

## Abstract

*Design-in-Motion: Choreosonic Wearables in Performance* entitles a PhD thesis, undertaken at the London College of Fashion, consisting of practice-based research in design and performance. The project interrogates the choreographic space of real-time interactive dance performance through experimentation with specially designed audiophonic wearables. The fashion design-led interdisciplinary concepts presented here challenge movement processes and perceptions of the role of costume within dance and the performing arts. The thesis begins with a theoretical and historical investigation of pertinent artistic works which exemplify material extensions of the moving body or hint at acoustic and sensory-kinetic dimensions of fashioning the choreographic – what this project proposes as ‘transformational wearing’. It then focuses on the compositional dynamics within which such instrument bodies actively perform and become sounding-movement characters in two choreographic productions by the DAP-Lab – *UKIYO* (2009-2011) and *for the time being* (2012-2014). The written thesis is accompanied by media documentation of these productions which underlie and constitute my strategies of inquiry into wearable design.

Over the past decade, the interest in wearables as intermediary devices in mediatised performance has become notable in artistic explorations and research inquiry in the sonic arts and dance fields alike. Moreover, as this research reveals, dress/costume is becoming more studied in academic contexts for the multifaceted and significant role it can play in performance. This thesis investigates the performative and affective potentials of audiophonic garments and bodily extensions – where the act of wearing becomes a multi-sensorial (sound, image, touch) and perceptual performance technique for the dancer, enabling a new movement-sounding creativity.

The generative choreosonic aspect of the work is also theoretically and historically traced back through dance and music contexts (such as gesture-controlled music interfaces and interactional choreography) illustrating the notion of the ‘intertwined body’ proposed in the thesis. Positioned as *wearable-performance design*, and placing the creation of prototypes at the start of a performance-making process, the original designs introduced here augment both body and process by provoking new movement choices. The work thus questions how wearables/costume can be used to extend the sensory engagement of performers and shape the emergent dance through a specific entwinement of body and material artefact. The wearable also plays a significant part in the overall scenographic and choreographic organisation of interactive performance, integrating into the dramaturgical conception. Historical instances, for example Loïe Fuller’s voluminous costumes at the turn of the twentieth century animating her body through lighting technology and motion, and the Bauhaus Dances with sculptural costume designs by Oskar Schlemmer, are used to illuminate the context of my practice as well as the theoretical and practical concepts for wearable sound that I have advanced.

Transformational wearing is methodically examined here for analogue and digital corporeal engagement. It offers a newly expanded system of expressivity to the dancer for the emergence of movement which evolves through the dynamic interrelations between her perceiving body, the materiality of the wearable, and the ensounding.



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## Introduction

In this thesis, I examine the impact that dress – envisioned as *wearable performance design* – creates for practices of movement choreography and sound composition within interactive performance frameworks. Moreover, through this research project, I intend specifically to interrogate the predominantly peripheral position of dress to the emergence of movement in contemporary dance – arguing for a greater interlinking of costume and choreography. My approach is from the perspective of a fashion designer aware of the long trajectory of fashion designers creating costume for dance and, moreover, fashion's close relationship to performance art.<sup>1</sup> Although I will not be investigating the latter in any depth, but rather addressing the performative dimensions of fashioned garments in the performing arts, these well-established relations do have an important part to play in helping situate my work and the contribution to knowledge I make in this thesis. Significantly, I will reveal through my own practice-based research the extent to which a dynamic wearable design-led approach – involving multi-sensorial stimuli (tactile, aural, visual) for the dancer – can foster and direct movement composition and the performance-making process within theatre and performance-installation contexts.

The wearable – referred to interchangeably throughout this thesis as: costume, prototype, garment, dress and wearable performance design – is conceptualised as a mediator incorporating body-worn technologies, whilst my design strategies are specifically directed at designing and performing with sound. Primary research investigations for this project aim to interrogate how design interventions impact physical thinking, movement expression and composition both kinetically and sonically when introduced at the very beginning of a performance-making process. The practical aspects of my research inquiry involve the construction of a series of *sounding* wearables and their utilisation in devising dance/performance.

Approaching the compositional dynamics of design for performance – and particularly for performance with sounding garments – I place the idea of the choreosonic<sup>2</sup> (connecting movement and sounding) at the core of my practice-

based research explorations. As my project interlinks fashion, dance performance and the sonic, I first consider the immediate interdisciplinary context for critical and theoretical investigations of sound, garment design and choreography. My own professional background in fashion design has been the platform on which to build and develop the wearables. Expanding my design practice into fields of theatrical/dance performance, the moving image, music and the sonic arts is indicative of my interest to cross over into heterogenous research and experimental areas where aesthetic and technological formations intersect.

Chapter 1 of the thesis – ‘Research Contexts: Mapping the Field of Inquiry’ – maps what I consider to be the significant developments essentially of the twentieth and twenty-first centuries in the field of artistic innovation and theoretical reflection in relation to the concerns of this project: movement, dance, garment/costume design, sound, electronics, interactive art and performance with technology. The historical and contemporary contextual aspects of this research project thus necessarily aim to interlink design with the artistic discipline of sound art and the performing arts to provide the required foundation and underpinnings for my interdisciplinary<sup>3</sup> exploratory design investigations. In addition, the more theoretical underpinnings of this research project seek to interconnect the notions of movement and sensation linked to qualitative difference and the intensity of feelings, as proposed by philosopher and social theorist Brian Massumi (2002), who foregrounds this particular type of interconnectedness and the ensuing unpredictability of actions in the emergence of movement.

About the technological dimension of my work, my research studies have revealed the significant impact digital media have had on contemporary performance practice over the past twenty to thirty years – merging with the traditional theatrical elements of costume and sets to create multi-layered multi-media performances. Similarly, this dimension highlights the increase in the general interest in wearable and fashionable technologies and the mobile roaming potential they have afforded for digital interaction over the past twenty years. The characteristic challenges of wearable sound in performance, however, which I propose to explore in this thesis, I have found to constitute a novel context for confluences between dress, interaction design, sonic art and choreography. Chapter 1 illustrates how contemporary experimental performance artists,

composers and musicians such as Laurie Anderson, Imogen Heap, Pamela Z and Laetitia Sonami have adopted the notion of the wearable as controller in the generation and manipulation of sound and musical composition. Early influences of analogue and pre-digital technologies integrating wearable/costume concepts for performance are also evidenced, most notably in the modern stage experiments of Loïe Fuller and her *danses lumineuses* exploring movement, light and cloth (during the time of the birth of cinema at the beginning of the twentieth century). Examples such as these will be discussed together with a few case studies from twentieth and twenty-first century sound art as part of Chapter 1, where my aim is to synthesise research/artistic practice from a range of fields relating to the evolution of this interdisciplinary practice of wearable design and performance.<sup>4</sup>

It is important to note, however, that since my practice-led research is less explicitly focused on the purely technical modalities of interaction design, my review will not parse the entire field of wearable technologies. For example, I will not address the range of innovative market developments showcased at the annual Wearable Technologies conferences,<sup>5</sup> nor can I offer an in-depth history of sonic arts, instrument design and choreography through the lens of wearability. However, in Chapter 1, I carefully develop a critical overview of the sensorial and choreographical dimensions and movement/compositional potentials of wearables in performance, foregrounding an interrelationship between movement and design which is very promising yet I believe underexplored in the realm of theatre /dance and within fashion practice.

The motivations to interrogate the subject of wearable performance design stem from my background in fashion design together with several years of conducting design research inquiry within interdisciplinary and interactive performance contexts. Such research investigations are also fuelled by my intrigue as a fashion educator in search of new design paradigms and innovative teaching strategies to advance my core discipline. In order to further my knowledge and formulate a specific research contribution relating to the aims of this project, I propose to:

- 1) Interrogate the choreographic in real-time interactive performance and performance installation through experimentation with specially designed wearables, thus aiming to formulate new hypotheses on dress as ‘wearable-performance design’.

- 2) Understand the potential effects and affects choreosonic wearables might have on the performer's bodily sensation, movement technique and the emergence of kinetic movement expression.
- 3) Gain insights and understanding on how to effectively construct such design provocations through my own total immersion and intimate working method in the performance space.

I thus situate myself within an integrative and collaborative framework. Furthermore, as part of Chapter 1, I therefore look carefully at the literature and documentation of such cases where design concepts, derived from fashion, art, costume and digital interaction design, meet sonic/music performance, instrument building, electronics and choreography. Design, as I define it in this thesis – namely as emergent process of choreographic realisation – exists in its value as part of an ‘ecosystem’<sup>6</sup> of diverse interaction capabilities for which wearables are strategically positioned at the core of a process, developed and explored dynamically.

The disciplines of sound art and dance have crucially supported the practice-based elements of my design research inquiry, the latter offering the fertile ground and intellectual space necessary to conduct my experimentations with movement-design. This is the particular area of research investigation I propose to be transdisciplinary,<sup>7</sup> going beyond the boundaries of the individual fields and involving the application and potential transference of design thinking to performance – tactile and material methods of engagement and iterative processes of development informing the dance practice. Equally, the methods used in devising and rehearsing dance or digital performance are informing the emergence of design. Thus, through such collaboration across (‘trans’) disciplines, methods and not purely disciplinary knowledge are being shared. I refer to these dynamic interchanges between dance and design as *design-in-motion*,<sup>8</sup> where the worlds of design and movement are understood as complex and interlinked as opposed to distinct and separate, therefore in a state of flux, engendering an alternate and unifying approach to devising performance. This approach together with the notion of the dynamic-body interface will be expanded on in Chapter 2 ‘Design-in-Motion: Designing Movement/Moving Design through an Intermixture of Tactility and Sonority’.



Additionally, I would suggest that the field of emergent movement-design which I stake out and define more closely through the work undertaken in this thesis, can be considered to have some precursors in the twentieth century arena of art and technology. It is, however, situated in a complex manner at the borders between several artistic disciplines and contemporary positions on material practices and computational sciences. The latter, e.g. software programming used for digital movement and captured data, increasingly inflect our kinaesthetic awareness and perception in current cultural practices that integrate human movement and technology (for example hand-held, portable and mobile technological devices).

Chapter 2 aims fundamentally, to create an important intermediary link between the history and theory introduced in Chapter 1 and the application of my design methodology (Chapter 3) to the design and implementation of wearables in two large interactive performances – *UKIYO (Moveable Worlds)* (2009-2011) and *for the time being [Victory over the Sun]* (2012-2014) – produced by DAP-Lab. I will refer to these two works in the thesis simply as ‘UKIYO’ and ‘for the time being’ respectively from now on. Theoretically and practically, Chapter 2 establishes my active contribution, as a fashion designer, to interactive dance performance through wearable design and a design-led methodology in performance. In this chapter, I lay out my ideas and *design-in-motion* approach involving the conjoining of wearable design with the dynamics of the moving body through the physical and intimate act of wearing. Additionally, I highlight sensory strategies for the interconnections between the activity and gestures of wearing and those of sounding in and through dress and *wearable* sound design as a form of amplified presence and expressivity in the dancer/performer. Ideas are thus transposed and energies transferred in an interlinking of fashion/costume and technology with the performing body in action. This is then extended further to the impacts of wearing on musical composition and sonic effects as the costume incorporating sounding characteristics is activated through specific motions and gestures of the wearer. The research therefore integrates the significant role of design research in the innovative ecosystem of performance making, and more specifically its motivating impactful role in the emergence of the form of the dance.

Through these animating exchanges and sensory intertwinements in my creative practice-based research investigations and prototyping, I have grown to question more deeply the affective as well as the effective impacts wearable design can have on the performer, the performance-making process and the development of sounding movement-character in the

choreographies. The affectivity, I propose, can derive from the integration of technology into costume, a strong design aesthetic and palpable presence – touching/opening/ restricting the body in certain ways, such that it might motivate the dancer to move and express herself differently. This I refer to as a form of *affective wearing*, since it stimulates kinaesthetic activity in the wearer-dancer and, therefore, I believe, has the potential to become an aid to physical thinking in the choreographic and performance-making process. In Chapter 2, I furthermore expand on my concept of affective wearing, proposing that movement in performance might be instigated via particular non-verbal wearable means involving the experience of touch, proprioceptive awareness and an attention to listening. Notions on affect and phenomenological inquiry posited by Susan Kozel, Professor of New Media and performer, assist me in my articulation of this idea. Additionally, I turn briefly to the field of Social Sciences and Margaret Wetherell for support on an affect theory that is grounded in qualitative empirical research, situated ‘embodied meaning-making’ and an ‘ongoing flow of affective activity’ (Wetherell 2012: 12) pertinent to my work.

Throughout Chapter 2, I formulate my ideas more precisely on the tactile wearable stimulus of costume’s contribution – provoking somatic experience influencing movement style – to the emergence of units of movement that become crucial for the choreographic process, as it might, for example, involve constraints or encumbrances. Moreover, I set out to counteract any existing preconceived and limiting notion of costume as passive or subordinate element in contemporary dance performance – defining it rather as something that is simultaneously dynamic, responsive, directive, actively sensed and responded to by the dancer in specific contexts. To enable me to do this, I must also highlight the more stagnant viewpoint of costume – compliant rather than active agent – where the emphasis is on surface rather than movement quality or endogenous impulse/pulsation of the costume-body organism. That is a viewpoint which generally sees the physicality and materiality of costume/ garment introduced late in the performance-making process (dress rehearsal), thus adding supporting forms of visual and narrative textures for the audience as opposed to core compositional ones for the dancer stretching throughout the whole pre-production and production process.

These ideas are briefly expanded on to illustrate the prevailing outward rather than inward or inward-outward influences of costume. Valerie Steele’s edited book entitled *Dance and Fashion* ((2013) proved particularly pertinent to me, as one of the only substantial texts on the subject of the interlinks between the two key disciplinary areas of my design-in-motion

approach – dance and fashion. Yet, disappointingly, whilst Steele’s edited book acknowledges the close links between the two disciplines, the emphasis is essentially always placed on the influence and modificatory effects of dance on fashion rather than the other way around. On the other hand, my argument presented here sets out to dispel this particular standard for dance costume production in favour of promoting a mutuality of impact between the two embodied art form processes.

My distinct methodological approach described in chapter 3 ‘Research Methodology’, derives from my role and experiences as co-director of DAP- Lab,<sup>9</sup> which I co-founded with choreographer and filmmaker Johannes Birringer in 2004, to explore the convergences between design and performance. Over the years, this laboratory has provided a shared creative environment for multi-media experimentation and many opportunities to collaborate – observing and learning from the work and approaches of others while contributing to interactional scenarios and leading the design for performance processes. It has also enabled me to access a suitably equipped research space necessary for the sustained progression of my design-led approach to performance – interchangeable with a performance-led approach to design<sup>10</sup> – the former having core significance to this thesis.

In my critical appraisal of these contexts and my practical research explorations (Chapters 4 and 5), I aim to challenge the more traditional and hierarchical perceptions that have often prevailed for the role of costume and its relation to theatrical/dance performance – through early design intervention and the close examination of an integrated, dynamic design and choreographic process<sup>11</sup> centred on choreosonic wearables and the extension of wearable materiality into movement quality and sound generation or amplification. The larger concern of this project is to reveal new and complementary approaches to the implementation of costume in performance, specifically in real-time interactive and improvisational performance, whilst proposing costume/garment design as performance-making tool and integral part of a compositional/choreographic methodology and poetics for performance.

Rather than looking at costume as a by-product of performance, the two core creations described in this thesis, *UKIYO* (Chapter 4) and *for the time being* (Chapter 5), examine the practice of design within a collaborative realm of production, where the emerging processes of interactive and wearable

performance provide specific experiential effects for the performer/dancer. Each wearable exploration offers both tactile and aural movement cues for the dancer and seeks, through its materiality and relationality to the body, to stimulate a process of sensory attunement within the dancer-wearer. The various prototypes to be presented are essentially designed as provocations for the dancer-choreographer, centring on the act of (interactive) wearing as performance technique for the emergence and evolution of movement expression in time and space. In such instances – where body also animates dress in a two-way process of exchange – I propose an alternate, more dynamic reality for costume in contemporary dance contexts, hypothesising that the form of the dance evolves via a momentum of reciprocal action and effects established and sustained between the dancer's bodily experiences and the *design-in-motion*. Movement, I postulate, thus becomes in part a representation of the dancer-wearer's somatic self – 'the self that lives experience' (Stinson 2004: 161), acutely attentive in her movement-awareness to the kinetic energy and sensory stimuli of the garment. This idea is explored relationally to the prototypes in Chapters 4 and 5.

In relation to the sound and movement perspectives for my practice-based research experimentations, I specifically aim to address the following:

- 1) The sensory augmentation and transformation of the performing body through the affects of wearable performance design extending the body expressively.
- 2) The integration of 'wearable' technologies into costume design concepts that touch and stimulate the body gesture using sensorial design techniques (sound/visual aesthetics and tactile qualities [of design]) to impact performer presence and experience.
- 3) The expansion of the performing body through wearable design to create fused and intertwined sounding instrument-bodies for particular performance contexts (where the design aesthetics are driven by the overarching thematic or narrative of the performance).

The focus of this thesis is thus not simply on wearables in contemporary dance/performance but on *wearability* (or to an extent, choreographability) of performance design incorporating sounding technologies. It examines the affective and effective uses of such technological and wearable design concepts – as interface, mediator and transceiver of information flow between bodies in

human computer interactions that influence movement behaviour, and alter or create movement-character. Moreover, this thesis investigates the ways a body can be augmented physically and opened up so to speak – sensorially, intellectually, imaginatively – by body-worn technologies offering enhanced capabilities to the performer to engage in performance. It posits the provocative potential of wearables worn in dance/theatre to facilitate sensory amplification in the performer-wearer for new and expanded modes of physical expression impacting the emergence of choreographic sound movement. Kozel acknowledges the potential force of such a uniting of computational systems with corporeality when referring to wearable technologies:

We are seduced by the convergence of computational systems with corporeality (wearable technologies) or by unseen systems that anticipate corporeal needs (ubiquitous computing); seduced by the potential expansion of our senses, intellects, and imaginations, of how we engage with the world, how we communicate, how we remember the past and project desires into the future. (Kozel 2007: 271)

After these practice chapters, I will conclude the thesis providing an overview of my findings and the decisions I have reached on my wearable method of movement and sound composition. I will sum up how new mediator technologies (sensors, microcircuits, motion tracking), incorporated into the very textures of a garment design concept, have located the potentials for real-time interaction directly with the body of the performer-wearer or ‘transceiver’.

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. 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 understanding on: (1) How wearables mediate the relationship between the dancer/performer and the performance space; (2) 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*.

## Notes

<sup>1</sup> In terms of contemporary fashion, the 1990s saw a resurgence of interest in this hybrid field of fashion and performance amongst the more avant-garde designers, for example, John Galliano, Alexander McQueen, and Martin Margiela. Fashion designers were experimenting with staging events to showcase their works that were more akin to live art performances and happenings than following any established traditions of the catwalk show. Fashion's relation to the performing arts (including film), and as performing art has been well documented in fashion theory books published in the last fifteen to twenty years, e.g. Granata 2017; Brand and Teunissen 2006; Evans 2003; Bruzzi 1997. Moreover, it has featured to some degree in key London based fashion exhibitions in recent years, e.g. *Aware: Art Fashion Identity* (2010-11); *Future Beauty: 30 Years of Japanese Fashion*, Barbican Centre (2010 – 2011); *Skin + Bones: Parallel Practices in Fashion and Architecture* (2008) and major designer retrospectives such as the recent *Alexander McQueen: Savage Beauty* (2015), *The Fashion World of Jean Paul Gaultier: From the Sidewalk to the Catwalk* (2014); *Maison Martin Margiela*, Somerset House (2010); *Hussein Chalayan: From Fashion and Back* (2009), and *The House of Viktor & Rolf* (2008).

<sup>2</sup> 'Choreosonic' is a term applied to performance that involves sound and movement. According to Stan Wijnans (2009: 16), who describes herself as a choreosonic artist, this term was coined during a research project between herself and Sarah Rubidge, Professor in choreography and new media at V2\_lab (Rotterdam, NL) in 2006. I have adopted and adapted the term for my research into wearables that are concerned with the generation of movement and sound.

<sup>3</sup> Interdisciplinary research is understood as combining two or more academic disciplines or branches of knowledge: <https://en.oxforddictionaries.com/definition/interdisciplinary>.

