries on her same trajectory towards her place of interaction, this time in a sideways motion revealing the Proun-style artwork stenciled on the back of her garment. Unlike the other featured prototypes in this performance, the technologies in this instance are not directly integrated into the costume, nor do they sit visibly on its surface. Rather, the costume is integrated into the camera tracking

system. This marks a significant shift in my approach to wearable sound. Such a method involves certain complexities, since to activate/de-activate the system for real-time audio-visual performance with the digital sun, through specific gestural movement, the costumed-body needs to partner with the particular characteristics of the system. Specifically, the shapes and surface textures presented to the 3D camera-vision must work within its parameters for inter-actions to occur.

As McKirdy points out in our lengthy email correspondences preceding the final realization of design:

> Reflective materials tend to not work well with the Kinect, this is probably due to the type of camera that is picking up the information […] Stelarc and I were having a conversation about this one day and he said when he was testing the Kinect, and it wouldn't work, he figured it was because he was wearing a rain coat (I couldn't tell you what material) but he claimed that was the reason it wasn't working.
>
> (2012)

The camera basically needs to recognise the human skeleton – arms, hands and legs to be precise – to begin tracking the body and generating data for effect, and certain materials confuse its vision such as those with over shiny or retro-reflective surfaces. The sarcophagus silhouette of the GraveDigger with its broad shoulders, then narrowing towards the knees, a tapered shape similar to that of Lissitzky's *Gravediggers,* is crucial to first conceal the true body inside its form. Ren, who enters the realm of the camera-eye, can hide her arms inside the coffin shape and thus stow away her skeleton so to speak. Just as the costumes of Modernist theatre aimed to erase the actor's body onstage (cf. Monks 2010: 64-65), the sarcophagus form of the GraveDigger aims to momentarily obscure the body from the view of the camera-eye. The similarities end here, however, since this costume is not concerned with erasing the body due to its limited expressive potentials as was the case in the early twentieth century, but more hiding the true potentials of a body to be expressive whilst interacting with a system. The moment Ren reveals her arms, allowing them to each emerge from her coffin-body, the system is activated and data generated and mapped from her movements. Certain parameters are set by our programmers to enable Ren, hired for the assassination of the sun, to first capture and eclipse the onscreen fiery globe through her knowledgeable hand gestures/interactions and then bury it deep beneath the earth. As she leans from side to side, isolating movements to her upper torso, feet firmly planted within her square of interaction, she can also pulsate the sound through the position of her hands in space altering frequency and oscillation of the throbbing

pulse of the sun. Without looking at the sun (project behind her), she can feel the motion effect of her gestures through the pulsating, expanding/contracting breath-sound generated by her movement.

Sound artist Oliver Doyle who programmed the sound in relation to McKirdy's digital image explains the relation of gesture to the sound manipulation:

> I'm working on a drone sound with dense multi-tonal wall of sound that has shifting tones moving in waves as the base, from here I've programmed the patch to measure the distance between the XY coordinates for the two hands being tracked and sent by Cameron. This can then be mapped to a frequency based amplitude oscillator to allow the sound to pulse, with the frequency of the pulse changing depending on how close the two hands are (I'm thinking a steady pulse at a larger distance that gets faster as the hands get closer insinuating an increased heart rate).
>
> (Doyle 2014)

What this prototype reveals is the delicate kinesthetic and tactile experience afforded to the dancer wearing a costume which requires gestural work (and acoustic awareness) within a distinct character-shape, tuned to the tracking system's response to calculable anatomy, while the gestures at the same time affect an actionable image (the sun) as well as the throbbing sonic rhythms of the dying sun.

CONCLUSION

The use of costume within responsive media systems of interactive performance draws attention to the more sensory aspects of 'body-computer' interactions. The sensorial nature of the wearable interface, in my experience, affords new relationships and compositional possibilities to emerge through the specific ways it augments a performer's body in an intimate binding of body, cloth, technology, movement and sounding. In *for the time being*, we explore costumes incorporating technologies for their potentials to extend the 'present body' visually, sonically and sensorily, but the overall narrative, dramaturgical emphasis is on the generation of a wide variety of acoustic and electronic noises, distorted voices, bird sounds, phonic noise and glossolalia. There is a scene near the end of Act 2 where I in fact try something that we had not done before, namely conceptualise and design an interactional garment for an expanding duet (trio, quartet). Here the actions of partners are necessary for the sounding wearable (RedMicroDress) to become effective and also affect the partnering directly, as the

other dancers will need to perform into the miniature microphone built into the shoulder of the RedMicroDress.

The intimate entwinement of the body instrument is pushed further in this scene ('RedMicro Duet in the 10th Country'), as 'Man with Ill Intentions,' 'Elocutionist,' and 'Futurian' (the latter also wearing a bespoke garment with chestplate that can emit sound) enter into proximal relationships to the RedMicroDress's microphone. The woman in red is like a propaganda machinist; she executes a repeated series of revolutionary, declamatory poses while the Elocutionist leans into her to speak of 10th lands and open doors. The Man with Ill Intentions swirls around her to entice the propagandist with small speaker and shortwave radio noise; then the Futurian approaches her with a science-fictional instrument adorning her chest, and two small speakers attached to the lower back. The Futurian prototype is equipped with specially designed micro-circuitry on the chest plate (Figure 8) allowing the wearer to generate sound on metallic strings across her chest while – in close proximity to the dancer in RedMicroDress – being amplified by the microphone worn by the first dancer as well as emitting noise from her back.