<sup>4</sup> Whilst, for the purposes of this project, the contextual review extends its study only as far back as the late nineteenth century, it is perhaps important to acknowledge here: how the tradition of wearable sounding in Western theatrical performance extends back much further. Indeed, in Commedia dell'Arte for instance – a popular form of improvised comedy in Italian theatres developed over the sixteenth, seventeenth and eighteenth centuries, the costuming of stock characters such as the jester incorporated small bells into the mask, main garment and even the footwear which would ring out as accompaniment to gesture and movement in performance. Furthermore, though not a subject I have researched for this thesis, the elaborate costumes of the baroque ballets developed during the reign of Louis XIII (1610-1643), for the burlesque ballets of the French court, and designed as spectacle, often included objects and in certain instances, musical instruments (Burt 2012: email). Thus, the dancer was also equipped to generate sound as part of their performance.

<sup>5</sup> <http://www.wearable-technologies.com/>.

<sup>6</sup> An ecosystem when defined in a general sense i.e. not a biological one is: 'a complex network or interconnected system' (<https://en.oxforddictionaries.com/definition/ecosystem>). I use the term 'ecosystem' creatively to denote a system of complex interdisciplinary relationships and knowledge-exchange potentials that exist in interactive performance-making environments. It is also for me a dynamic and fertile space, where I can situate design/costume-body as organism (thus more in the biological sense of an ecosystem), benefitting from the diverse energies and collaborative possibilities to investigate and develop new ideas on its role within this ecosystem of interrelated parts.

<sup>7</sup> In part, I position my *design-in-motion* approach as a transdisciplinary one ‘relating to more than one branch of knowledge’ (en.oxforddictionaries.com), since it seeks to involve and combine research methods specifically from the different disciplines of design and dance/performance to discover new approaches to the evolution of both design and movement/performance.

<sup>8</sup> I have also used *design-in-motion* as research tool and method in previous research projects not discussed in this thesis, and not connected to wearable sounding, but rather purely for the dynamic evolution of design through an engagement of the moving body in the development process. Thus, challenging standard static methods of design development: ‘The Telematic Dress: Evolving garments and distributed proprioception in streaming media and fashion performance’ (2005). I presented this work at the 7<sup>th</sup> International Foundation of Fashion Technology Institutes (IFFTI) Annual Conference in 2005.

<sup>9</sup> DAP-Lab (Design and Performance Laboratory) is a cross-media lab exploring convergences between performance, telematics, textile/fashion design and movement, clothing and choreography, visual expression, film/photography, sound and interactive design: <http://people.brunel.ac.uk/dap/>. It has provided the experimental space in which to undertake my research and explore the choreographic potentials of wearables – using sensor choreographies, wearable computing and soft technologies (analogue and digital) whilst working with dancers and performers in the context of immersive and interactive performances and performance installations.

<sup>10</sup> In a previous research project entitled *The Emergent Dress* (2007), I have explored a performance-led approach to design where the form of the garment is revealed as an emergent and dynamic process of bodily interactions with cloth explored and captured in motion (transmitted via camera to distant locations in networked/telematics space). These ideas were not connected to the work undertaken in this thesis but rather acted as precursors to my Master’s level study which in turn was the foundation on which this PhD was formulated. I presented these ideas at: The 9<sup>th</sup> International Foundation of Fashion Technology Institutes (IFFTI) Annual Conference in 2007.

<sup>11</sup> Beryl Graham (2010: 165-174), discusses the notion of design methods informing art practice, highlighting the tensions such as language that might exist between disciplines in artistic research, stating that: ‘those with experience of overcoming accepted hierarchies of value systems across disciplines can offer methods that might help resolve the validity of knowledge’ (166).

## CHAPTER 1

### **Research Contexts: Mapping the Field of Inquiry**

This chapter aims to set the contextual stage and to navigate the varied landscape that provides the foundation for the research project and thus frames the work I do with dancers and choreosonic wearables in interactive performance. Included in this review of literature and practice are particular key historical trajectories and contemporary examples across the diverse but interrelated range of interdisciplinary fields that inform my work – dance, interactive performance, music/sound, wearables, fashion, design and technology. Moreover, it maps some of the major developments in the field of artistic experimentation and theoretical reflection on the creative and technological integrations between the areas. Since the subjects that inform the project are multifarious, the chapter aims not to provide an in-depth study of each distinct area but rather a contoured outline that meshes together the essential and interlocking elements underpinning the thesis.

As the fields of interest are far broader than can be dealt with in the scope of this thesis, this has necessarily involved a process of selection which is rationalised within the various sections and sub-sections of the chapter. The study has been informed through a variety of sources – peer reviewed journal articles, books, research publications, websites and internet searches together with dialogue and attendance at conferences/symposia, contemporary dance performances and exhibitions to discover research and artistic work already completed on the topics and available in the public domain. I will be referring to these various relevant examples and authorities in the different fields of my inquiry throughout the chapter.

In the architecture of the chapter, I navigate through six core themes: Materiality and Technological Bodily Augmentations; Movement and Sensory Perception and the Intertwined Body; Methodologies for Movement in Dance; Choreographic and Metamorphic Garments in Dance; Wearable Technologies, and finally Interactive Performance. My intention in constructing the chapter in this way is to build an interrelated and coherent research narrative for the project. The process of investigation and organisation of my findings whilst expanding my knowledge has also enabled me to



give greater clarity to my research questions. Questions connected to performance at a sound-generating material level of the garments in movement. A level where the dancers respond to or ‘interpret’ the costume to embody, amplify, manipulate and attenuate behaviours of the costume-phenomena, i.e. the material sound or technological instrument sonics built into the costume. Moreover, how they wear, extend and perform the costume, and how they ‘instrumentalise’ the costume’s sounding capacities to interact with the stage environment, processual structures and in some cases the visual digital projections.

Furthermore, key philosophical thinkers past and present – Michael Polanyi (1957), Maurice Merleau-Ponty ([1962] 2005), Marshall McLuhan ([1967] 1996), Don Ihde (2002) and (2013), Brian Massumi (2002), Susan Kozel (2007) – have guided my theoretical and philosophical thinking on the subject of performing bodies and technologies, and the latent potentials of body-worn design to extend and augment the sensory, perceptual and expressive systems of the wearer through interrelated movement.

Moreover, movement studies conducted in the early part of the twentieth century, as part of the Modern Dance era – some involving specially designed costume – and more recent conceptual approaches of choreographers to movement in dance have helped situate my work in *movement-design* for dance. Further support has come through my investigations of *design-in-motion* and wearables in performance, some with sounding potentials, others enabling gestural composition for musicians. New collaboratively explored ideas involving accessing hidden and resonant sounds of material structures for compositional purposes, i.e. Di Mainstone’s *HumanHarp* (2013-2015), are indicative of a growing interest that has emerged in the conjoining research fields of sound, movement and wearables, while investigation of musicians also reveals their particular sustained interest in the exploration of wearable-gestural compositional practices in electronic music.

Significantly, the chapter also explores the notion of digital embodiment, new media technologies, human-computer interaction (HCI) and the digital realm. This is substantiated predominantly by the writings of experimental artist and researcher Anna Munster (2006). The notions of sounding-in-motion and performing inside interactive choreographic systems in the context of dance are highlighted towards the end of the chapter in order to explicate some of the progressive ways in which movement is being explored today through interdisciplinary practice-based research, where dancers, musicians, software engineers, designers, media artists and choreographers work together

in mediated performance towards a common aim, whilst simultaneously, and through the collaborative process, extending the boundaries of their own individual disciplines.

### 1.1. Materiality and Technological Bodily Augmentation

#### 1.2. Material Extensions of the Moving Body

In his book *The Study of Man* (1957), theorist Michael Polanyi, whose contributions to knowledge spanned the fields of philosophy, economics, physical chemistry and the social sciences, states on our physical interactions with objects in the world:

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... (Polanyi 1957: 31)

His theoretical contributions to understanding tacit bodily knowledge and the ways we learn to move with and relate to the instruments that extend our bodies and bodily capabilities – through incorporating them into our movements rather than seeing them as separate to our being – still seem highly relevant in today's technological age.

Instruments or objects, which might also now be seen to encompass our digital accoutrements (mobile phones, laptops, wearables, tablets), continue to serve not purely as a part of our functional movement but become part of the movement of our bodies in the world as a whole. In other words, they are embodied whilst simultaneously extending perceptual and motor skills in a process of immersive engagement or 'pouring', as Polanyi calls it.

The concept of embodied relations and the theorising of object or artefact as instrument for the body's physical pouring into the world – through a process of acquired perceptual and motor skill – are discussed by Maurice Merleau-Ponty in *Phenomenology of Perception* ([1962] 2005). For example, he explains, when a blind man becomes familiar with the use of a stick, its point – an area of sensitivity – extends the active radius of his touch in the navigation of his environment (Merleau-Ponty [1962] 2005: 165). Thus, the world for him begins not at the skin of the palm of his hand in direct contact with the stick but at the end of his stick (176). The stick, explains Merleau-Ponty, through the habit of use and acquired motor skills is no longer an object perceived but becomes an instrument providing perceptual feedback for the visually

impaired man to process information about his environment. In Merleau-Ponty's words, 'it is a bodily auxiliary, an extension of the bodily synthesis' (176). These ideas posited by Polanyi and Merleau-Ponty contribute to the theoretical underpinnings for this practice-based PhD project where I have aimed at the assimilation or synthesis of the dancer's body and her wearable *instrument* for the emergence of movement and sounding. A fundamental concept in my work: the dancer's body becomes extended as a sounding instrument in the performance space through an entwinement and flow between body and choreosonic wearable in motion. I will discuss this idea in direct relation to my prototypes in the context of the two specific performances (*UKIYO* [2009-2011] and *for the time being* [2012-2014]) later in this thesis (see Chapters 4 and 5).

The notion of the extended body in relation to material and technological additions gained new dimensions in the second half of the twentieth century when philosophers of media began to theorise the machinic/technological assemblages and complementary functions of communicational prostheses. As Marshall McLuhan notes in *The Medium is the Massage: An Inventory of Effects*, 'all media are extensions of some human faculty – psychic or physical' (McLuhan 1967: 26), and this includes clothes which he posits as extensions of the skin. In addition he posits 'electric circuitry' as an extension of the 'central nervous system' (McLuhan 1967: 38-40).<sup>1</sup> In the context of today and concerning our more recent past, US American philosopher of science and technology Don Ihde has published widely on issues concerning the body's shifting relation to technology and technological advancement.<sup>2</sup> On the question of how technology transforms our perception, he explains in the context of astronomy and the telescope that the latter becomes an amplifier of perception. Thus, 'instrumentally mediated observation' (2013: np), as he calls it in this case, enables extended viewing beyond the limits of normal human perceptual range. He adds that, furthermore, the computer can then transform image into data and data into image in a form of reversibility (2013: np).<sup>3</sup> In this project, whilst optical technologies are not under scrutiny (although I use a telescope on stage in *for the time being*), the data from dancers' body movements are being transmitted to and transformed by the computer into visual and sonic output (see Chapters 4 and 5).

In connection to digital technologies and in our mediatised world, the various media extensions to the human faculties therefore facilitate an extended reach (optically in the case above) and access into new previously uncharted zones. The technologically equipped body can traverse realms, moving between near and far, real and virtual – its reach

extended through its interactions and mediating tools and through the internet.

Furthermore, media extensions offer the experience of remote forms of touching via technological instruments, virtual reality (VR) headsets and haptic devices. Here the process of embodiment of new media technologies has the potential to become both sensate and virtual – beyond pure engagement on an incorporeal level – as argued by practicing digital artist and theorist Anna Munster in *Materializing New Media: Embodiment in Information Aesthetics* (2006: 17). Munster's theories concerning the notion of digital extensions and corporeal engagement will be discussed further below.

### 1.2.1. Body-worn Extensions in Performance

On this subject of body-worn extensions in performance, Brian Massumi explains that these can be regarded as bodily prostheses provided it is not forgotten 'that the body is equally a prosthesis of the thing' (2002: 95). He presents an argument for the existence of a reciprocal and two-way process between body and that which extends it in the context of the early performance work of Stelarc – *Helmet no.3: put on and walk* (1970). This early work involved Stelarc and his audience-participants wearing specially designed headgear to confuse binocular vision – combining rear, side and frontal views, thus making the world look very different to the wearer-perceiver. Despite its specificity, pertaining to the work of Stelarc, I interpret Massumi's theorising on the notion of the mutuality of extension to be applicable more generally to contemporary performance contexts involving both digital and wearable material extensions. Moreover, I relate it to my own practice-based investigations, where inter-relationality and reciprocity of actions are explored together with the potentiality for interchangeability between the body of the dancer and her wearable 'object' or 'thing' in motion whereby, as Massumi explains:

'Body' and 'thing' and, by extension, 'body' and 'object' exist only as implicated in each other. They are different plug-ins into the same forces, two poles of the same connectability. The thing is a pole of the body and vice versa. Body and thing are extensions of each other. (Massumi 2002: 95)

It can thus be argued that our assimilation of such media extensions – and thus our extended perception, as theorised by Polanyi (1957), Merleau-Ponty ([1962] 2005), McLuhan ([1967] 1996) and Massumi (2002) (above) – not as objects in themselves, but as augmentations to the body, alter and expand our relations to space enabling an extended perceptual reach into a world of infinite possibilities.

### 1.2.2. New Media and Digital Corporeal Engagement

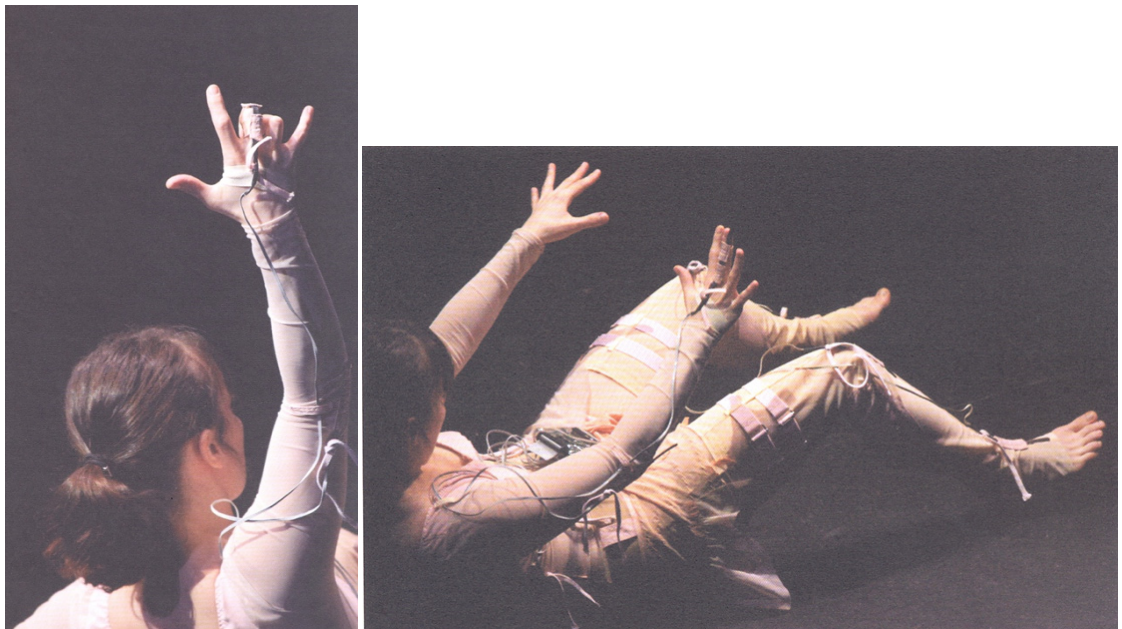
By the turn of this century, discourses of digital corporeal engagement in dance/dance theatre and music were beginning to largely replace the earlier wave of technological euphoria and disembodiment in new media. This came as a natural advancement from the preceding decade when issues of embodied experience and technology had already slowly begun to enter philosophical, theoretical and artistic debate, further crystallising some of the potentials of interactive media to extend the presence and immersion of bodies.

Munster's previously mentioned 2006 publication came out of this new wave of discourse on bodies and contemporary machines and an intention to move forward from old dualities of the mind-body split<sup>4</sup> in the Digital Age. Munster's text decisively leaves behind any outdated notions in new media aesthetics of the Cartesian subject so popular in the 1980s and 1990s HCI models. Moreover, Munster's mission is to prioritise different types of embodied experience afforded by the digital – experiences that draw attention more to the sensory nature of body-computer interactions over disembodied models. In a rapidly advancing field, her theories are still pertinent, as issues of embodiment in new media have continued to gain importance in artistic and academic debate over the past decade.<sup>5</sup>

The digital, according to Munster, requires new ways of being in the world, and 'digital embodiment is a way of experiencing the body' (2006: 64) affording new relationships and compositional possibilities to emerge through the fusions of bodies with digital codes. Such discussions imply that the body is transformed differently by digital technologies which are distinct and dissimilar in the way they touch and transform the body to other (non-digital) technologies. As discussed above, this research project studies analogue in addition to digital technologies as a means of bodily extension. Such extension, as in all embodied technological experience, high tech or low tech, has the potential to offer new movement possibilities through the way it alters bodily interactions or, to stay with Polanyi's metaphor, of 'pouring' into the world. This fundamental notion is transferred to the compositional possibilities of sound and movement for dance performance in the practice-based elements of my research. There, analogue tools (e.g. speakers, circuits, mechanical devices etc.) as well as digital hardware and software (e.g. sensors, motion tracking devices, cameras, and various software for real-time interaction and processing such as Ableton Live, Isadora, Max/Msp) are explored for their potentials to augment what Ihde calls the 'here-body' (2002: 6) visually, sonically and sensorily – the real body as opposed to the virtual or image-body. In the practice chapters of this thesis, I will specifically discuss how the dancer's bodily experiences and movement pourings have

unfolded in the responsive multimedia performance space, as she learns to relate to the technologies that extend (but may also limit) her body, integrating them into her mode of being.

Interactive design and interface systems utilising digital technologies enable movement and biometric data to be gathered from dynamic bodies (e.g. from the pulse, heartbeat, breath, muscle activity etc.), and this data can be used in a form of affective body-code mapping within new media artworks – some with wearable scenarios. Exemplary works I have studied are *Passage* (2007-2008) by kondition pluriel,<sup>6</sup> *whisper[s]* (2002 -2006)<sup>7</sup> – a wearable research project involving collaboration between Susan Kozel and Thecla Schiphorst<sup>8</sup> which will be discussed further below in this chapter – and Myriam Gourfink's *Contraindre* (2004 [figs. 1 and 2]).



Figures 1-2. Myriam Gourfink in her work with sensors, *Contraindre*, 2004. Photos © courtesy of the artist.

The photographs from Gourfink's performance illustrate quite clearly how the body worn motion-sensors are strapped on the dancer's limbs and can thus extract or extend out data from the movement of hands, arms, shoulders, legs and feet. In some of the prototypes developed for my research project, visual and sonic output are linked specifically to the generation and transmission of the dancer's movement data. This type of data is harvested and transmitted in the WorkerWoman and LeavesWoman prototypes in *UKIYO* via a contact microphone and sensor technologies respectively for the generation of sound and in the case of the latter also image.

Thus, in such instances, the mapping of biometric and biophysical data allows for the inside mechanics of the body to be revealed on the outside, so to speak, as they are externalised as visual/sonic output. Munster refers to this process as ‘informatic rendering’ (2006: 142) whilst discussing an instrumentalised perspective of external imaging by state-of-the-art brain scanning technologies, ultrasound and PET scans. An informatic rendering of the body can be experienced first-hand as an aesthetic embodied experience through a process of subjective bodily recomposition where ‘affect slips in and “inhabits the passage” between sensing and rendering’ (142). Such an affective phenomenon is credited by Munster with enabling a transformation from a third-person objective perspective to a first-hand experiential one when regarding imaging of one’s own intimate body data. This same notion of an affective phenomenon being at play, though not in any medical context, and I presently do not use biometric data, is applied in this project and the dancers’ experience of *hearing* their bodily actions and interactions as audible output in the performance space. Furthermore, this extends to also encompassing an affective experience of visual output via the transmission of personal movement data in the LeavesWoman prototype (see Chapter 4 [section 4.5.3.]).

### 1.3. Movement and Sensory Perception and the Intertwined Body

#### 1.3.1. Movement and Sensation

In the opening lines of *Parables for the Virtual: Movement, Affect, Sensation* (2002), Massumi argues that movement and sensation are inextricably linked, each instantly summoning up the other. A body *moves* and it *feels* – moving as it feels and feeling itself moving (Massumi 2002: 1). Movement, even the slightest, he explains, produces qualitative difference, as feelings are invoked in the body by its movements, which through a process of infolding and intermingling intensify and tend to unfold as action. With such qualitative difference, *change* is the issue for Massumi. ‘Felt and unforeseen’, it is represented as ‘conceptual displacement’ as the equation ‘body–(movement/sensation)–change’ (2002: 1). Massumi as I understand him is concerned with the notion of becoming in relation to cultural theory, where movement is viewed not simply as displacement, but as a process of qualitative transformation. (Massumi 2002: 3).

This project, on the other hand, is less concerned with Massumi’s ideas in the context of cultural theory but rather in applying them to a process-oriented approach to the

emergence of movement in performance regarding the sentient dancer and the sensations evoked in her body through a process of performing the wearable. *Design-in-Motion*, as a design approach for the project (see Chapter 2 [section 2.1.]), intends to study the unfolding of movement/sensation in performance-making in two specific contexts: *UKIYO* (Chapter 4 and *for the time being* (Chapter 5).

Regarding the intertwinement between movement, perception and sensation within the context of improvised dance, philosopher and dancer/choreographer Maxine Sheets-Johnstone writes from a first-person and phenomenological perspective suggesting that

Sensing and moving do not come together from two separate regions of experience, fortuitously joining together by virtue of their happening in, or being part of, the same body. Perceptions are plaited into my here-now flow of movement just as my here-now flow of movement is plaited into my perceptions. (2009: 32)

Sheets-Johnstone explains her own movements and perception in the creation of improvised dance to be intimately connected in a body she describes as experiencing itself ‘thinking in movement’ (32). For Sheets-Johnstone thinking does not take place separately from movement in the creation of her ‘dance on the spot’ (32); rather, thinking and corporeal expression for her are inseparably entwined. Furthermore, she discloses that her emerging thoughts – kinetic images and inclinations – do not interrupt the flow of movement which she explains ‘is the dance’ (32). Although I am aware, that a phenomenological approach does not sit comfortably with Massumi’s philosophical ideas on process, stemming from thinkers such as Gilles Deleuze and Felix Guattari, it is an approach that interests this project, and I will return to discuss later in Chapter 3.

### 1.3.2. The Acoustic Space and the ‘Sensory-Kinetic’

The interlinks between the sensory and the kinetic relating to a sonic dimension are discussed by Julian Henriques, Professor of Media and Communications, in *Sonic Bodies: Reggae Sound Systems, Performance Techniques and Ways of Knowing* (2011). After a close examination of Reggae music and sound systems, he advocates a simultaneous interlinking of movement and ‘whole-body’ perception of sound. Henriques presents a model for listening – at very high volumes – where perceiving sound is not restricted to one particular sensory modality but is felt through the entire body – ‘with all sensory organs at the same time’ (Henriques 2011: 104). Furthermore, listening under such



reverberant and visceral conditions of *sonic dominance*, explains Henriques, produces an apparently immediate translation of the ‘listening experience’ into ‘feeling and kinetic dance movement’ whilst the listening subject dissolves into their environment (104).

In this research project, the notion of a simultaneity of the *sensory-kinetic* within the acoustic space, where listening is experienced qualitatively and spontaneously as dynamic phenomenon by the animate dancer on stage, is pursued through the sounding wearable investigations. I argue that the material vibrations of sounding touch and move the perceptual body-subject – the dancer – who in turn experiences enhanced sensation through the phenomenon of whole-body listening in movement in a form of sonic immersion. In Chapter 5 (pp. 193-194), feedback from dancer Vanessa Michielon provides experiential and first-hand insight of how sound vibrations pass through her listening body in the case of the TatlinTower head(dress).

### 1.3.3. Instrument Bodies and Auratic Fashion Design-in-Motion

‘The visual and the tactile, distance and proximity, play a part in shaping our aesthetic perception’, writes Professor in Theory and History of Fashion Ingrid Loschek in *When Clothes Become Fashion: Design and Innovation Systems* (2009: 57). She is acknowledging the impacts of design on the ‘aestheticising of the subconscious’, referring specifically to the materiality of one of the dresses from Alexander McQueen’s *Voss* collection (Spring/Summer 2001), a dress which utilised glass microscope slides, ‘blood plasma slides’, and ostrich feathers in its construction. What Loschek goes on to write is most interesting in the context of my project, as she shifts the emphasis away from the realms of the visual and tactile to embrace the aural dimensions of the dress-in-motion, a form of instrument worn by the body. Introducing its wearing in a one-off performance by the musician Bjork, she states:

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 instruments. (2009: 57)

In the same chapter, Loschek devotes a small paragraph to sound in which she introduces and discusses briefly the sounding creations (adorned with hundreds of golden bells of different sizes) in Viktor and Rolf’s couture collection *Bells* (2000/2001) and the challenges they posed aurally for a fashion audience (seated in the dark) accustomed to

focusing on the visual. In this particular instance, the sounding activated by the movement of the models in the garments adorned in bells is the main focus. Subtle aural irritations and sonic textures (in the absence of the visual) suffuse the air, generating a particular, perhaps unique lyrical aura and raising questions for those attuned to a certain sensibility and consciousness of the performing body on the fashion catwalk. Both designer examples mentioned here in this section are not invested in sound creation *per se* but in sound related to movement in the fashioned garment and how that can be experienced, as music researcher and improvising musician Deniz Peters explains with regard to instrument sounding, as ‘direct result of a bodily act’ (2012: 1). The garment in this case becoming extended as an auratic instrument which ostensibly creates its own distinctive aesthetic atmosphere and presence, a presence that cannot be anticipated.

This notion of the instrument body held my attention for a number of years working on this project, and I will discuss this, joined with more thoughts from Peters, further below. The body coupled with the garment becomes an instrument-body on many levels and, in the case of the Bjork/McQueen and Viktor and Rolf examples, an instrument-body of sonification where both body and garment are expanded in the wearing to the added sensorial benefit of the recipient (viewer/listener). Such examples offer new ways of clothing a body for intellectual and sensorial affect, they aim to offer new stimuli and new provocations – ideas I explore in this research project.<sup>9</sup> Loschek introduces provocation as a creative technique which when used in the design can ‘generate paradoxical, unrealistic or unusual consequences’ (2009: 39), so deviating away from the norm or expected outcome of experience, which above I associated with the unanticipated, auratic impression. She goes on to say that: ‘The aim of new provocations in clothing design is a fresh perception of both vestimentary coverings and the body’, explaining that new coverings for the body as with the objects and architectures wrapped by the artist Christo can provoke ‘fresh perceptions’ (2009: 39). This is a notion explored in this thesis where vestimentary coverings act as provocation to the dancer – enhancing, modifying, distracting, encumbering or unaligning movement – aiming to stimulate fresh body consciousness and distinctive perceptual experience.

## 1.4. Methodologies for Movement in Dance

### 1.4.1. Modern Dance

European studies in body motion and perception in dance in the late nineteenth/early twentieth centuries, to the beginnings of Modern Dance, foregrounded a methodological approach amongst dancers to movement composition and a modernist aesthetic able to formulate and claim a new understanding of *kinaesthetics*. The term choreographer was not generally applied in the Modern Dance era (Huxley 2015: 1); rather, as dance historian and author Michael Huxley explains: ‘It was the dancers themselves whose experience became the substance of the dances that encapsulated the period’ (2015: 2).<sup>11</sup> Alongside Mary Wigman<sup>10</sup> and her professional school for dancers (in Dresden) in which she instructed the dancer to conceptualise ‘the body as an instrument’ (Lazarus 2006: np) – through physical individuation on the foundation of a comprehension of experienced (inner) self-perception and (outer) performance – Rudolf von Laban was another crucial figure in this development of interdisciplinary working strategies or technologies. Unlike Isadora Duncan’s pioneering efforts to proclaim a kind of intuitive expressive freedom from any rationalised technical vocabularies or ‘mechanical movement’ (Duncan 1995: 64) of the ballet tradition, Laban’s exploration of the *kinesphere* – the personal space within reach of the body with outstretched limbs, as distinct from the general space that surrounds a body (Laban 1966: 10) – offered an elaborated scheme for a new understanding of spatial notation or writing of dance.

As I have discussed above (sections 1.2.-1.2.1.), our relations to the space within our reach can be altered and expanded through tools and technologies which, via a process of bodily assimilation, act as extensions of the body. By the same token, that which constitutes the space within reach of a dancer – her *kinesphere* – can be re-negotiated through the use of digital and body-worn technologies that extend her body, facilitating access to an expanded realm and, furthermore, afford a remote form of touching. In this type of augmented performance, Laban’s explorations can be re-interpreted to embrace a *kinesphere* of infinite dimensions. The concept I embrace in this project is the development of the wearables which aim is to empower the dancer to dynamically re-define spatial structures – accessing new dimensions and unexplored peripheries through her emergent gestures and interactions in wearable performance. Significantly, her body, and her ‘outstretched limbs’ symbolically speaking, are now equipped to re-negotiate that

which constitutes her kinesphere in the writing of dance. The exploration of such ideas can be viewed more concretely in Chapter 4 (section 4.5.3.) where dancer Katsura Isobe enacts her LeavesWoman character in *UKIYO* (2010). Here, she can reach into a virtual 3D world via the movement-data she generates in her sensortised dress through an intermingling of corporeality and code (Munster 2006: 184) in a process of digital embodiment and actualisation of her body data. Similarly, in Chapter 5, Helenna Ren's performative actions as the GraveDigger (section 5.6.2.) in conflict with the sun (*for the time being* [2012 and 2014]), illustrate clearly a dancer's digitally augmented and extended reach into the virtual realm.

Laban's study of motility or movement quality within objective spatio-temporal givens defined four motion elements or initiatives; weight, space, time and flow. The term 'Eukinetics' – 'the Effort content of movement' (Davies 2006: 43) – was coined by Laban to encapsulate the range of phenomena that interested him in relation to the spatial aspects of dance and human movement. 'Choreutics' on the other hand centres on his study of the spatial qualities of movement and involves the analysis of how movements are initiated or synthesised and what kinds of movements a body might undertake in space. The quote below on the impulses, mechanics and shape of movement comes from Laban's book *Choreutics* (1966), annotated and edited by former pupil Lisa Ullman, a dance and movement teacher who was Director of the Art of Movement Studio, founded in Manchester in 1946:

Man's movement arises from an inner volition which results in a transference of the body or one of its limbs from one spatial position to another. The outer shape of each movement can be defined by changes of position in space. (Laban 1966: 10)

The publication explores the essence of Laban's movement thought and discusses his practice as an art and a science. What Laban posits leads me to question in this research project concerning an inter-relational emergence of movement expression in interactive dance: 1) How the assimilation of wearable media extension to the dancer's body might become an active part of the movement process as outlined by Laban (above) through its connectivity to the architectural space that surrounds a dancer. 2) Specifically, what multi-sensorial and wearable interaction design strategies I might employ to palpably touch and move the dancer in ways that potentially could generate outputs that further affect her inner volition and thus impact the sculptural form and positioning of her movement in space. I am interested here in the notion of sensory corporeal engagement in the emergence of movement form in space-time – the wearable serving as extension of the senses as

proposed by Polanyi and Merleau-Ponty when discussing the body's physical relations to instruments. I activate this idea with regards to my wearable performance designs and their architectural relations in my practice-based Chapters 4 and 5.

#### 1.4.2. On Process and Affect of Dance

The choreographers Jérôme Bel and Xavier Le Roy have both utilised garments as an active and interactive part of their conceptual movement processes and choreographic strategies for dance. As a way of 'deskilling' dance in the case of Bel (e.g. *Shirtology* [1997]) and a form of 'dissent' from more dominant and prevailing conceptions of choreography and performance by Le Roy (e.g. *Self-Unfinished* [1998]). 'Conceptual strategies to deconstruct conventional expectations about the nature of dance', argues Ramsay Burt,<sup>12</sup> do not render unconventional ways of moving and performing 'purely cerebral' (2009: 204). Instead, he proposes in reference to the *Konzepttanz* – conceptual dance questioning movement techniques and modes of expression – of Bel and Le Roy, that there is a movement away from something located in the mind toward a more embodied form of experience. Burt goes on to outline the significance of challenging our beliefs about *what the dancing body can do* by stating that:

New ways of moving and performing can create new kinds of feelings. By doing so, they can give expression to new ways of perceiving and thinking thus contributing to cultural development and change. (2009: 204)

He is expressing the potential of the dancing body to influence developmental change in a socio-political sense through his invocation of seventeenth-century Dutch philosopher Baruch de Spinoza and the value he placed on bodily experience. Although my research is not seeking to be influential in this way, Burt's statement above is one that magnifies in significance to my project, when I consider the employment of clothing by Bel and Le Roy in their evolutionary processes of conceptual forms of dance involving conjoined body-garment movement statements. Moreover, the 'deconstruction of normative performer audience relations', explains Burt, prompts dancers to find new ways of relating to one another (205). And this can be witnessed, for example, in choreographer/dancer and filmmaker Yvonne Rainer's late 1960s/early 1970s works-in-progress (*Continuous Project – Altered Daily*) as well as her 2006 'reconstruction' of material from George Balanchine's 1957 ballet *Agon* (with its processual strategies of showing on stage how the dancer

teaches herself the movement – observing herself on a video monitor), and Le Roy's *Self Unfinished* with its analysis of movement and fragments of a dance in an abstracted sense.

To strengthen his point of view further, Burt also discusses Le Roy's *Product of Circumstance* lecture demonstrations where Le Roy sets out to answer the question: 'Can the production of a dance become the process and the production in itself without becoming a product in terms of performance and representation?' (Burt 2009: 213). Here, Le Roy demonstrates isolated cellular movements he had studied as a scientist engaged in cancer cell research, completing his thesis on molecular and cellular biology when he took up dancing. Since some of these isolations looked uncanny, even inhuman, Burt argues that in the audience's experience of the dance, kinaesthetic relations between performer and audience members are prioritised over a standard 'narcissistic-voyeuristic' model to maximise the affect of the dance (2009: 213). My research project, on the other hand, whilst concerned with the emergence of movement in dance through material kinaesthetic relations for the dancer and conceptual strategies, does not involve scientific studies or extend to embrace performer audience relations as part of its investigations. Rather, it is the dancers themselves who are witnesses and 'perceptual' participants in my research study. My reflections in Chapters 4 and 5, incorporating feedback from the dancers, are intended to expose the process, not solely the product, but the in-between-ness of things through which I have been able to progress my ideas and develop my analysis.

#### 1.4.3. Improvised Dance

In her book *The Primacy of Movement* (2011), Sheets-Johnstone explains that the structures of thinking in movement for the dancer in improvised dance have aesthetic ends – as opposed to the practical and self-instructional ones of learning about the world through explorative movement as an infant (419-20). Furthermore, she notes that whatever the rules for the dance improvisation – 'fast group movement to alternate with slow, large individual movement' or 'contact improvisation only' (420), for example, and however restrictive, essentially, it can be summed up in a very general sense as: 'dance the dance as it comes into being at this particular moment at this particular place' (420). Thus, there is a clear qualitative and experiential dimension to this movement that forms minus a score as it were.

Crucially, in her writings, as previously highlighted, Sheets-Johnstone analyses dance improvisation as a paradigm of thinking in movement, whereby these two aspects of dance form a thematic that is ‘dynamically-tethered’ (419). I borrow this term from Sheets-Johnstone to represent the entwinement and flow between body and wearable in my work which become dynamically-tethered through a process of engagement that is ‘*the dance itself*’ (421). According to Sheets-Johnstone in the quote below, the improvised dance or the dance itself is the embodiment of creativity as process – emergent, open and unpredictable:

A dance improvisation is the incarnation of creativity as process. Its future is thus open. Where it will go at any moment, what will happen next, no one knows; until the precise moment at which it ends. (421)

It is important to explain here that the type of improvisation Sheets-Johnstone describes does not however involve working with technical instruments and interactive systems as we do in DAP-Lab. For the types of mediatised performance environments in which my wearables emerge and are performed, the co-director of DAP-Lab, Johannes Birringer<sup>13</sup> theorises in his essay ‘After Choreography’ that in addition to there being no set choreography, one also cannot speak of improvisation, but only of the freedom for dancers to move within the technological parameters of the system (Birringer 2008a: 119-120). Birringer here refers to DAP-Lab’s 2007 interactive dance performance *Suna no Onna*<sup>14</sup> where the dancers’ movements ‘controlled’ the space via sensor technologies integrated into their garments. Their wearable interfaces enabled them to become embedded in the world they created (2008a: 121). In such encounters with ‘wearable space’ in interactive performance, it is not clear, however, what the dancer will do next or when she might or might not repeat her movements, a concept Birringer also supports since interactive systems tend to be open-ended, fluid, and unpredictable. In this respect, I would regard the movement’s future in my practice-based research to be ‘open’, in the same sense Sheets-Johnstone explains in her quote above.

Moreover, in this research project, where the garments are specifically intended to act as palpable and framing or rather re-framing devices to the emergence of movement and sounding, I suggest the dance can emerge through similar techniques of creative and embodied dancer-centred processes as those discussed by Sheets-Johnstone. Certain limiting and restrictive elements are offered, in my case through design features – weight, structure, texture, integrated technological devices and objects, etc. – aiming to constrain the dancer from the outside-in, whilst conversely affording her new modes of expression

as externalisation of her sensate and motor experiences relating to the act of dynamic wearing in the performance space.

Furthermore, the emergence of movement connects not just to the dancer performing her sensorial garment and wearable instrument, or to her performance of the space that surrounds her, but also to her complex and spontaneous entanglements in motion. Her expressive movements and interactive gestures (performed inside the parameters of the system), becoming audible – distorted, amplified, looped and so on in the digital. These ideas will be further explained and described within the context of *UKIYO* and *for the time being* in Chapters 4 and 5.

## **1.5. Choreographic and Metamorphic Garments in Dance**

### **1.5.1. Historical Contexts – Loïe Fuller and Oskar Schlemmer**

The idea of the garment as movement or choreographic instigator in dance is the subject for this next section. I have chosen to focus on two contrasting historical examples where costume has been integral to the movement of the dancing body. Both are equally important to my work but for different reasons which I will explain. The first example discusses the stage costumes of dancer Loïe Fuller from the late nineteenth and early twentieth centuries – voluminous fabric creations requiring skillful negotiation of their metamorphic form. Fuller is of interest to my research, not specifically for the methods she used to animate her body, or for her preoccupation with the creation of spectacle, but more for her integration of stage technologies into costume concepts for her dances. Fuller is considered a pioneer of modern dance and stage technologies; early physical transformations of the modern dancing body achieved through costume and technology are largely credited to her.

The second historical example in this section concerns the constraining costume designs of artist Oskar Schlemmer for the theatre of the Bauhaus in the 1920s. His costume concepts were central to his movement research and highlight a very different approach to that of Fuller. In the case of Schlemmer, his methodology incorporating costume and objects into dance has informed my work to some degree together with his experimentation in movement and sounding: his strategies for design incorporate techniques of constraint



aiming to deliberately limit the fluidity – and thus altering the flow – of movement through time and space.

New ideas involving stage technologies and dynamic methods of working with cloth and costume in Fuller's dances are discussed by Rhonda K. Garelick's *Electric Salome: Loïe Fuller's Performance of Modernism* (2007). Most notable examples mentioned are Fuller's *Serpentine Dance* (1896) and *danses lumineuses* (dances with light), such as *Fire Dance* (1892), which used up-lighting and indirect lighting techniques, innovative at the time, to create spectacular effects. Garelick describes Fuller as a dancer with an unconventional, not so aesthetically pleasing body at the time of her arrival on the Parisian dance scene in the early part of the 1900s. Yet, through her experimental performances, Fuller presented dynamic multi-sensory experiences of amalgamated movements of body and technologies so powerful, Garelick explains, that she was reported to have left her audiences at the Folies Bergère breathless. According to Helen Thomas,<sup>15</sup> the effects of Fuller's dance images caused a sensation amongst her audiences in Paris, who witnessed her body transforming, through her manipulation of an abundance of cloth and light, into a series of transient organic forms (1995: 56). Fuller's captivating effect was attributed to her specific way of moving with her tools and materials. As Garelick puts it, this was the result of:

the unique amalgam of Fuller's human agency, 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, the disembodied, rising and falling silken shapes. (2007: 4-5)

Fuller's *Serpentine Dance* and *Lily Dance* (1895) are early examples of interactive costume design and a two-way process between the emergence of movement and costume – where choice of cloth (silk), design features of the garment (with integrated rods) and fabrication methods are developed in direct relation to the movement and resultant forms of the dance. This interdependence of movement and costume is emphasised by theatre historian Catherine Hindson in her writings on Fuller in *Birds of Paradise: Costume as Cinematic Spectacle* edited by Marketa Uhlirova. She suggests that: 'Clearly, costume design was an integral part of Fuller's creative process and aesthetic, responding to the dance and facilitating its development' (Hindson 2013: 72).