The microphone located on the woman in red beckons the others to come closer. Inverting Merleau-Ponty, who suggests that 'the plunge into action is, from the subject's point of view, an original way of relating himself to the object' (2002: 127), this perceptional relationship can also be triggered from the object, and this interconnectedness and the reciprocal nature of things are pertinent to my work. The Futurian chest plate, as a seductive prosthesis, also beckons and draws the others into a quartet of sonic intercorporeality, the amplification process becoming shared and indistinguishable.

As I have tried to show in this article, the case studies of integrated wearable design, gesture and system illustrate how costume concepts can be fully synthesised into interactive narrative performance. I have also implied how such performance, if it embeds political and historical subtexts into the characters and their actions, can point far beyond any technical interface design to social meanings of entwinement, an opening up to other voices (we deliberately use several real and imaginary languages in *for the time being*) and affective experiences. The case studies thus also reveal how costumes might use multiple sensorial methods including sounding characteristics for the unfolding of character and movement choreography in performance, obtaining a richer multidimensional and sometimes ironic textured and

Figure 8: For the time being, Sadler's Wells, 2014. Microcircuitry on sounding chest plate worn by Aggeliki Margeti, Act II. (Photo © Hans Staartjes).

sculptural quality that takes them beyond the purview of fashion and theatrical costume design.

ACKNOWLEDGEMENTS

ENDNOTES

i Founded in 2004 by myself and Johannes Birringer, DAP-Lab's cross-media work highlights convergences between fashion/wearable design, physical movement choreography, and real-time interactive data flow environments. My main role is as a designer and art director, but I also take part in all other aspects of production and work closely with our composers, sound and graphic interface artists (Oded Ben-Tal, Sandy Finlayson, John Richards, Oliver Doyle, Cameron McKirdy). The ensemble has created networked performances, films and interactive dance-works including *Suna no Onna* (2007-2008), *UKIYO [Moveable Worlds]* (2009-2010), and *for the time being [Victory over the*

Sun] (2012-14). *for the time being* premiered at Watermans' International Digital Arts Festival in London, 2012; an expanded version was shown at the Lilian Baylis Studio, Sadler's Wells, 2014. Scenes from the production were also featured in the BBC World Series "Click" Program on 'Wearable Technologies', BBC Radio Theatre, London, February 25, 2014. See: http://www.brunel.ac.uk/dap/

[ii] *Victory over the Sun* (1913) involved libretto by Aleksei Kruchenykh and Velimir Khlebnikov, costumes and abstract set design by Kazimir Malevich and experimental music score by Mikhail Matiushin. For sources of design inspiration see: Bartlett and Dadswell (eds) (2012); Compton (1978); Lynton (2009); Milner (2009a); Milner (2009b); Rowell and Wye (eds) (2002), Stepanova (1987) and Stern (2004).

[iii] 'Choreosonic' is a term that conjoins issues of choreography and sound exploring the notion of sound that can be generated through movement. It is a term originally used by artist Stan Wijnans and Sarah Rubidge, Professor in choreography and new media who coined the phrase during a research project they jointly conducted in 2006.

[iv] I attended numerous concerts at the Barbican Centre, Southbank Centre, Sadler's Wells, the Place Theatre, and other European venues and festivals, including the exhibition *Move: Choreographing You* at the Hayward Gallery, London (October 13, 2010 – January 9, 2011) which featured work by William Forsythe, Merce Cunningham, Michael Clark, Wayne McGregor, and others.

[v] Attributed to Mark Bokowiec and Julie Wilson-Bokowiec: 'The term kinaesonic is derived from the compound of two words: Kinaesthetic meaning the movement principles of the body and Sonic meaning sound. In terms of interactive technology the term Kinaesonic refers to the one-to-one, mapping of sonic effects to bodily movements' (Bokowiec and Wilson-Bokowiec 2008). For a more detailed insight see Bokowiec and Wilson-Bokowiec (2006).

[vi] For contemporary experimental explorations of performing bodies and fashion artefacts / wearable sculptures as "musical prosthetics" extending the body as instruments see Di Mainstone's collaborative and practice-based research. *Serendiptichord* is described as a "wearable musical instrument that invites the user to explore a soundscape through touch and movement": http://dimainstone.com/project/5

[vii] For discussions on earlier works see Birringer and Danjoux (2009a); Birringer and Danjoux (2009b); and Birringer and Danjoux (2013).

[viii] 'Audible choreography' is a term Birringer has coined in relation to our work in wearable performance when he considers audible movement and sound creation. See Birringer, Johannes 'Audible and Inaudible Choreography'. *Etum* 1:1 (Accepted for publication, 2013).

[ix] http://www.benoitmaubrey.com/

[x] http://www.pamelaz.com/

[xi] http://www.bodycoder.com/

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