In her chapter on: 'Dancing on Top of the World: A Serpentine through Late Nineteenth-Century Entertainment, Fashion and Film',<sup>16</sup> Hindson describes how the serpentine dance emerged from the skirt dance which was a popular attraction in musical stage comedy of

the latter part of the nineteenth century (2013: 68). Moreover, she explains how the movement sequence shifted relationally to the costume, from a focus on the lower body in the skirt dance, to incorporating ‘a new kind of sinuous arm movement’ to animate the voluminous expanses of cloth in the serpentine (72). Hindson notes:

The most successful serpentine dancers of the 1890s recognised the centrality of costume in the performance’s scenography: the dancer’s dress played off – and became inextricable from – the music, the lighting and the motion of the body. (2013: 75)

Fuller’s *Serpentine Dance* (fig. 3) symbolised this integrative approach of dance and technology and pushed things much further. She had brought this particular dance form from the United States to Europe at the end of the nineteenth century and, according to Hindson, ‘came to symbolise it – its likely inventor and greatest innovator’ (67). Such ‘centrality of costume in the performance’s scenography’, as expressed by Hindson here, achieved via integrative approaches that link the costume inextricably to other factors of the performance, is a fundamental feature in my project.

Costume design concepts and technological strategies developed by Fuller for her *Serpentine Dance* created potential for strong and dynamic metamorphic effects. The technique of stitching metal rods into sleeves, for instance, was key to enabling her to manipulate an abundance of silk cloth/costume into sculptural forms through her extended arms. Furthermore, Fuller’s use of rotating coloured spotlights to dye her costume deep jewel tones added to the visual transformational effects. Indeed, the use of electrical stage lighting techniques, considered commonplace today (Thomas 1995: 55), formed a core part of the spectacular effects of Fuller’s early modern dance through her dynamic interactions with the staged environment. She energetically manipulated her enveloping cloth, and thus she could metamorphose herself – each shifting configuration of her cloth-body further accentuated by the stage lighting – transitioning between ephemeral material forms: butterfly, snake, ocean wave etc., in a recomposition or re-fashioning of her performing body-in-motion. The most spectacular transformational effects of lighting techniques, according to Thomas, belong to Fuller’s *Fire Dance*. While Fuller danced on frosted glass illuminated from below, indirect lighting catching swathes of swirling cloth created the illusion of Fuller being enveloped by flames (1995: 56-57).



Figure 3. Loïe Fuller in *Serpentine* costume, 1898.  
Archival image.

Furthermore, Uhlirova, in her writing, credits the serpentine dance as exemplifying the metamorphic costumes popular in cinematic as well as theatrical contexts of the time – concerned with an elaborate optical illusionism – due to its visually striking effects and dynamic transformational qualities described here:

These were costumes that could unfold and fold back again, open and close, swell and subside, shimmy energetically and spread out across the stage/screen to claim space, catch the light and register colour in stimulating ways. (Uhlirova 2013: 22)

Here, Uhlirova draws attention to the intertwining of costume and architectural space and the spatial aspects of costume-in-motion from a kinetic and visual perspective. Such costume and architectural intertwinements in the practice-based research for this thesis, whilst sharing similar notions of expansion in staged performance spaces, relate predominantly to the propagation of sound as opposed to the spreading of image. Specific examples in relation to this will be discussed in Chapters 4 and 5. Moreover, whilst highlighting the agency of Fuller's costumes, the above quotation also hints at a mutuality of impacts between costume and scenographic space. As the costume expands and contracts, spreading out into the performance space or across the screen – transforming it – it is also transformed as it becomes coloured and altered by the light.

The transformations of the sonically spreading costume in my work are not the same as those created through lighting effects. Nevertheless, I would argue that the sounding costume itself undergoes sonic transformation in a process of transforming the dancer. The costume also undergoes visual changes, but for the moment I concentrate on technology and aural expression. Furthermore, transformation occurs relationally to on-stage technologies, as indicated in Uhlirova's reference to lighting above, and to the dancers' movements. In the mediatised performance spaces of this research project, and in relation to how the costume is perceived aurally (via a condenser microphone, for example), my costumes can amplify sounds the way lighting can exaggerate image. Moreover, software processing can distort transmitted sound that originates from the dancer in costume just as lighting can disfigure a form. I argue such sonic effects lead to a similar folding and unfolding of costume presence aurally in space to that described by Uhlirova. This notion will be illustrated via description of specific prototypes and associated technologies in Chapters 4 and 5.

Unlike the technological costumes of Fuller, which seemed to set her body in motion demanding a highly physical and fluid performance opening out to animate the large expanses of cloth, Schlemmer's Constructivist costumes were designed more with the intention to constrain the movements of the performing body, closing them in. His aim was to limit movement through costume and other accoutrements to more precisely hone in on the mechanics of moving joints and limbs and his central concern with the abstract mathematics of lines and geometries created by body movement in space. Thus, Schlemmer's costumes and wearable objects – central to his movement research – were often quite reductive and abstract in their relationship to the body in order to maintain his intended focus.

In *Stick Dance* (1927), for example, Schlemmer employed a series of eight straight sticks symmetrically attached to the limbs of a male performer to make its geometric visual movement statement in space. Lines opened into planes unfolding as volume, the body – clothed in a black body suit – diminished in the subdued lighting of the performance space by the glowing dynamic sticks it set in motion. I am particularly drawn to this piece and the way the movements of the body expand out as a series of kinetic lines in space: a dynamic visual patterning of the constrained movement gesture. In a contemporary context, I consider examples like *Stick Dance* almost comparable to the affect of the performer's 'moving body' data and interactions in space on screen images and visual outputs in today's digital immersive environments. Equally, these movement data and performer interactions can alter sonic output which has been under exploration in my

work. The WorkerWoman prototype for *UKIYO* represents a good example of this and will be discussed in Chapter 4 (see section 4.5.1., pp. 135-139). Schlemmer's mathematics of lines and motion does not literally fuel my research interest, only in so far as data in digital contexts are numerical representations of a body that in mediated staged performance environments can be revealed in alternate and abstracted ways. Rather, the notion of *design-in-motion* drives my practice and the experimentation with movement sonification systems that can stretch aspects of movement improvisation. Moreover, the implications for my research, when considering the work of Schlemmer alongside Fuller, relate to the significance of the design decision-making process involving selecting and crafting materials for movement study and creative output in dance.

The resultant visual aesthetic in *Stick Dance*, and indeed in all Schlemmer's studies, was very different to that of Fuller's dynamic body-material interactions, and yet in the case of *Stick Dance*, it could be argued that similar basic tools and bodily extensions – rods/sticks (animated by limbs) and lighting concepts – were employed. Furthermore, in each of their works with costume, the body almost disappeared, or rather became abstracted as an image. Its presence was sensed, in the case of Schlemmer through the arrangement of dynamically moving lines, and with Fuller through her organic metamorphosing swathes of cloth, decorative as opposed to reductive or minimalist.

Throughout his work with costume, Schlemmer created distinct movement characters where the costumed dancers' bodies choreographed the movement through sculptural designs that integrated the use of elementary material forms such as spheres, ellipses, circles, straight and diagonal lines. Such forms demanded isolated and specific gestures. In her chapter 'Body and Motion', in *The Theatre of the Bauhaus* (2011), theatre scholar and practitioner Melissa Trimingham analyses the movement studies undertaken by Schlemmer in his quest to seek new 'Gestalten' of the body utilising exploratory and analytical processes implicating both performer and audience. Trimingham explains that the experience of motion originated in Schlemmer's two-dimensional artwork, where Cubist compositional techniques implicated the viewer, offering multi-perspectival viewpoints that unfolded over time and through a process of viewing (2011: 79). In fact, Schlemmer's trajectory of investigations into motion and human-object and spatial interactions can be mapped from his early figurative sketches (circa 1910) of human bodies engaged in activities, through his explorations with costumes and objects (1920s) – aiming to erase mimetic action – to his later two-dimensional artworks depicting the interrelations between dynamic bodies and static sculptural forms such as staircases (e.g. *Bauhaus Stairway* [1932]), rooms and railings (e.g. *Railing Scene* [1932]) in their

environment.

Schlemmer's performance works, such as *The Triadic Ballet* (premiered 1922), and *Mechanic Ballet* (1923-24), analysed motion, namely the restricted movements of the performing body in relation to costume's physical material characteristics as geometrical form located on the body. Costumes were the most important part, in *The Triadic Ballet*, for Schlemmer's studies in movement and dance. All eighteen 'figurines' were designed specifically to constrict the range of wearer movements in search of new dance expression. Despite the strong visual characteristics of the designs, the costumes as inhibitors of movement made them unpopular with the dancers, as they were 'continually pitting the body against material form(s)' (Trimingham 2011: 105). In fact, Trimingham goes as far as to say in a recently published interview that the dancers 'hated' (2016: 270) the geometric forms that extended their bodies and restricted them so.

In this research project, I am not aiming to restrict a dancer's movements to the point that they abhor and feel creatively shackled by the design; rather I seek to create a more symbiotic relationship of body and wearable where mutual extension comes into play, as posited by Polanyi (1957) and Massumi (2002) as discussed above. Yet, as Massumi argues in philosophical terms, to move forward in our transit through life is not necessarily about escaping, but rather playing with constraint (2015: 12). An idea which also interests me when considering a dancer's negotiation of encumbered movement in performance, and is applied to my own research investigations involving costumes which aim to offer certain constraints to the dancer. Reproductions of three of the *Triadic Ballet* costumes made of wool, silk, metal and other mixed media were on display at the exhibition *Bauhaus: Art as Life*, 3 May 2012 - 12 August 2012 (Barbican, London).<sup>17</sup> In this format – static untouchable exhibition context – the copies inadequately represented the true nature of these experimental wearable artefacts designed to exert their palpable and restraining influences on the dancers' movements.<sup>18</sup>

Altering physical movement through his costume/object interventions to generate new dance expression was for Schlemmer not the only intention; he also wanted to find ways to traverse into a metaphysical realm where movement could become transcendental. According to Torsten Blume, research associate and choreographer at Stiftung Bauhaus Dessau (Bauhaus Dessau Foundation), he did not regard his figurines for *Triadic Ballet* as 'mechanical dancers', as they were often dubbed (2014: 6), since his concern was not with a mechanised body in a mechanistic age but rather with a metaphysical transcendence away from the machinic that came through the body and from within the human being

(Blume 2014: 6). Blume explains that Schlemmer saw dance as presenting near perfect conditions for the exploration of his art and ideas incorporating human beings spatially and atmospherically into a technical environment whilst simultaneously generating a modern abstract design aesthetic (2014: 6). Moreover, Trimmingham, in her chapter ‘Body and Objects’, argues that the means of artistic expression used by Schlemmer in *Triadic Ballet* were intrinsically experiential and embodied (2011: 106). In a similar vein, I would argue that interactive dance scenarios provide the conditions necessary in my project to explore concepts on wearable design as movement and sound initiators in performance.

Schlemmer’s stage-space-architecture movement pieces (1927-1929), such as *Stick Dance*, *Form Dance*, *Glass Dance*, *Space Dance* and so on, scrutinised the motion of performers’ bodies as they engaged with material forms in space. Moreover, these theatrical experiments were the output of a more affirmative outlook on machines adopted by Schlemmer – as a possible route to spiritual transcendence – during his years as director of the Bauhaus theatre workshop (1923-1929). Less drawn to the notion of spiritual transcendence, I find Schlemmer’s experimentation in dance and movement – featuring material encounters and interaction with objects – certainly fascinating, including the inexpressible or merely imaginary transfigurations implied in the motion of pure lines or geometries. According to Blume, Schlemmer began to translate his experience of mechanisation into simple performance spaces consisting of human bodies and objects as apparatuses (Blume 2014: 10). In performances such as *Stick Dance*, for example, the sticks (i.e. the object), when worn and skillfully negotiated by the performer-body in the space, generated a precise visual geometry in a reimagining of the body in motion empathising with the mechanics of the bodily extension.

Furthermore, at a certain point in the dance, the sticks were used by the performer to generate acoustic sounds live on stage – clashing sound as an event, orchestrated by the apparatus. In the performance *for the time being* (2012 and 2014), described in Chapter 5 of this thesis, all sounds (digital, acoustic and electroacoustic) originate with the dancers and their wearable interactions on stage. The dancers are extended as an instrument in the space, the dancer’s embodied performance unfolds audibly as well as visibly over time.

Another key reason for my interest in Schlemmer in addition to his movement studies with dancers, is the keen interest he had in exploring the phenomenology of sound. He incorporated the notion of sounding originating with the dancer – speaking and basic percussion– into his performances with costumes and objects in a desire to find ways to connect the medium of sound more fully to the form or ‘Gestalten’ of the dance

(Trimingham 2011: 129). Trimingham, in a chapter specifically devoted to ‘Sound’, proposes that Schlemmer sensed the relationship of the dynamic body to the making of sound to be both simple and complex. Moreover, she argues that whilst he concentrated on the material qualities of sound relationally to the body (as opposed to the more intangible aspects favoured by some of his contemporaries at the Bauhaus [Paul Klee, Johannes Itten, Wassily Kandinsky]), he was greatly limited in fully realising his ideas by the technologies available at the time (130). Nevertheless, Trimingham maintains that the potential of Schlemmer’s work with sound can be evidenced in the development of sound art over the last thirty years and more significantly in the postmodern stage soundscapes that connect intimately with the live performing body (130).

Since Schlemmer did not have the means to explore newly emerging technologies of his time for the recording and amplification of sound, he was confined to using simpler methods to navigate his interests in the intertwinement of dancing and sounding. He could not, for instance, capture and explore the sounding of material costumes in motion in *Triadic Ballet* as he may have wished to do. Furthermore, his realisation that the overly constraining costumes of *Triadic Ballet* were not helpful to his explorations of sounding in motion motivated him to find new solutions in terms of the structure and design of the costumes he employed. As a result, Schlemmer began to develop a different type of aesthetic to his previous one involving heavily padded costumes combined with various accoutrements, still restrictive but not to the same degree as his previous creations. These were employed in his Bauhaus Dances on the Dessau stage such as *Metal Dance*, *Hoop Dance*, *Stick Dance* etc., together with percussion methods involving drum, triangle, cymbal, claves etc., and with piano. Furthermore, materials with inherent percussive characteristics such as glass (*Glass Dance*) were appropriated as instruments of sounding.

### 1.5.2. Transformational Wearing: Re-fashioning the Performing Body

The notion of transformational qualities of dress to the body in motion relates less to the outward forms of movement in dance described above, and more to a metaphysical realm (briefly mentioned in the previous section on Schlemmer). Here movement is considered as inwardly focused, a notion that belongs more to Eastern philosophies and practices than Western ones. I will reflect now on my interest in the relationship of garments to the transformational process of the slow-moving body in this metamorphic form of dance – as a form of internal re-fashioning of the performing body. My own experiences<sup>19</sup> of having



worked directly with Japanese butoh dancers and costume in 2010, as part of the process of creating the third iteration of the performance installation *UKIYO*<sup>20</sup> provided firsthand insights into the real potential for costumes or garments to aid as a means of reconfiguring movement identity via the perceptual systems of the wearer.

The idea of transitioning states through performing dress in butoh can be examined from a phenomenological perspective, relating to the notion of embodied relations, through the eyes of one of the principle founders of butoh, Kazuo Ohno.<sup>21</sup> The importance of costume to Ohno's performances and movement identity is acknowledged in his book *Kazuo Ohno's World from Without and Within* (2004), a tribute to Ohno's working method, co-authored with his son Yoshito Ohno and translated by John Barrett. Ohno's fascination with, and perhaps even dependence on, costume, styling and makeup in much of his work is evident and well documented in a career spanning almost six decades. For Ohno, what mattered was the connectivity he could have with garments in performance. He perceived their significance as that of becoming a form of second skin and sought to experience an instinctive response that evoked something deep inside his (dancing) body for transformational purposes and a reconfiguring of identity. In relation to this and to the wearing of women's clothing in performance, the book notes that Ohno repeatedly stated throughout his life that:

My intention in dressing as a woman onstage has never been to become a female impersonator, or to transform myself into a woman. Rather, I want to trace my life back to its most distant origins. (2004: 76)

Thus, Ohno was interested in allowing the apparel to be a conduit to a metaphysical journey of regression he wished to undertake. However, to what degree his body transformed or was aided in that transformation process through the wearing of garments is difficult to ascertain through observation alone, and belongs to Ohno himself. How for instance could the onlooker know whether in *Admiring La Argentina* (1973), Ohno had really become La Argentina, or that she had entered him, merging to give bodily form through the dance (2004: 166). It would require an analytical and yet empathetic type of observation, coupled with a knowledge that could only really reside with and be fully interrogated through Ohno's dancing body experiencing and negotiating such a phenomenon – expressed in his movements and his own voice. Such a methodological approach I sought to undertake in my research, and Ohno's writing from a first-person perspective has been of great interest to my work, since it acknowledges such garment-led impacts. I have chosen to conduct this study on *design-in-motion* working directly and

intimately with dancers in order to seek their experiential knowledge. Whilst physically a bodily change might be detectable visually on the surface, knowing of any deeper movement involving transformational change belongs to the dancing subject.

I recognise that to attempt to prove such metamorphic affects of wearing without thorough and extensive scientific inquiry would be contentious, and also extend far beyond the remit of this research. In my project, I am not proposing that the garments offer transformational aspects of this nature, but rather that the garment's intertwining narrative and material touch encompass both a psychological and physical dimension for the dancer-wearer that assist in a transformation of the performance-making process. Nevertheless, it is a belief some are prepared to expound, such as Sondra Fraleigh, author of *Butoh: Metamorphic Dance and Global Alchemy* (2010). Fraleigh studied butoh alongside the transformational aspects of Eastern movement practices and authored several books on the subject.<sup>22</sup> She clearly supports the notion of transformation through wearing in butoh. In her sub-section on 'Costume & Metamorphosis' (2010: 56-57) Fraleigh discusses garments in the context of metamorphic change in the performer regarding items of clothing worn by butoh dancer Denise Fujiwara. Furthermore, she assertively acknowledges the garments' assistive qualities in the morphing process whilst referencing *Unearthed* and *Wellspring*, two of Fujiwara's many site specific solo pieces. In this project, I prefer to interpret this as the dancer reaching a more attentive and deeper level of internal focus through the body's encounter with garments and wearable objects inducing an almost meditative state, involving a slowing down of movement, as is the case in butoh, for closer scrutiny of bodily sensation.

### 1.5.3. Contemporary Western Dance Contexts

In more contemporary Western dance contexts and by complete way of contrast, the French choreographer Christian Rizzo has explored the notion of the absent body (relationally to the garment) by removing the body completely from the dance. In his piece *100% Polyester* (2000 [fig. 4]), two identical hanging dresses conjoined at the sleeves rotate and are given movement via the use of a fan blowing air at them to become an *objet dansant*. Movement is separated from the body in what Rizzo considers an expression of his 'desire to be able to present a dance from which the body-material is missing'.<sup>23</sup> In his other dance works, such as *Et pourquoi pas: bodymakers, falbalas, bazaar, etc. etc.* (2002), Rizzo explores metamorphosis of materiality and form, creating worlds with

objects and bodies where his body-garment-object hybrids are both sculptural and bizarre, rich in textures and commentary on the fantasy body.<sup>24</sup> Rizzo's work offers an interesting point of comparison with the 'digital costumes' in movement created by Jane Harris who explores the presence and portrayal of characters through dress and textiles in the realm of 3D computer graphic visualisation. The digital animations (*Potential Beauty*) she exhibited in the UK since 2002 focus on the poetic and dreamlike movement of the dresses alone, insofar as the actual wearer of the garments is 'deleted' in the final screen versions.<sup>25</sup>

Cultural critic Laurent Goumarre, in his essay on the relationship between clothes and the body in performance in the *Dysfashional* (2007) exhibition catalogue,<sup>26</sup> refers to the type of movement where dancing bodies become invisible, take up new positions, become horizontal or are changed somehow by their relationship to garments in performance as an 'act of deposition'. Regular everyday actions in dance have become more significant than choreographed movements, he explains, as witnessed for example in the dressing and undressing of the body explored by La Ribot's in her solo piece *Candida iluminaris* (2001) featuring a short strip-tease. He notes in this instance that:

The point was not to produce an authored dance, as in the 1980s, with trademark movements signed by choreographers – the elegant movements of the wrist and joints by Dominique Bagouet or the neck movements, bobbing heads and robotic gestures of Karine Saporta, etc. In short, immediately identifiable gestures which clothed the dancer's body. No, dance had found other gestures, which were not so much movements as they were actions. (2007: 20)



Figure 4. Christian Rizzo, *100% Polyester*, 2000. Photo © courtesy of the artist.

Goumarre saw this as potentially indicating a new way of dance exploring clothing since its fatigue of the 1980s heavily costumed dances such as *Le Défilé* (1985), a collaboration between choreographer Régine Chopinot and fashion designer Jean-Paul Gaultier. A fatigue that resulted in a movement of ‘dancing naked’ in the 1990s. Dance pieces such as Jérôme Bel’s previously mentioned *Shirtologie* were prime examples of a renewed interest and new discourse emerging in the late 1990s on dance with garments. ‘I remember Frédéric Séguette’s masterful solo’, muses Goumarre, ‘dressed in a series of t-shirts with injunctions, reflections, numbers and faded colors. And the dance? A two-step. Step One: respond to the clothing’s messages; step Two: remove them one by one, as if turning pages, but also with the general movement of a neutral striptease’ (2007: 20). It was the process of slow undressing in an analysis of the ‘system of clothing’, which Roland Barthes had so influentially written about in *The Fashion System* ([1967] 1983), and an interpretation of the garment’s message (as in Bel’s *Shirtologie*) that Goumarre concluded was significant for some 90s-style dance in its relations to garments (2007: 20).

#### 1.5.4. Choreographers and Fashion Designers

On the process of creation through collaboration, specifically between choreographers and fashion designers, whereby costume/clothing presents movement implications for the dance(r), there are further examples: William Forsythe and Issey Miyake (*The Loss of Small Detail* [1991]); Merce Cunningham and Rei Kawakubo (*Scenario* [1997]); Russell Maliphant and Alexander McQueen (*Eonnagata* [2009]); Michael Clark and Stevie Stewart (*Come, Been, Gone* [2009]) and Wayne McGregor and Gareth Pugh (*Carbon Life* [2012]) to cite a few in the realms of recent contemporary dance. While each example employs its own strategies for engaging and negotiating movement through dress, none explore the integration of sounding concepts into the costumes for movement expression in dance. In Cunningham’s *Scenario*, for instance, Kawakubo’s intention with the padded costumes she created for the piece was to alter the performers’ sense of self through garments that distorted their bodies with bulges and protuberances (Carpenter 2012), and not via sonic means. I write further on this particular collaboration in Chapter 2 (section 2.4.2.), in connection with my own design approach as a fashion designer working in the field of dance.

Pugh’s sculptural, architectural costumes and angular footwear, on the other hand, presented McGregor’s dancers with an avant-garde alternative to the traditional tutu and

pointe shoe, visibly and palpably different for the dancers. McGregor, in his exploration of new movement possibilities with fashion designer Pugh for the ballet *Carbon Life*<sup>27</sup> (fig. 5), acknowledges the complexity, challenges and opportunities Pugh's garments pose to a dancer's movement, and also to himself as the choreographer and to the choreographic process when he states:

I think the more extreme the clothes, the more the body has to work out how to solve the problem of moving: and I think in solving the problem it's necessary to present interesting things for the body to do. (McGregor 2012: np)



Figure 5. Eric Underwood and Edward Watson in Wayne McGregor's *Carbon Life*, 2012. Photo © Dave Morgan.

The navigation of the choreographic process through dress, according to McGregor, thus involves a problem-solving approach in a re-direction of movement on the part of both the dancer and the choreographer. Moreover, it requires movement solutions that are creative and responsive to the material stimulus (clothes) – and their ‘extremity’, as McGregor suggests. These are all factors important to my own *design-in-motion* methodology incorporating the added dimension of sounding, where the wearables aim to provoke the choreographer whilst simultaneously touching the dancer influentially in often surprising ways.

## 1.6. Wearable Technologies

### 1.6.1. Fashion and Wearables

In *Fashion Futures* (2012), the author Bradley Quinn<sup>28</sup> explores the relationship of wearable technologies to the fashioned body. He postulates that increasingly there will be less distinction made between technological devices and garments, whereby, through technological advancements and the continued miniaturisation of technologies, a greater confluence of cloth and technology will materialise. This would create a ‘technological synthesis’, where garments literally absorb communications technology and embed IT systems, which according to Quinn will render garments the most popular form of hardware within the platform created by information technology and communications networks, as the hardware of computing yields to the soft folds of fabric (2012: 212). So far, we have not witnessed the fulfilment of this prophecy in mainstream fashion concerning garments in everyday contexts. However, significant advancements have been, and continue to be made in more niche categories – sport and fitness, health and wellbeing, for example, where garments and wearable accessories can track performance data and operate on more diagnostic levels transmitting statistical information in real-time. This has also been acknowledged by Susan Elizabeth Ryan, author of *Garments of Paradise: Wearable Discourse in the Digital Age* (2014),<sup>29</sup> in her introduction to her study of wearable technologies, where she points to a marked evolution in recent years of wearable computing involving e-textiles, clothing and accessories engineered with microcontrollers to perform different functions (2014: 2-3).

My project is not, however, interested in the notion of wearables and intelligent garments as monitoring and diagnostic devices but more as artistic compositional devices. Nor is it necessarily concerned with miniaturisation or the achievement of invisibility or impalpability of the technologies. On the contrary, palpability for the dancers is an essential feature of the work as it seeks to explore the tactile material presence of technologies which also might become encumbrances as well as enabling devices. Moreover, state-of-the-art technologies tend not to be the default choice in the design process, and the ability of the hardware to merge with the softness of cloth is not a pre-requisite in the choices I make. Instead, I opt often to utilise older, more clunky technologies – sometimes analogue, sometimes digital and frequently displaying levels of

dysfunctionality – in the prototype designs for the projects’ choreosonic performance wearables.

According to Sabine Seymour (2008), ‘fashionable technologies’, a term she coined in 2000, are amplifiers of fantasy in addition to being mediators of information (12). She described such wearables as ‘designed garments, accessories, or jewelry that combine aesthetics and style with functional technology’ (Seymour 2008: 12), where the expressive potential of the fashionable wearable is extended with technology.<sup>30</sup> Quinn’s envisioning of the functional and experiential aspects of such intelligent clothing in fashion’s future, on the other hand, involve their participatory role in networked societies facilitated by wireless mobile telecommunications technology. There is presently an unfolding of a new dialogue between body and dress, states Quinn, four years after Seymour’s statements were made, which he credits to ‘fashion’s potential to function as a technological device’ (2012: 12).

Both notions are of interest to this project, the amplificatory and the communicational potentials of wearables. As previously outlined, there is a participatory role for the garments to play in the interactive and networked performance spaces of DAP-Lab’s work. In this way garments/accessories tune into environments, real and virtual, receive and transmit data and furthermore can augment and stimulate the senses and re-invent the dancing body in motion (not however via shape-shifting technologies integrated into cloth), thus offering new experiential modes and expression to the dancer-wearer. Furthermore, as I have also started to explain, my envisioning of fashion’s potential to innovate within the realm of wearability and functionality – concerning movement and sound composition in interactive performance contexts – is very different to many of the scenarios introduced by the fashion industry.<sup>31</sup>

### 1.6.2. Fashioned Wearables in Performance

With specific relevance to fashion and interactive performance contexts, Quinn introduces Studio XO and their collaboration with Nancy Tilbury (fashion designer), Ian Wallace (couture craftsman) and Benjamin Males (designer and engineer) to create interactive stage costumes for the Black Eyed Peas’ 2011 world tour. The costumes/interface design located on the body and in the responsive stage set integrated various wireless technologies to allow the wearer-performer to ‘connect’ to the stage environment, altering sound (audio

loops), video outputs and lighting real-time in performance (Quinn 2012: 52). Such interactive costume design is discussed here in the context of the hybrid (fashion) practitioner offering amplification to performers' presence on the stage, but little further reference is given to sound beyond a brief introduction.

In the film *The Next Black – A film about the Future of Clothing* (2014), directed by David Dworsky and Victor Köhler and narrated by Hanna Wiederud, Tilbury – co-founder and director of Studio XO – features as pioneer for her work fusing fashion with technology. According to Wiederud, Tilbury's *digital couture experiences*, which she defines as garments that are both interactive and evolving, aim to challenge the traditional notions of clothing – shifting the boundaries of fashion through performance art and the 'art pop' music scene. Tilbury has created stage clothes, often utilising light that might for instance blink and flash in sequence, for clients such as the previously mentioned Black Eyed Peas, Canadian-American indie rock band Arcade Fire and US American singer Lady Gaga (Wiederud 2014: np).

The garment featured in the film is a bubble manufacturing sculptural 3D printed mechanical dress designed by Tilbury for Lady Gaga called 'Anenome', described by Tilbury in the film, as 'a garment with a factory inside' (2014: np). It is not intended as a sounding garment, but the mechanical parts of the garment produce sound as they work to animate the dress, transforming liquid into bubbles. Tilbury briefly mentions this sound yet the aural quality for her seems secondary and merely adding to the delight and aura of the performative dress or 'transformative piece', as opposed to having any more deliberate underlying compositional intention – blending with the clicking of the paparazzi cameras – as she recalls the visual spectacle of Lady Gaga appearing to fans, bubbles blowing from her dress – exiting the Roundhouse at the iTunes Festival, London, in 2013. Tilbury, acknowledges that her approach to redefining the concept of dress generally starts with what she terms an 'effect', with the 'intentions of the machine' her prerogative. Here, she defines her work as: 'Pure design engineering that happens to be dressed up as fashion', crediting the machine with 'transforming the way we dress' (2014: np).

Similarly situated within the realm of fashion, wearables and performance, my mode of inquiry differs significantly from that of Tilbury, highlighting the diversity of the field we both explore as fashion designers. Rather than focusing on characteristics of the machinic for a remodeled concept of dress, this thesis foregrounds a more distributed sense of agency and intention between dress and wearer, investigating the transformative



contribution the former can make to the process of performance practice. Moreover, interrogation and evolution of ways of wearing in my work focus less on clothing as performing art and audio/visual trigger as is the case with Tilbury's work, and more on the performative and affective dimensions that exist interrelationally between garments and performer-wearers. This notion will be discussed later in the thesis by way of example in my practice-based chapters.

More directly related to the poetic sensibility I seek to create in my work are Di Mainstone's wearable sonic sculptures or 'new musical instruments' and her experimental explorations of these in performance with dancers. Originally a fashion design graduate of Central Saint Martins College, Mainstone was artist in residence at Queen Mary University (2012-2015), working with researchers from the Centre for Digital Music and Media Arts & Technology<sup>32</sup> to develop her sonic wearables. She now defines herself on her website as an 'artist and movician', the latter, a term she coined to also describe the dancer or performer who plays her wearable instruments – half dancer, half musician – whereby physical movement is transformed into sound using digital technology (Mainstone 2017a: np). Therefore, similarly to my work, the sounding elements of her designed bodily extensions or more precisely 'musical prosthetics' are activated directly via the movements of the wearer. The acoustic device *Serendiptichord* (2009) for instance, described by Mainstone as a 'choreophonic prosthetic', and involving interdisciplinary investigations between fashion, dance, music and technology, is designed to invite the wearer to physically probe its surface architecture and tactile qualities through interaction and expressive movement (Mainstone 2017b: np). Hers are however generally solo performances exploring the wearable instrument in itself and not as part of a larger performance narrative, as is the case in my research practice.

Furthermore, in my case, the wearable as material artefact does not necessarily always rely on a causal relationship of movement to the direct sounding of the artefact. Rather, my research inquiry requires a dancer to explore the sounds she elicits and/or emits in motion – a subtle shift from the notion of moving for the primary purpose of eliciting sound from the wearable artefact as is the case in Mainstone's work. Moreover, my research explorations sometimes localise those sounds to the surface of the dancer's body e.g. InstrumentWoman in *UKIYO* (see Chapter 4) and the TatlinTower (head)dress and Futurian ChestPlate in *for the time being* (see Chapter 5). With other prototypes, the sounds are relocated (through interactive and speaker systems) in the performance environment, making it more akin to Tilbury's work with the Black Eyed Peas (above) in

this aspect than Mainstone's. Examples here in my project include the RedMicro Dress and GraveDigger prototypes in *for the time being* (see Chapter 5). These two prototypes do not in themselves hold any sounding characteristics, but rather are conduits to amplified and distorted sounding (generated via some other source e.g. another performer) in performance. Whichever strategy is applied, the sounds generally become part of a larger composition, as processed and re-emitted layered, fragmented, scrutinised and distorted sonic textures, and are rarely explored solely within themselves.

Mainstone's *Human Harp* (2009-2015) project received much recognition for its ability to make audible the inaudible subsonic tones of the resonating structures of bridges – Brooklyn Bridge, New York, Clifton Suspension Bridge, Bristol, the Hungerford Bridge, London and Bob Kerrey Suspension Bridge, Omaha, to name a few.<sup>33</sup> Here, the entire bridge is hooked up to a dancer and turned into a musical instrument, so to speak. On closer scrutiny, the concept for sounding is not dissimilar to the ongoing acoustic explorations of composer Ellen Fullman with her *Long String Instrument* (1981-present).<sup>34</sup> Additionally, I argue there are also connections to be made to experimental musical composers such as Alvin Lucier and his explorations of acoustic phenomena, auditory perception and resonating sculptures from the 1960s and 1970s. In respect of this, clear similarities are evident between Mainstone's work and my own with regards to our shared interest in experimental music and sound art. Moreover, we share collaborative and interdisciplinary approaches; the *Human Harp* involves collaboration with physicists, structural engineers, musicians, dancers and opera singers. In my work, I also collaborate with engineers, musicians, dancers together with media artists, filmmakers and choreographers.

Finally, it is evident from Mainstone's meticulously crafted heavy duty leather holster designs for the dancers (to attach the dancers to the bridges via cables and allow for interaction), more akin to fashion artefacts than high performance wearables or purely functional harnesses, that we share a similar fashion consciousness. Insofar as Mainstone's performance wearables subsume and creatively incorporate technical features and functionality into the designed visual aesthetic of the accessory, they reflect a visual design strategy I also prefer to employ in my own research practice.

### 1.6.3. Musicians and Wearables

According to Eduardo Miranda and Marcelo Wanderley (2006: 2), until the end of the nineteenth century, musical instrument design was dependent on mechanical systems and acoustic properties. However, the advent of electricity and, later, opportunities for sound generation via electronic means led instrument designers to experiment with new possibilities. This experimentation continues with the design of what Miranda and Wanderley term digital music instruments (DMIs), where ‘digital interconnection possibilities’ enabled via ‘data communication protocols’ allow anyone today to connect a control surface to a synthesiser and computer (2006: 2). In terms of DMIs and the use of sound synthesis methods in contemporary artistic contexts, musicians and sound artists have been experimenting with the design of wearable gestural controllers to provide input to drive the musical parameters for some time now. This enabled an advancement in their field from the prevailing laptop and disembodied performance models of the new media aesthetic of the 1980s and 1990s, to controlling digital and electronic sound creation via more dynamic and wearable means. Examples first developed in the 1990s include: Laetitia Sonami’s ‘Lady’s Glove’; Pamela Z’s ‘BodySynth®’ and Julie Wilson-Bokowiec’s ‘Bodycoder System’, to be discussed below. The gestural dimension of this, in particular, remains popular, and furthermore the wearable one, since sound artists discovered that through body-worn devices and the exploration of the sensory aspects of interaction, they could turn their entire bodies into performing instruments. My research project partially stems from this turn towards more sensory modes of engagement for the generation of sound where corporeal activity sits at the heart of the technological system, where wearable and interactive digital technologies link to the phenomenology of sounding in staged performance.

Experimental sound artists and performers such as Sonami<sup>35</sup> have built an entire performance practice around this notion, using interactive sensor-packed gloves – wearable apparatus – as interface for musical composition. The ‘Lady’s Glove’,<sup>36</sup> as she named it, initially built in 1991, is designed first and foremost as a controller – the sensors and actuators all highly visible on the surface of the glove. Sonami, however, reflects on its unfolding as instrument relationally to the software and her musical sensibility in the following comment, thus positioning the glove as much more:

I think it becomes an instrument when the software starts reflecting and adapting the limitations and possibilities of the controller and your musical thinking ideas are more a symbiosis between the controller, the software and the hardware. (Sonami 2010: 229)

Sonami's notion of a mutuality of becoming through a process of interaction reflect my own thoughts on the experience of sounding through movement in the work I do with dancers and wearable instruments. However, I do not refer to my prototypes as controllers but prefer to position them as interfacial and responsive media that generate a form of distributed agency, as opposed to a form of control. Electronic musician and composer Tara Rodgers, author of *Pink Noises: Women on electronic music and sound* (2010) – a series of interviews with female composers – notes on the physicality and multilayered aspects of Sonami's performances with the Lady's Glove: 'Her compositions have been described as "performance novels", because musical form and textual narrative unfold and are transformed through her physical motions' (2010: 226). In a similar vein in *for the time being*, design thinking aims to link wearables to the sensorium and an unfolding of narrative in performance through the creation of multi-dimensional and intertwined sounding-movement characters<sup>37</sup> as I will illustrate in Chapter 5.

The notion of activating sound through wearing and simple gestures or everyday motions was explored by the previously mentioned Fullman in her *Metal Skirt Sound Sculpture* (1980). Fullman designed and built her *Metal Skirt Sound Sculpture* – a pleated skirt constructed out of metal as the name suggests – as performance wearable. 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 her 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. (Fullman 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 created perplexed reactions from the passers-by.<sup>38</sup> Her experience demonstrates how body-worn wearables, responding directly to bodily motion, potentially challenge performers and audiences alike when the focus of a work's aesthetic design is directed at the creation of a particular character of sound or sound character that subtly redefines the idea of the 'instrument' as well as movement's temporal affects – especially the latter's gestural and narrative characteristics which are most relevant to my practice. Fullman mentions the Judson Dance Company as key to her aesthetic. Established in 1962, this group was radically unconventional in their approach to working with mundane action choreography and everyday movement in the manner of presentation (Jackson 2012: 1), avoiding spectacle and virtuosity. The Judson artists invented a new kind of minimalist dance, later named postmodern, which embraced diversely trained dancers (alongside untrained performers) as well as musicians, filmmakers or visual artists (such as Carolee Schneemann); it was often not possible to distinguish between performer and choreographer.<sup>39</sup> Such ambiguities in the approach to movement invention, especially, are favoured in DAP-Lab's performances and this project, where lines of demarcation and disciplinary boundaries become blurred.

The conventions of music-theatre and dance position the instrument as both an object (a device created or adapted to produce musical sounds) and a body. The performers engage their instrument and invite the audience to observe, listen to and experience the sonorous body. Among the most well-known practitioners working with wearables in sound art and street performance contexts is Benoît Maubrey and his Audio Gruppe. Worn in public spaces, the costumes Maubrey created for characters such as the *Audio Ballerinas* (1990 [fig. 6]), *Audio Geishas* (1997) and *Audio Peacock* (2003) were worn by members of Audio Gruppe who developed solos with a particular instrument-costume (often with built in amplification). 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.<sup>40</sup>



Figure 6. Benoît Maubrey, Audioballerinas, dancers with electroacoustic tutus and digital samplers and movement sensors allowing them to trigger their sounds via their choreography, 2000. Photo © courtesy Benoît Maubrey.

Vocalists have also experimented with interactive sensor suits and accessories, for example composer/performer and audio artist Pamela Z with BodySynth®,<sup>41</sup> copyrighted in 1994, featuring wearable electrode sensors enabling muscle movement to control how her voice is processed, and Julie Wilson-Bokowiec with the Bodycoder System,<sup>42</sup> developed in 1995. Rodgers' book features an interview with Pamela Z where she explains her choices for incorporating various technologies into her work stating: 'In every piece I do, I incorporate technologies in a certain way. I have kind of a love affair with modern high-tech objects, but I also like the simplicity and directness of mechanical things' (2010: 220). Thus, she highlights her interest in both the digital (e.g. cell phone) and the analogue (e.g. typewriter) to the compositional processes of her electronic music, an idea that has always guided me when designing with technologies.

Furthermore, works that integrate the glitch as compositional tool, such as Stanley Ruiz' *Barong Analog* wearable synth built into a cheap plastic poncho, a trashy performable noisemaker (exhibited at Osage Gallery, Hong Kong in 2005 as part of FuturaManila), have significance to my project. Glitch aesthetic, known for the exploitation of dysfunctionalities or accidents in sound and noise music, is an aesthetic I am keen to

explore for its disruptive and affective potentials which are subjective and can also be mobilised more positively. Such disruptions are explored by musician and author Paul Hegarty in *Noise/Music: A History* (2007) – a detailed study of noise art from its origins in the early part of the twentieth century to present day. The Italian Futurists invented experimental music machines specifically for the generation of sounds such as popping, hissing, crackling to utilise in composition in a desire to broaden musicality (Hegarty 2007: 6). Artist and musician Luigi Russolo's entirely acoustic *Intonarumori* or noise machines (circa 1910-1930) not only generated a whole raft of sounds which could be altered tonally and amplified through mechanical interaction, but were also designed to be visually distinctive. Thus, whilst not able to be worn, these acoustic devices with their strong visual presence and sounding – manipulated through interaction – to be mobilised into compositions, comprise all the elements I seek to be present in my own wearable instruments for interactive dance performance.

## 1.7. Interactive Performance

### 1.7.1. Gesture-controlled Music Interfaces

While the growth of computer-based interactive art is widely accepted in today's art worlds and technological cultures, the development of interactive systems or instruments in dance and digital performance is still relatively recent. As I endeavoured to point out above, it draws conceptually from the historical precursors in electronic music/computer music and instrument design. The more sustained lineage of computer music and instrument design therefore offers a strong background for understanding the compatibility between movement/dance and sound as well as other media outputs and behaviours that are gesturally controlled. Unlike the earlier modern acoustic or electro-acoustic devices, interactivity today is generally understood to be based on digital software interface programming.

Gesture-controlled music interfaces arguably form the core of the experimental evolution of interactivity in music performance ever since electro-acoustic and computer music/composition evolved after the 1950s (Camurri and Volpe 2004; Miranda and Wanderley 2006). They are characterised, as I have come to understand it, by an *interface structure* typical of all performance works in which interface design (device design), MIDI or other data transmission protocols, and computational processes (in the software patches

driving the algorithmic processing, parameterisation and outputs) are integral for the composition and content, the aesthetic performance techniques, programming configurations and delivery forms. In many instances, this integration of human-machine interfaces implies the custom-built design of interactive systems for real-time synthesis of digital outputs/objects. In the music field, the emphasis was placed naturally on sound, whereas in theatre and dance, the inclusion of an interface system began more slowly with the incorporation of cameras and projections (film, video, slides) on stage – visual projections that could be generated or manipulated live in real time. One only has to observe some of the recent film-theatre productions directed by Katie Mitchell to see to what extent onstage filming of performance actions and live generation of sound (by her folie artists and sound operators) have become an integrated method of mainstream dramaturgy (Birringer 2014).

Frances Dyson, author of *Sounding New Media: Immersion and Embodiment in the Arts and Culture* (2009), probes the issue of the live generation of aurality, emphasising the ‘undifferentiated, multiplicitous associations that aurality provokes’, especially when sound artists (in the wake of *musique concrète* and Pierre Schaeffer’s acousmatics) focus not on the object (i.e. the instrument or the material ‘cause’ of sound or music is not visible) but on the event, the ‘ephemeral and immaterial nature of sonority’ (Dyson 2009: 11). For Dyson, the event is sound affecting the whole body as a vibration, pulse, or signal, being felt, not just heard. Since we have a hearing range of 360 degrees versus a sight range of 180 degrees, and because we are able to shut our eyes but not shut our ears (4), sonority is fully immersive.

Contrary to the acousmatic tradition in sound art, instrumental performers tended to foreground their musical instruments and discover extended techniques through preparations/modifications for playing them beyond the expected manner of performance. Already in the 1970s, for example, Steina Vasulka began to interface her acoustic violin via microphone; later she worked with electric violin and MIDI output to use the strings as controllers for manipulation of video images (e.g. *Violin Power* [fig. 7]).<sup>43</sup> In this gesture-controlled musical performance, the artist plays video with her primary musical instrument, the violin, so to speak. But in this example of early interactive performance interfacing electronic sound and image, according to Yvonne Spielmann’s description of the work, the violin becomes a new instrument for the simultaneous generation of sound and image (2004). Where Vasulka, with her ‘prepared’ violin (reminiscent of the prepared piano used in many of composer John Cage’s performances or Christian Marclay’s playing



of his customised turntable, the ‘phono-guitar’)<sup>44</sup> can lower the pitch with the frequency shifter (making the violin sound like a cello) to achieve particularly expressive effects through sound and image frequency alignment (Spielmann 2004: n.p).<sup>45</sup>



Figure 7. Steina Vasulka, *Violin Power*, 1978. Photo © courtesy of the artist.

Laurie Anderson, in *United States I-IV* (1983) and *Home of the Brave* (1986 [figs. 8 & 9]), also became quickly recognised as one of the major avant-garde music and multi-media performers exploring real-time manipulation and distortion of sound and image, using her custom-built instruments and other electronic props such as the Tape-bow violin (first using magnetic tape in place of the traditional horsehair in the bow as well as magnetic tape in the bridge; later she used MIDI-based audio samples triggered by contact with the bow), the wireless Talking Stick (a 6-foot long baton-like MIDI controller that can access/replicate any sound and works on the principle of granular synthesis), voice filters to deepen her voice, and the Drum Suit (see fig. 8). The latter is described by RoseLee Goldberg, in *Laurie Anderson* (2000), as: ‘... a percussive outfit with electronic drum sensors sewn into its seams, which produced a big “boom” whenever she tapped her knee or chest or made particularly expansive movements’ (Goldberg 2000: 14).



Figure 8. Laurie Anderson, performing in Drum Suit with electric violin, *Home of the Brave*, concert film, 1986. Video still.



Figure 9. Laurie Anderson, *Home of the Brave*, 1986. Video still.

### 1.7.2. Sounding-in-Motion (Dance Contexts)

A transition from Anderson's tapping, instrumental and vocal performances to dance is a small step; the dancer's dynamic body has long been associated with live generation of sound in performance through body-worn technologies. The use of the tap shoe commencing around the mid-nineteenth century is a prime example – its origins in cultural dances such as the Irish jig, clog dancing and Juba Dance performance of the Afro-

American slaves but now sustaining wide-spread appeal in popular tap dance musicals on Broadway – to recognise not just the rhythmic and percussive dimensions of tap dance but note its design aspect, namely that sonic output is the result of a dynamic-tethering between dancer and shoe. Similarly, the Ghungroos or footbells of Indian Classical Dance provide another example, insofar as the rhythmic foot movements of the dance, for example in Kathak and Bharatnatyam, are also intertwined with the visual sonic manifestations which symbolically amplify the accents – and thus one could say the language – of the movement. My practice is not necessarily concerned with these more traditional, cultural or classical modes of rhythmic audible movement expression often connected to national identities in dance, although I do examine the relational aspects of moving bodies and instruments and bodily expression of dancers in the generation of noise/music that mobilises into composition. Moreover, and as I will point out in the chapters on the practice, I carefully explore the whole moving body from head to toe. However, I also extend the notion of instruments to encompass objects, computers and information systems to examine the phenomenon of movement sonification through wearables in interactive dance performance.

In a more academic dance-movement context, Danielle Wilde has published several papers on her practice/research into design and movement, some specifically relating to sound. In her paper entitled ‘*hipDisk: using sound to encourage physical extension, exploring humour in interface design*’ (2008),<sup>46</sup> Wilde discusses the sounding potentials of a body in relation to movement/body gesture through her wearable interface design *hipDisk* which, she states, ‘turns the body into an instrument by augmenting it with instrumental capabilities’. Other sounding movement wearables from Wilde are *Ange* (2001-2003), a custom-made corset with rib cage incorporating electronic sensors to enable a playing through touch of pre-recorded samples.<sup>47</sup>

Electronic music is broadly defined as music that uses analogue or digital electronic devices, or a combination of these.<sup>48</sup> The edited collection of essays in *Bodily Expression in Electronic Music: Perspectives on Reclaiming Performativity* (2012) brings together contemporary discourses within the fields of electronic music, contemporary dance, and aesthetics. The aim of this publication, according to its editors – music researcher and improvising musician Deniz Peters, composer and researcher Gerhard Eckel, and philosopher and musicologist Andreas Dorschel – is to interrogate ‘the body’s role in musical expression and experience’ (2012: ix). Peters suggests in the introduction that ‘music affords bodily expression. It is the direct result of bodily acts’ (2012: 1). In other

words, he is suggesting up front that there is an intricate, entwining and reciprocal connection between the moving body and music and sound. I have chosen two essays from this book involving dance to discuss further, since these investigations highlight specifically the dynamic, yet varied and fluid relations and growing interest in bodily presence in electronic music-making and sound-led practices in dance. In some instances, the significance of body-worn technologies as part of a system of expressivity and expansion of the performing body is foregrounded (see Kozel below). In others, the instrument-body, the ‘tactile-kinesthetic-sonic’ or sensing, moving sounding body is emphasised (see Jaana Parviainen further below). The ideas and approaches held in both examples are of interest to my own wearable experimentations, where the aim is to initiate an attentive and intimate binding of body and artefact through experienced touch-movement and sensory engagement in analogue and digital corporeal contexts.

In her essay ‘Embodying the Sonic Invisible: Sketching a Corporeal Ontology of Musical Interaction’, Kozel proposes from the phenomenological perspective of a dancer with a knowledge predominantly generated through performed bodily experience that: ‘all bodies continuously sound and are heard, as noise, silence, or the many registers in between such as whispers, grunts, sighs heard either within or without’ (Kozel 2012: 63). She outlines her method in a responsive media environment as involving an unfolding of attention to the sonic dimension and associated form of the body. A more deliberately skillful and learned object/instrument handling is suggested by philosopher and scholar Jaana Parviainen whose research encompasses the choreography of user interfaces, when she writes about ‘Seeing Sound, Hearing Movement: Multimodal Expression and Haptic Illusions in the Virtual Sonic Environment’ (2012: 71-81). Parviainen argues for a form of ‘tactile-kinesthetic intelligence’, or a touch-movement knowledge that might emerge through engagement with the artefact/object or instrument and lead to an intimate binding of body, instrument, movement and resultant sounds developed through the interactions (2012: 71-79).

Kozel, on the other hand, fosters a notion of the body as a ‘listening organ’, a receptacle for sonic experiences in her work. Moreover, subjective and bodily perspectives on dance involving electronic and interactive music form the basis of her discussion on the existence of a ‘sonic invisible’ (Kozel 2012: 63), in which she claims, following Merleau-Ponty, that sound remains just outside the visible and the conceptually formed, always appearing to become vapourous, fading, and in the case of ultrasonic soundwaves, inaudible. Her previously mentioned wearable research project *Whisper[s]* (2002 - 2006), created with

Thecla Schiphorst, sought to develop new vocabularies (physical, technological and affective) in the transformation of physical (literal and indirect) practices. This was an experiment in the capturing and transmitting of data and bio-feedback mechanisms, but did not develop the compositional potentials of the bodies in the way my research proposes to do. *Exhale* (2005), a real-time interactive media installation and product of the *Whisper[s]* project, and the research experiment *Figments* (1999), both incorporated wearable devices on the dancer's body and wireless computer communication.

The latter was an experiment in visualisation of the inaudible (ultrasonic sound). It utilised an ultrasonic motion capture system and involved dancers wearing small microphones on their bodies (to collect and make audible [to the system] the data generated by their movements which in turn controls visual output in the space). In contrast, *Exhale* involved several participant bodies and experimentation with wearable (biofeedback) technologies. However, there were no sounding devices placed directly on the participant bodies, rather physiological data from the breath of the participants was to be transmitted and made audible via a prototype sound wall incorporating several small speakers, thus locating the sound elsewhere. These projects and others such as *The Yellow Memory* (2009), which harnessed the voice of dancers, have led Kozel to argue in the context of dance that 'the sonorous gives amplitude to form, gives it density, vibration and undulation' as opposed to dissolving it (62). Importantly, she thus stresses the augmenting effects of the sonic – as an intertwined extension – to the dance.

Dancers display extraordinary tactile-kinaesthetic intelligence, as Parviainen deduced through her Embodied Generative Music (EGM) research project (2007-10). Here dancers performed with a virtual instrument, developed by Eckel, Peters and sound artist and researcher David Pirro. The virtual instrument was created with the intention to explore sound generation through movement interactions of the dancer. In her essay, Parviainen notes that:

When dancers improvise with EGM, their hearing becomes a real-time manifestation of their kinesthetic and motor activity, as there is not sufficient time for sonic information to be turned into gestures intellectually. (2012: 73)

In other words, I understand her to be saying that the dancers' movements are expressive and spontaneous arising more through a sensation of touch than any *conscious* mental processing – from a combination of intuitive reactions, active interferences, and learned manipulations which, as Parviainen later puts it, are based on: 'the body memory

connected with the sounds of the sonic scenarios' (75). The suggestion here I interpret as being two-fold; that sound expands the dancer affording new bodily expressivity – it enters and touches his/her perceptual and motor systems – and is simultaneously performed gesturally and intuitively.

### 1.7.3. Dance and Interactivity

With the growth of digital performance over the past twenty years, attention was drawn in particular to the new fusions between dance and technology. Several highly acclaimed productions appeared since the late 1990s that drew critical interest to the use of interactivity and 'virtual dancers' (e.g. in works by Merce Cunningham, Bill. T. Jones, and Trisha Brown with the software design team of OpenEndedGroup, formerly known as Riverbed). Some of the works toured around the world – Cunningham's *Hand-drawn Spaces* (1998), *BIPED* (1999) and *Loops* (2001-04), Jones' *Ghostcatching* (1999) and Trisha Brown's *how long does the subject linger on the edge of the volume...* (2005 [fig. 10]), while other choreographers such as William Forsythe developed intensive research projects into their organisational and algorithmic processes, publishing the results on CD-ROM (*Improvisation Technologies* [1999]) or online platforms.

Other choreographers, such as Wayne McGregor in the UK, Emio Greco in The Netherlands, or Klaus Obermaier in Austria developed research affiliations and projects that also led to new productions, interactive installations (e.g. Greco, *Double Skin/Double Mind*), symposia and books which reflect a provocative new stage in the discourse on contemporary dance and dance technologies, as well as the closer links that had been forged between artists, ensembles and engineers/scientists. The Australian dance company Chunky Move collaborated with engineer Frieder Weiss on two interactive dance works, *Glow* (2006), and *Mortal Engine* (2008 [fig. 11]). The latter production, choreographed by Gideon Obarzanek, which features Weiss's software-generated (Kalypso) graphics responding to the movement of the dancers to throbbing minimalist electronic music by Ben Frost and laser design and sound by Robin Fox, was shown at London's Southbank Centre on October 19-20, 2012.



Figure 10. Trisha Brown Dance Company, *how long does the subject linger on the edge of the volume...* with Marc Downie, Paul Kaiser, Curtis Bahn, et al., 2006. Photo © Paul Kaiser.



Figure 11. Chunky Move, *Mortal Engine*, Southbank Centre. London, 2012. Photo © courtesy of Southbank Centre, London.

Remarkably, the overall designed ‘instrument’ (stage set and interactive software system, graphic projections and laser projections) in *Mortal Engine* was so prominently overbearing that I observed it was quite difficult for the six dancers to develop new relationships between sound and movement.

The particular relationship of dance to technology illuminates the changing contexts for new performance concepts. They may be derived from new tools or innovative scientific



and sci-art frameworks for the creation of digitally augmented human movement or digital movement archives. *Synchronous Objects*,<sup>49</sup> William Forsythe's web-based research project, is a prominent case of such re-examination of digital technology in regard to its representations of the corporeal and of a choreographic system of operations. Forsythe's dance *One Flat Thing, reproduced* (2000), is examined from numerous angles, and the researchers (at Ohio State University's Advanced Computing Center for the Arts and Design) analyse and creatively redeploy various spatial data from the dance, re-visualising its kinetic *dispositif* and expanding it. *Synchronous Objects* thus becomes a perplexingly wide-ranging series of re-mappings or re-figurations of the distributed flows of the dancers' movements, providing tools that allow the user to trace, re-imagine and re-draw spatio-temporal behaviours from the dance, experiencing the dramaturgies on screen (fig. 12).<sup>50</sup>

Choreographic systems are not only constituted by principles of organising movement in space-time or by combinatories of movement and other media or software environments. They can even point beyond screenic (projected) and auditory scenographies to current conceptions of 'machining architectures' (Spuybroek 2004) informed by patterns of spatial mobilisation, flows or behavioural expressions studied by designers who re-imagine the kinetic organism of motion in the city and in buildings, re-defining architecture as an intelligent machine that integrates numerous computers dedicated to sensing-calculating-actuating – each making their own decisions in order to produce an interactive interface.<sup>51</sup>

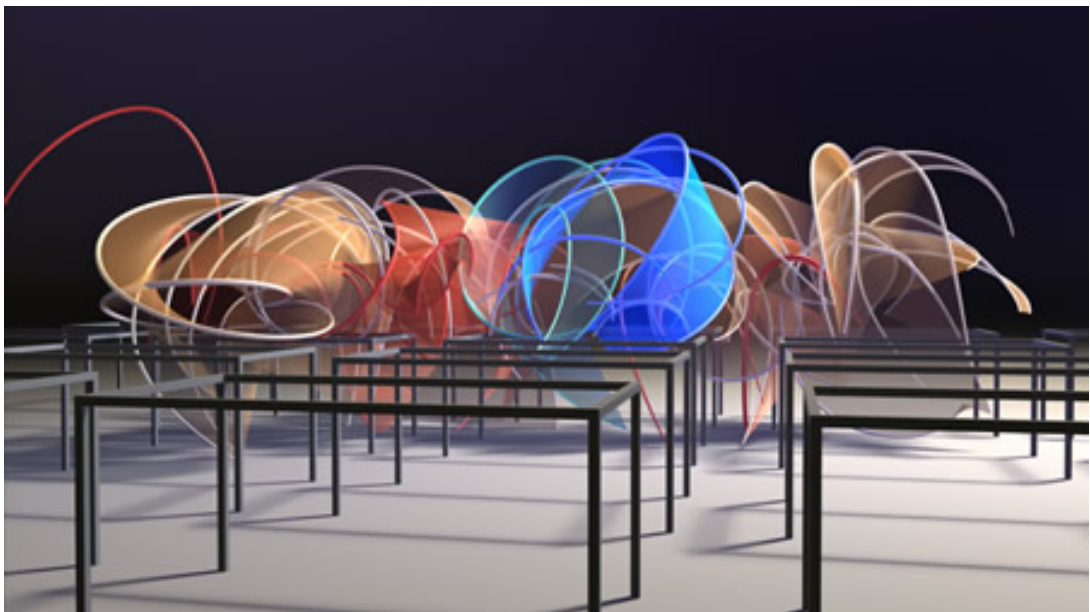


Figure 12. 3D Alignment Forms within *Synchronous Objects*, taking a sampling of dancers' alignments into three-dimensional space creating volumes between them to create new sculptural-spatial configurations. Photo © Ohio State University/William Forsythe.



In the new century, overlapping interests in related fields – film, electronic music, digital art, science and technology, design, engineering, robotics, architecture – thus advance our understanding of the complementary thinking processes that drive interdisciplinary research. One common interest that has become noticeable is the question of embodiment, a return to a stronger phenomenological investment in theories of the digital and the virtual, and an increasing interest in multisensory experience. These research interests are generating conceptual models derived from informatics, artificial intelligence, biology and artificial life, wearable computing and telecommunications. Not all these pursuits are relevant to my subject here, but it needs to be pointed out that my own practice and research interests are inspired by the cross-overs between these fields, and it has also been a common experience in recent years to encounter thought-provoking exhibitions connecting performance, art and science/technology.<sup>52</sup>

## 1.8. Conclusion

Having thus mapped the landscape and the many diverse aspects nurturing the artistic growth of the *design-in-motion* practice I will describe in the next chapter, I believe the framework for dance and choresonic wearables in interactive performance has quite clearly emerged. And yet, one might think the landscape is too vast, and the connection between fashion and the choreographic still tenuous when interwoven with the various sonic, prosthetic and technological fibres. But by way of conclusion, I wish to re-invoke the core issues I mentioned earlier at the end of the fifth section: they derive from the kinds of performance systems and bodily augmentation I have worked with and which reflect many of the dimensions of interface and instrument design I have introduced here.

The questions begin and end with a profound impulse to refashion the ‘wearable’ in a performance art context: can wearing become a performance technique and the design of wearables a potential method of informing movement and choreographic practice? This is the first level of my practice, namely to think of my garments as performative instruments. In the mapping of the interdisciplinary rivers that flow into my design practice, I also imagine that it will be possible to redraw boundaries and change spaces – thus inspiring innovative productions that challenge our conceptions of what garments and costumes can do and what they can be. Are movements enabled or constrained, expanded or contracted

by them, how do extended bodies perceive themselves and make sense of their extended body sensing? If new sensations emerge through the process of material engagement of ‘affective’ wearing – are proprioception (the sensual awareness of movement within the body)<sup>53</sup> and performer technique altered through the relationship to the garment/wearable in performance?

In this thesis I intend to show as well as argue that the choreographic is also the choreosonic: what happens if movement becomes ‘audible’ so that the choreographies can be heard, how is this processed by the dancer/performer when moving body becomes instrument-body, when expanded instrument-performance tells stories and the dancer is fashioned into a character of a theatrical dance? In the first chapter I have sketched the connections between body-worn extensions, transformational wearing and sounding-in-motion by analysing a range of examples from fashion, music, dance and media art. In addition, I have suggested that one of the results of the research overview is the recognition of a technological landscape: we cannot look at performers in interactional interface as separate from software systems and responsive programming environments. Software programs can also be performers of choreography but they do not wear garments and as far as we can tell, they are not flesh and blood. But even as my research focuses predominantly on the physical performer and the creative potentials of sensortised and audiophonic fashion design, I shall integrate technical explications and discussions of the software in the main body of the thesis, at those points when it is necessary for the conceptual and aesthetic understanding. Primarily I will from now on concentrate on my aesthetic concepts and methodologies for the design practice.

## Notes

<sup>1</sup> Earlier in the same decade, and concerning the notion of media as extensions to the communication condition of the present body, sociologist Erving Goffman had discussed (analogue) technologies such as microphones and other mechanical devices as ‘boosting devices’ – to amplify and augment the naked senses. See Goffman 1963: 14.

<sup>2</sup> Don Ihde’s publications include: *Existential Technics* (1983); *Technology and the Life World: From Garden to Earth* (1990); *Instrumental Realism: The Interface Between Philosophy of Science and Philosophy of Technology* (1991); *Bodies in Technology* (2002); *Chasing Technoscience: Matrix for Materiality* (2003); *Postphenomenology and Technoscience* (2009); *Embodied Technics* (2010); and *Husserl’s Missing Technologies* (2016).

<sup>3</sup> Ihde refers to this as the ‘second scientific revolution’ (2013:np).

<sup>4</sup> The notion of a mind-body split, an idea known today as ‘mind-body dualism’, originated with the French philosopher René Descartes in the seventeenth century when he proposed the mind and the body to be separate and distinct. See Moriarty (2008).

<sup>5</sup> This is reflected in the philosophy of international postgraduate research centres such as Hexagram (Canada) whose investigations are focused on research-creation in media arts, design, technology and digital culture. Their website (<http://hexagram.ca/index.php/eng/>) notes that the research programme for 2014-2020 has three axes: 1. The Senses, Embodiment and Movement; 2. Materiality; 3. Ubiquity, thus reflecting the shifting theoretical and practice-based landscape of media arts, design and technology over the last ten years (Hexagram 2017: np).

<sup>6</sup> For more information on this dance company working in research, development and creation activities in contemporary dance, installation and interactive environments, visit: <http://www.konditionpluriel.org>. A video of *Passage*, an interactive installation where visitors were invited to touch the dancer and the sensors she wore on the body (as well as sensors deployed in the environment), see: [www.youtube.com/watch?v=apmPKrvxbEk](http://www.youtube.com/watch?v=apmPKrvxbEk). For an excellent analysis of installations and the challenges they pose to interactive choreography, see, for example, Rubidge 2009. Choreographer and interaction designer Sarah Rubidge belongs to the same international dance and technology movement context in which Marie-Claude Poulin and Martin Kusch (kondition pluriel), Susan Kozel, Thecla Schiphorst, Gretchen Schiller and others pioneered their installations.

<sup>7</sup> *whisper[s]* stands for wearable, handheld, intimate, sensory, personal, expressive, responsive system. It was a collaborative wearable research project (2002-2006), led by Kozel and Schiphorst and involving dancers, designers, musicians, sculptors, and computer scientists coming out of the *whisper[s]* research group at Simon Fraser University in Vancouver, Canada: <http://whisper.iat.sfu.ca>.

<sup>8</sup> Thecla Schiphorst is Associate Director and Associate Professor in the School of Interactive Arts and Technology at Simon Fraser University. She has a background that spans both dance and computer science and her research investigations encompass dance, choreography, digital and media arts, wearable technologies and embodied computer interaction. She helped develop the choreographic software *Life Forms* as part of the original team working with choreographer Merce Cunningham. See: <http://www.sfu.ca/~tschiph/>.

<sup>9</sup> ‘The Sound of Clothes: Anechoic’ (SHOWstudio: 2006) explored the sound of fashion garments (e.g. zips, chains, beads, feathers and materials [sequins, taffeta, velvet, leather etc.]) to create a series of then groundbreaking interactives that for the first time in fashion media explored the sound of clothes (<http://www.showstudio.com/projects/anechoic>). This work was featured in the fashion exhibition *SHOWstudio: Fashion Revolution* (2009).

<sup>10</sup> Mary Wigman was a German dancer and choreographer, one of the pioneers of modern expressive dance (*Ausdruckstanz*) as developed in Central Europe in the early part of the twentieth century. A pupil of Émile Jacques-Dalcroze (at Hellerau) and Rudolf von Laban, her expressionist dance involved dramatic use of gesture and space: reaching, stretching, push-pulling, exploring the edges of her kinesphere through movements of expansion followed by contrasting contractions. Her dance work *Hexentanz* (Witch Dance) was performed in 1914 without music, an absence that almost seems to amplify the physical presence and movement qualities of Wigman. For Wigman’s own writing on the body as instrument, see Wigman (1925) and Bach (1933). See also Lazarus (2006). For an excerpt of the original *Hexentanz*, see jupsie4 (2014) available at: <https://www.youtube.com/watch?v=AtLSSuFIJ5c>.

<sup>11</sup> Michael Huxley’s book, *The Dancer’s World, 1920-1945: Modern Dancers and their Practices Reconsidered* (2015), provides insight into the experiences of dancers of the Modern Dance era, from the dancer’s first-hand perspective at the time. Chapter 1 is an examination of early Modern Dance through the study of dancers’ writings at the time. Here he explains that modern dancers such as Rudolf Laban, Martha Graham or Isadora Duncan did not use the term ‘choreographer’ in their writings but rather referred to themselves as dancers. Huxley argues in his abstract to the chapter that the term was applied later as a ‘revisionist interpretation’ (2015: 1).

<sup>12</sup> In his chapter ‘What the Dancing Body Can Do: Spinoza and the Ethics of Experimental Theatre Dance’ in *Writing Dancing Together* (Briginshaw and Burt 2009).

<sup>13</sup> Johannes Birringer directs the Centre for Contemporary and Digital Performance at Brunel University. For further reading on interactive performance/performance installation and new resultant kinaesthetic scenarios, see Birringer (2008a) and Birringer (2008b).

<sup>14</sup> The performance installation *Suna no Onna* (2007) featured garments designed using bend and photo sensor technologies for my MA (Master of Arts) collection. The sensors enabled the dancers to interact with their performance space affecting visual output (image, video and animation). Sound was not interactive but rather composed (by Oded Ben-Tal) and followed a set score. The only sounding that came from the garments was the acoustic sound of cloth. This was at its most audible and distinctive when elicited from a stingray skin (worn on the chest of dancer Katsura Isobe [who performed ‘the woman of the dunes’]) when she scratched its surface with her nails. This small and almost incidental act of sounding, initiated by Isobe, ignited my initial interest in the exploration of choreosonic garments which became the focus of this doctoral study.

<sup>15</sup> Helen Thomas is Professor Emerita at the University of the Arts London, she is also Professor of Dance Studies at Trinity Laban Conservatoire of Music & Dance.

<sup>16</sup> Catherine Hindson’s chapter is not about costume in dance per se but uses, in Hindson’s words, ‘costume as a prism through which to re-examine existing histories of cinema’ (2013: 19).

<sup>17</sup> [http://www.carmodygroarke.com/Bauhaus\\_Art\\_As\\_Life\\_at\\_the\\_Barbican/index.html](http://www.carmodygroarke.com/Bauhaus_Art_As_Life_at_the_Barbican/index.html).

<sup>18</sup> The exhibition *Tropicália - A Revolution in Brazilian Culture 1967-72* (2006) presented visitors with wearable reproductions they could interact with and experience sensorially. For example, copies of garments and accessories by artist Lygia Clark designed to challenge wearer perception were available to try on together with the *parangolés* or wearable paintings of Hélio Oiticica. In the case of the latter, conceived as dynamic three-dimensional paintings to be set in motion by movement of the wearer, the weight and kinetic influence of such designs could be explored and experienced firsthand. This experiential wearing provided palpable insight and access into the affective intentions of the artwork for the exhibition visitor, unavailable in the static reproductions of Schlemmer’s costumes for the *Triadic Ballet*.

<sup>19</sup> In 2009, I participated in two residencies with Japanese partners and butoh dancers from the Maison d'Artaud, Tokyo, Japan. The first residency was at Brunel University, London in June 2009 and the second in Tokyo at Keio University in December 2009. As part of the residencies I studied the 'Artaud Method' and undertook a workshop with master teacher Hironobu Oikawa (director of the Maison d'Artaud, Tokyo). Oikawa-san's butoh training interlinks the internal focus characteristic of the original butoh (Hijikata, Ohno) with Chinese natural philosophy of the five elements (wood, fire, earth, metal, water) and their motions and the Qigong system utilising a mixture of training methods, combining dynamic, static, meditative and interactional patterns of movement. His archive is available at: <https://sites.google.com/site/afterscorpio/oikawa-texts>.

<sup>20</sup> *UKIYO: Moveable Worlds* was first staged in London (Artaud Performance Centre) in 2009, and then toured to Slovenia in June 2010 and was performed, in an expanded version, at the Lilian Baylis Studio, Sadler's Wells, London, in November 2010. The final version performed in London featured three Butoh dancers – Biyo Kikuchi, Jun Makime and Yumi Sagaru – guest artists from Japan who had studied with Hironobu Oikawa at Maison d'Artaud in Tokyo.

<sup>21</sup> Alongside Tatsumi Hijikata, the principle founder of butoh, Kazuo Ohno is credited for his significant contribution to the emergence of the dance form in 1959.

<sup>22</sup> In addition to her 2010 publication, Fraleigh has authored *Dance and the Lived Body* (1987); *Dancing into Darkness: Butoh, Zen and Japan* (1999); *Dancing Identity: Metaphysics in Motion* (2004); *Hijikata Tatsumi and Ohno Kazuo* (2006); *Land to Water Yoga: Shin Somatics Moving Way* (2009), and most recently *Moving Consciously: Somatic Transformation through Dance, Yoga and Touch* (2015).

<sup>23</sup> [http://www.lassociationfragile.com/christian-rizzo/choregraphe/spectacles\\_eng/christian-rizzo-choregraphe-spectacles.php?id=1](http://www.lassociationfragile.com/christian-rizzo/choregraphe/spectacles_eng/christian-rizzo-choregraphe-spectacles.php?id=1).

<sup>24</sup> <http://www.jgperiot.net/3%20AUTRES%20PROJETS/Falbala/falbala.htm>.

<sup>25</sup> For an exhibition archive of Harris' *Potential Beauty* 3D computer graphic animations, see: <http://johncurtingallery.curtin.edu.au/exhibitions/archive/2004.cfm>. See also: <http://www.bienale.lt/2011/?p=600&lang=en>.

<sup>26</sup> *Dysfashional* (2007) Curated by Luca Marchetti and Emanuele Quinz, La Rotonda 1, Luxembourg, (May – June 2007). The essays in the exhibition catalogue were translated from French to English by Birgit Lemaire-Pohland, Wesley Trobaugh and Taal Ad Visie.

<sup>27</sup> Interviews and video footage are available online mainly on the Royal Opera House archived website page for the ballet *Carbon Life* (<http://www.roh.org.uk/productions/carbon-life-by-wayne-mcgregor>), where documentation of Wayne McGregor's devising process for the collaborative work he did with Gareth Pugh and musician Mark Ronson is held. Additionally, an interview with Giulia Tonucci has been revealing to me in terms of McGregor's interests and processes in relation to wearable technologies and garments, specifically Pugh's designs for *Carbon Life*, which he is attracted to work with (<http://www.digicult.it/news/lexicon-for-dancing-an-interview-to-wayne-mcgregor-on-carbon-life/>).

<sup>28</sup> Bradley Quinn has published widely on wearable technologies in fashion contexts. For some of his earlier writings on wearable technologies in relation to the fashioned augmented body see Quinn (2002), and Quinn (2003).

<sup>29</sup> Susan E. Ryan's book, *Garments of Paradise* (2014) includes a chapter on what she calls 'critical dressing' (Ryan: 2014: 193-227), suggesting that design of wearable technologies can assume a tactical role of critiquing proprietary industries, on the one hand, and advancing greater awareness of 'motivated' dressing (225) and social performativity, on the other. Her study excludes investigating wearables as 'pure performance' in the context of theatre (7).

<sup>30</sup> Sabine Seymour is Director of the Fashionable Technology Lab at The New School for Design, Parsons, New York City and CEO of Moondial, consulting to companies worldwide on wearable technologies. She has been active in the field of fashionable and wearable technologies for two decades. Her company Moondial is concerned with the convergence of fashion, design, wearable and wireless technologies and develops fashionable wearables in addition to consulting on the subject. For a wealth of examples from the first few years of this century see: Seymour (2008).

<sup>31</sup> In addition to the merger of the garments and technological devices, Quinn does postulate about the significance of the emotional side of wearing such ‘future fashions’. Relating to the experience of fashion, he suggests that: ‘Future fashion will deliver more than a technological portal; garments will be inextricably intertwined with our experience of wearing them’ (2012: 32). In more concrete terms, the encounter of clothing via the senses and its stimulatory affect on our senses to ‘activate a range of cognitive processes that spark our experiences’ (32; 35) are considered in relation to other areas of design where ‘multisensory products’ are explored in relation to multimodal in store and retail experiences (sound, touch, smell etc.) for a more positive brand experience.

<sup>32</sup> There are a number of research laboratories attached to academic institutions where fashionable ‘wearables’ are under exploration such as Hexagram (<http://hexagram.concordia.ca/>), the Centre for Research-Creation in Media Arts and Technologies at Concordia University, Canada, which also houses the XS Labs founded by Joanna Berzowska (a design research studio working in the field of electronic textiles and responsive garments), and the V2 Institute for the Unstable Media in Rotterdam (<http://v2.nl/lab/research>), an interdisciplinary centre for art and media. The *fashioningtech* website (<http://www.fashioningtech.com/>) is also a useful source of information on new experiments in wearable technologies some involving ‘sounding’ concepts.

<sup>33</sup> Documentation of Di Mainstone’s *Human Harp* projects available at: <http://humanharp.org>.

<sup>34</sup> Documentation of Ellen Fullman and the development of her *Long String Instrument* available at: <https://www.youtube.com/watch?v=Uq9AFRMWLTU>.

<sup>35</sup> <http://sonami.net>.

<sup>36</sup> Documentation of Laetitia Sonami in performance with ‘Lady Glove’ available at: [https://www.youtube.com/watch?v=C8GqbS2w\\_Lg](https://www.youtube.com/watch?v=C8GqbS2w_Lg).

<sup>37</sup> It is important to note here, that the term ‘character’ as I use it in this thesis does not seek to connect to a notion of psychological realism driven by narrative in theatrical production. Indeed, such complexity of representation and embodiment by an actor is not featured in the research inquiry undertaken for this project. Rather, I adopt the term character to connect to characteristics of movement and sounding – the choreosonic. Characteristics that are stimulated via a process of intertwining of a dancer and her wearable such that the dancer becomes transformed into a sounding-movement character in the performance space.

<sup>38</sup> Documentation of Ellen Fullman’s exploratory 1980 walk with her *Metal Skirt Sound Sculpture* available at: <https://vimeo.com/channels/1017437/45207205>.

<sup>39</sup> The seminal critical studies of the Judson Dance Theatre were written by Sally Banes (Banes 1983; Banes 1993); for a vigorous political and aesthetic reinterpretation of the legacy of the Judson’s postmodern minimalist dance, see Burt 2006.

<sup>40</sup> <http://www.benoitmaubrey.com/>.

<sup>41</sup> <http://www.pamelaz.com/>.

<sup>42</sup> <http://www.bodycoder.com/>.

<sup>43</sup> <http://www.foundation-langlois.org/html/e/page.php?NumPage=485>.

<sup>44</sup> For a media-archaeological history of instrument manipulation, modification and destruction, see Kelly (2009: 83-86).

<sup>45</sup> <http://www.see-this-sound.at/print/work/107>.

<sup>46</sup> <http://www.daniellewilde.com/swing-that-thing/hipdisk/>.

<sup>47</sup> See: Wilde and Birkmayer (2004) and <http://www.daniellewilde.com/embodying-interaction/ange/>.

<sup>48</sup> An extensive online bibliography of interactive electronic systems and instrument design in music and performance had been available at: [www.sensorwiki.org/doku.php/isidm/introduction](http://www.sensorwiki.org/doku.php/isidm/introduction). The archive was developed by the ICMA Workgroup on Interface Design and coordinated by Brazilian composer Marcelo M. Wanderley. The section on Interactive Art and Dance-Technology was initiated by American composer and instrument builder Curtis Bahn (Rensselaer Polytechnic Institute) who directs the ensemble Interface (<http://www.arts.rpi.edu/~bahnc2/interface/>). Wanderley's comprehensive overview, 'Gestural Control of Music', created for the International Workshop on Human Supervision and Control in Engineering and Music, is also significant, and available at: <http://recherche.ircam.fr/equipes/analyse-synthese/wanderle/pub/kassel/>.

<sup>49</sup> <http://synchronousobjects.osu.edu>.

<sup>50</sup> At the SenseLab based in Montreal, Canada, founded in 2004, its founder Erin Manning together with Brian Massumi have also considered William Forsythe's 'choreographic objects' along with the work of other choreographers in the formulation of their ideas on 'affect'. See: The SenseLab, defined as 'a laboratory of thought in motion' (<http://senselab.ca/wp2/>).

<sup>51</sup> I attended a presentation by Alexandros Kallegias and Yosuke Komiyama at London's KINETICA Art Fair 2012 on their 'tensegrity design' projected for interactive, moveable canopy structures for a public square in Greece. The tensegrity design uses new materials made of innovative bimetal/artificial muscle material that can flex and bend, and such architectural vision is to some extent indebted to the recent developments in materials science and intelligent textiles. For some of the milestones in materials and textile research, see Tao (2005); Quinn (2002); Braddock Clarke and Mahoney (2005); Brownell (2006); McCann and Bryson (2009); and Braddock Clarke and Harris (2012).

<sup>52</sup> For example: *Move: Choreographing You* (2010-11); *Building the Revolution* (2011-12); KINETICA Art Fair (2012); *Bauhaus: Art as Life* (2012); *Sound art: Sound as Medium of Art* (2012-13). Catalogues published on the occasions of these exhibitions have offered rich material supporting my investigations for the practice.

<sup>53</sup> Einav Katan-Schmid, in his study of sensual and mental emphases of movement, describes proprioception as a perceptual bodily feature, not merely sensation, enabling the performer to maintain (inner) balance and control through self-awareness of movement derived from muscles, tendons, and articular sources, as they are related to each other (2016: 54).

## CHAPTER 2

### **Design-in-Motion: Designing Movement/Moving Design through an Intermixture of Tactility and Sonority**

In this chapter, I will begin by setting out the fundamental ideas guiding my design approach for the project, which links the work of the fashion designer to the dynamics of the moving body and the emergence of movement in dance through material interactions. *Design-in-motion* is the phrase I use to describe this reciprocal strategy, where movement in performance can be orchestrated through the affective potentials of dress and the activity of wearing, whilst design can simultaneously be advanced through its exploration relationally to the dynamics of the moving body. The term *affective wearing* is one I have coined for the project to describe the influence wearable design can have on the process of making dance. I will be defining this more fully in the chapter and how I am using the term *affect*, supported in doing so by the writings of Susan Kozel and social psychologist Margaret Wetherell. But before this, I will discuss the idea of movement expression linked to a performance methodology of material interactions not limited purely to dance, or dance and fashion, but also to actor training, as utilised by performer and visionary teacher Jacques Lecoq as an optional part of his pedagogy.

Moreover, a key intention for the chapter is to interrogate specifically the dynamic relations between dance and fashion to more precisely situate my own work. The notion of collaborative approaches to movement is thus predominantly examined through this lens and incorporates analyses of two acclaimed choreography and fashion examples previously mentioned in Chapter 1, namely: Merce Cunningham and Rei Kawakubo and Michael Clark and Stevie Stewart. They reveal particular ways in which fashion has become intertwined with movement concepts for the dance. Furthermore, it is important to turn to how my developmental processes link the dynamics of wearing and movement in dance to the activity of sounding. The chapter thus also aims to outline my methodological and stylistic approach to *wearable sound* and the choreosonic: a series of wearable prototypes devised and performed within DAP-Lab's immersive interactive scenarios enable gestural movement to generate sonic textures that link the dance to the noise music genre.



I intend to briefly interweave a counter perspective on the dynamic agency of dress in dance, arguing against the viewpoint that costume should not aim to interrupt or influence the flow of movement but rather conform to it. A particular viewpoint my research project does not align with, and I am not alone in my rejection of this perspective, as reflected in the rapidly shifting landscape concerning costume for dance/performance, and what it can do. This is witnessed in the recent emergence of dedicated research platforms such as *Critical Costume*, a biennial conference and exhibition initiated in 2013, and the newly established biannual journal *Studies in Costume and Performance* (2016). Research in costume is thus being placed more centre stage, although the notion of costume co-creating movement in dance is not entirely new, as I have illustrated in Chapter 1 and will further interrogate here.

## 2.1. The Design Approach

As a methodological approach, *design-in-motion* specifically situates wearable design at the core of the movement process in mediatised dance, whilst simultaneously placing the dynamic body of the dancer at the core of this design process. The intention of such a design-led approach to dance, and movement-led approach to design, is to discover more fully design's choreographic potentials and potency as movement initiator in interactive scenographic contexts, whilst allowing movement considerations to also stimulate the design process and, furthermore, sonic composition. However, as a practice-based researcher coming from fashion design, I do not claim to possess either an in-depth theoretical or technical knowledge of dance/interactive dance nor of theatre costume. Rather, dance and wearables represent two of the major artistic and research fields, alongside sound and fashion, which my project fundamentally aligns with. In terms of a more precise positioning relative to dance, my work is situated within the broad spectrum of contemporary dance or physical theatre, and does not associate itself movement wise with more classical forms such as ballet, where a specific technical vocabulary of movement, rigour, proficiency or virtuosity are necessarily dictated by the genre.

Here, movement is approached from the perspective of the fashion designer investigating how wearables or more precisely body-worn performance design in the form of garments and accessories can motivate a dancer to move in certain ways. Through such dynamic movement-design processes, I thus consider the interrelationship between wearable design and performer behaviour/movement in space, and propose ways in which my own dynamic

and sounding design strategies can influence choreographic and composition strategies to alter the processual dynamics of design for performance. Furthermore, I aim to establish a new interactive design-dance dialogue through the collaborative work I do with DAP-Lab.

Accordingly, I design for the project always through movement and with movement and sonorous expression and interactivity in mind, as essential characteristic of the form and content of my performance wearables. As identified in Chapter 1, my focus in design's relation to movement stems from early twentieth century experimental dance involving an amalgamated exploration of movement and costume/material artefact, evidenced in the work of Schlemmer, with his sculptural material constructions used to choreograph movement, and Fuller's physical and flamboyant interactions with cloth and lighting – her body transforming into butterfly, lily, and other natural phenomena such as fire. Moreover, it aligns with the expressive and integrative aspects of Modern Dance of the same early era when dancers would choreograph their own works and often also design and fabricate their own costumes, which in certain instances would become intrinsic to the dance and the transmission of its emotional expressive content. Such was the case with Martha Graham in early Modern Dance: she was adept at interlinking techniques of costume creation, narrative and music into her works concerned first and foremost with the primacy of movement and emotional meaning, for example in her well-known *Lamentation* (premiered in 1930).

In my integrative methods for DAP-Lab's performances, costume is similarly conceptualised as intrinsic to the compositional and expressive processes for the dance. These methods, however, do not involve the dancer directly in the fabrication of costume in the way Fuller or Graham may have done, and the notion of transmission is something altogether different, involving the dancer in sounding out her movements as partner to the dance. I will be discussing this notion further below and then within the context of the specific interactive performance works *UKIYO* (Chapter 4) and *for the time being* (Chapter 5), which form the two case studies for this research (see also Chapter 3).

## **2.2. Physical Movement and Material Interactions**

In terms of material performance techniques and the dynamic and creative processes involved in my particular design approach, the pedagogy of Lecoq is of specific interest.

Firstly, as the methods he employed in his actor training interlinked the experience of movement in and through the body with the realm of the emotions (Bradby 2006: xiv). Significantly, he wrote on the emergence of movement that arises primarily through bodily experience and interactions that:

Each emotive state leaves traces within us that lay down ‘physical circuits’, which stay in our memory. This is where the impulses that will turn into gestures, attitudes and movements are organized. (Lecoq in Bradby 2006: 6)

His statement, appearing in *Le théâtre du geste* (‘the gestures of life’ [first published in 1987]), emphasises the enduring nature of emotive or affective states and their potentials to orchestrate movement in the body. These are ideas I am interested in and that resonate with in my next section (2.3.) where I propose a process of affective wearing as conduit for the emergence of movement. This is a conduit that is a motivational and sensorial method of performance linking to a notion of actions shifting relationally to an ongoing flow of affectivity and changing subjective states as proposed by Wetherell (2015: 147), where, as she previously argued affect can be seen to be perpetually “‘turned on” and “simmering”, moving along...” (2012: 12).

Secondly, Lecoq is of particular relevance to my studies for the ‘body-based’ method of devising theatre he employed at L’École Internationale de Théâtre Jacques Lecoq in Paris. The emphasis in the school was placed on: 1) The emergence of expressive movement minus the stimulus of a playwright’s text; 2) The performer’s body in motion generating a ‘text’. This underlined the agency of the actor and the force of their unspoken expression in theatrical contexts. Notably, while *UKIYO* and *for the time being* both have a libretto generated by DAP-Lab co-director Johannes Birringer, the emphasis in each case has been placed on allowing movement expression to emerge first and foremost through via the costume and (sounding) wearable interactions undertaken by the dancers. This notion of material interactions brings me to my third specific area of interest in relation to Lecoq. As the website L’École Internationale Théâtre de Jacques Lecoq (2017) explains, in 1976 Lecoq created the Laboratoire d’Étude du Mouvement (LEM) in Paris with architect Krikor Belekian to conduct movement studies with objects as extension and optional part of his pedagogy.

Furthermore, these training methods for mime and physical theatre utilised experimental, plastic objects – masks, portable structures and dynamic costumes – to be animated through movement interactions. Fabricated by the mover, the material constructions were

then set in motion via interactions with their maker and in turn exerted their own influence on the rhythms through time and space. In other words, the body was articulated in movement, not dissimilarly to the performer body in Schlemmer's experimentations, through the objects, in an exploration of the spatial and bodily architectures. These workshops, originally designed for students of architecture at l'École Nationale Supérieure des Beaux-Arts in Paris were directed by Belekian until 2011, and today by architect and stage designer Pascal Lecoq. In addition to providing actors with optional supplementary training, they are also open to international artists and researchers. Many of the objects produced today are portable but some are also wearable on the body and aim to change the body dynamic through the material interactions. This is a concept of animation that is central to my own design intention where the thinking body is encouraged to discover its own 'physical circuitry' and expressive movement style through engagement with the materiality of things.

In 2006, costume-based scenographer and scholar Donatella Barbieri discussed what she calls the connections between the corporeal and plastic arts based exploration embodied by the LEM as offering new potential routes of enquiry for costume based performance projects within pedagogical contexts (Barbieri 2006: 112).<sup>1</sup> Like Barbieri, I am interested in the expressivity of the body in movement and, early on during the formation of the DAP-Lab, formulated this as significant to the process of costume development and vice versa.<sup>2</sup> But in my case I incorporate a technological and sonic dimension to the wearable and develop ideas within interactive and immersive contexts, a dimension not considered at the LEM. In both case studies for this project, involving immersive performance spaces, I have searched for rhythms and counter rhythms – dynamic and sonic, that: 1) Are set in motion through the interrelationality of body and material design-in-motion; 2) Extend outward to the scenographic space as interactive and affective gesture and whole-body movement; 3) Create movement phrases and sonic textures that can be used compositionally. My aim is that the momentum of the visual, tactile and sonic design interventions animate the dancer by exerting their own dynamic influences whilst the dancer in turn animates not only the dress but also her performance environment with sound and in some cases projected imagery (*LeavesWoman*). I will return to these ideas in Chapters 4 and 5 when I discuss my research practice in greater detail.

### 2.3. Affective Wearing – A Process for Movement-Design

The phrase *affective wearing* refers to the *affects* of a multi-sensorial – visual, tactile and aural – wearing experience on the emergence of corporeal expression in the two interactive dance performances described in Chapters 4 and 5. Specifically, it connects to a predominantly non-verbal activation of movement-sounding character through the utilisation of embodied and perceptual techniques as primary means in the evolution of the individual dancer's performance. Design strategies involving tactility and sonority, together with the visual dimension, thus aim, via a responsive and intertwined developmental dance making process, to facilitate the evolution of a physically individuated visible, audible and dynamic movement character. Movement and sounding specifically are intended by design to be inextricably linked in the emergence of choreosonic performance that unfolds without a musical score and via sensory means rather than causal relations.

In Chapter 1, I discussed the latent affective potentials of technology and body-worn designs to extend and augment the sensory, perceptual and expressive systems of the wearer through interrelated movement. Moreover, I introduced Brian Massumi's construct of bodily extension as a two-way process between body and thing and foregrounded his philosophical argument on the inseparable connections between movement and sensation in the production of qualitative difference (see Chapter 1, section 1.2.1.). Now, I apply those same philosophical thoughts to my own ideas on movement-design with dancers and the affects of material tactility and sounding. Through attention to listening and touch, acting as primary movement instigators for the sentient dancer, the unfolding of the dancer's movements intertwines with the simultaneity of her experienced sensations and sonic outputs. Her costumed-body is thus understood to feel as it moves-sounding, and move as it feels-sounding, thinking through its entirety in *movement-listening*, whereby the feelings invoked in her body unfold as actions (Massumi 2002:1) and thus can be argued to influence her dance through an entwined and emergent process.

According to Kozel whose work with sound and wearable devices I also introduced in Chapter 1:

Affect is the term that refers to the more liminal and less clearly defined qualities of experience. Affect is frequently reduced to emotion and this is a good starting point but affect can refer to the domain of impressions, intuition, memories, imagination or even the feeling that hangs in a room [...] Affect is what is conveyed in-between the words or gestures – it is the unspoken. Sometimes, it falls between the senses too or it goes beyond them. Affect is also a sort of exchange of forces between people or between people and objects. The outer world and the structures are also part of it. It has been called a ‘shimmer’ or a ‘ripple’ in affect theory. (Kozel 2013: np)

Kozel is proposing such intangible and transitory notions of affect in relation to her thoughts on phenomenological inquiry as methodology for creating both content in an artistic/research context and reflecting on it in creative and critical modes, proposing ‘the idea that phenomenology can access more subtle emotions, affects and liminal qualities’ (2013: np). She is therefore aligned in her philosophical approach to Sheets-Johnstone who I mentioned in the context of improvised dance in Chapter 1. Kozel’s statement in many ways, and particularly where she highlights ‘affect’ as an exchange of forces between people and objects, exemplifies how I am using the term in this project – as dynamic, and pertaining to sense perception and matter, where its palpable force oscillates and transfers between bodies and between bodies and things. Furthermore, I subscribe to Kozel’s notion that affect lingers in the interstitial spaces of the experiential realm of felt bodily intensity for the dancer and is thus often hard to access or specifically define, entering silently in-between words and actions of the dancer’s perceptual body. In Chapter 3, further defining my methodological approach for the project, I will discuss the work in relation to aspects of Kozel’s phenomenological approach, as method to begin questioning the ‘relations between practice and theory revealing a deep entanglement between the two’ (2013: np).

As outlined above, I propose the affective activity of wearing in this project to be unfolding naturally, whereby the dancer’s movement states unfurl in the performance space relationally to her perceptual experiences, and over time. This particular proposition I have substantiated so far using Massumi’s notion on the complex infolding and unfolding interconnections between movement and sensation. Yet, as I noted in my previous section (2.2.), I am also interested here in drawing attention to the unfurling nature of the subject in this project, and turn to Wetherell for this. In her relatively recent proposals for an affect theory grounded in qualitative empirical research and situated, ‘embodied meaning-making’, Wetherell states specifically that:

Affective activity is an ongoing flow [...] of forming and changing bodyscapes, *qualia* (subjective states), and actions constantly shifting in response to the changing context. (Wetherell 2015: 147)

With regard to what she is suggesting here, and linking back now to Lecoq's ideas on 'physical circuits', I am particularly drawn to the notion of an ongoing flow of shifting subjective states – *qualia* – responsive to a changing context, which in my case I suggest is a flow augmented through the perceptual and affective activity of wearing. When performed physically and sensually within the interactive space (movement and sensory perception intertwining), this technique of affective wearing, I argue, can lead to new sounding bodily articulations and sonic textures in the performance-making process.

Thus, I propose convergences between design and the body in motion, and that the dynamic activity of wearing can be understood as an ongoing flow of 'affective activity'. Wetherell refers to the affective being an 'activity' in her 2012 publication *Affect and Emotion: A New Social Science Understanding*. In an opening chapter, she acknowledges the 'huge surge of interest across the social sciences in the study of affect' (2012: 2). In my readings of Wetherell, I realise that I cannot claim to study affect to the levels of a social scientist or a psychobiologist for that matter. Moreover, this is not my intention when I use the term *affective wearing*. Rather, I am inspired by what Wetherell is saying when she explains that there is currently a decisive paradigm shift in the 'turn to affect' towards process-based perspectives away from current conventions of critical theory, disembodied talk and texts, in order to expand the scope of social investigation. This interests me in the context of my own *design-in-motion* approach which explores embodied and sensory experience and what that might reveal in terms of affective patterns which, as Wetherell explains, can relate to many different contradictory, interweaving and modulating elements: 'Somatic, neural, phenomenological, discursive, relational, cultural, economic, developmental, and historical' (2012: 14).

At DAP-Lab, and in this project, I transition from design to dance and back again, the wearable as the medium I tender. The wearable is brought to rehearsal processes for movement and sound composition, for choreographer and dancers to engage with in relation to the overall scenography and dramaturgy of our shared performance work. Birringer generally works on the scenographic architectures, to which my wearables provide inspiration and support when we develop the dramaturgical principles for the

productions. The scenographic architecture, or *mise en scène*, has advanced in the context of contemporary dance and theatre practices. No longer merely referring to set design but incorporating digital and virtual dimensions into the spatial actions, scenography mixes spaces, real and projected, into merged environments (Chapple and Kattenbelt 2006; Birringer 2010a; Wiens 2010). With their added dimension of sounding capabilities, my design interventions seek to create certain tensions between disciplines. With their multiplicity, they are not meant to be easy but rather provocative and frequently complicated, rendering complex the relations between body, dress and space, thus challenging the dancer in new ways. Yet, they aim to offer movement suggestions as well as limitations often via the restrictions they pose since they must be navigated as must the performance space.

The TatlinTower (head)dress for instance, worn by dancer Helenna Ren in *for the time being* (2012 and 2014), is a weighty yet fragile metal construction, essentially requiring an upright body posture and alignment (see figs. 63-65). A certain equilibrium and slowness of movement is thus demanded to effectively activate its presence in the performance space. Its sounding is quiet and monotonous. Such are the qualities and restrictions Ren must negotiate. She seems to understand, and I am assisted here by Massumi's explanation of 'walking as a controlled form of falling' (2015: 12), that to navigate movement, she must first 'throw off' her equilibrium then regain her balance. Moreover, Ren understands that in order to further amplify her sound and thus make her characteristic sonorous presence more auratic and pronounced to the audience, whilst also transmitting her sonic textures to the musician for compositional purposes, she must move within the range of one of the condenser microphones positioned in the space. I discuss this prototype together with Ren's performance in detail in Chapter 5.

As a design researcher in this field, one of my aims is to gain insights and understanding on how best to construct such design provocations through my own total immersion and intimate working method in the performance space. I describe this further in my next chapter on Research Methodology. Another key aim is to conduct analyses of the dancer's movement behaviours in costume, observing closely through her gestures and interactions:

- 1) How she begins to embody her wearable
- 2) How she moves and is moved by the wearable in and through the performance space – sounding;
- 3) How her character manifests both in terms of sounding and movement.

Furthermore, since the intention for me is that the wearables form part of a fused collaborative process of movement and sound



generation, rather than be worked in parallel, I question specifically how the wearable contributes not only to the dancers' individual performances, but to movement development and choreographic structure of the performance as a whole.

The dancers/performers I have worked with in my particular movement-design research come from different parts of the world – China, Japan, Korea, Thailand, Czech Republic, Spain, Portugal, Greece, Italy, France, The Netherlands and the UK. Rarely have they emerged from the same cultural or movement heritage or for that matter possess comparable levels of physical capability. This is not important to my research work; rather, what is important is not that the dancers share the same universal commonalities, but embrace the same openness to the notion of affective wearing and somatic experience influencing movement style. Some of the dancers and performance artists I work with command very high levels of technical craft and bodily knowledge; others are self-trained artists or come from different backgrounds (visual art, music) revealing distinctly alternative movement styles. Many have commented to me in our informal conversations that they particularly enjoy the tactile stimulus I provide as it offers a refreshing new way to explore movement and challenges them physically and intellectually in ways they had not imagined. For dancer Vanessa Michielon, during her interactions with the material-haptic qualities of RedMicro Dress and her bodily encounter with the garment in space, limitations imposed by the garment offered new movement suggestions, some associated specifically with sounding of cloth in an analogue sense (see Chapter 5, p. 172).

In an interview with Michielon (I will include portions of this interview and our other verbal and text based exchanges in Chapter 5), she appears to confuse affect with effect several times. This raises questions about whether those affects are palpable and understood, or able to be articulated. Yet, rather it seems she means one and/or the other, where for her there is essentially not much separation but rather a co-experience and existence of the affective/effective in relation to 'wearing' and the somatic. Michielon's responses reveal that for her, wearing intertwined with movement and performance studies could have both an affect and an effect.<sup>3</sup> She locates or senses the 'experiential' aspects of wearing as something concrete and yet fleeting. A displacement of weight, multiple rotations of the elbow, a slow and subtle bending of her knees, powerful striding movements across space transforming to tiny micro movements etc., – these effects of touch and kinetic sensibility lead to a visible reorganising of structures that are also felt affectively in her body. This intermingling of the affective/effective that arises through the dancer's own conscious movement reflections highlights to me that what I am calling

‘affective wearing’ in the context of this thesis and my own design approach could equally mingle and be interchangeable with the term ‘effective wearing’.

Another dancer, Miri Lee, commented specifically on being able to express her imagination when exploring one of my more recent wearable prototypes, BeakHandSpeaker, in an improvised form of dance, stating:

Actually, I don't really have much experience of performing with this kind of wearable... but I like to use objects such as these that happen to express my imagination instantly with ideas on making composition, especially improvisation performance. (Lee 2015: email)

Additionally, in an informal conversation with dancer Marc Nukoop, he confided that my sounding designs not only encouraged him to find new ways of moving to activate the designs, but also offered him a way to advance his own movement style. He explained that movements such as arching the back in an extreme fashion, for instance, to create a strong connection between the garment and the flesh to activate the sound, could be taken and re-worked independently of the wearable.<sup>4</sup>

## 2.4. Movement in Dance

### 2.4.1. Collaborative Approaches to Movement

Since *design-in-motion* cannot by its very nature function in isolation or outside of the performance context, I now turn my attention to the notion of collaboration in dance making as a means to generate new kinaesthetic and kinaesonic<sup>5</sup> possibilities. The strategies and collaborative methodological approaches of choreographers to innovation and the evolution of movement are varied and many. On the use of new technologies, choreographers such as Wayne McGregor and William Forsythe (see Chapter 1) have turned to interdisciplinary collaborations across the arts and science for a more research focused understanding of the choreographic process. Both these choreographers have explored digitally augmented human movement and artificial intelligence software as autonomous agent in dance. McGregor's *Choreographic Language Agent*<sup>6</sup> (2004 - present), for example, has evolved interactive digital objects via collaborative means to assist in dance making. The most recently developed ‘Becoming’<sup>7</sup> was used to support the creation and development of the dance work *Atomos*<sup>8</sup> in 2013.

This piece also involved the use of emotional wearable technology designed by the fashion and technology duo Studio XO mentioned in Chapter 1. It utilised their ‘XOX Emotional Technology Platform’<sup>9</sup> to map the dancer’s biometrical data (temperature, pulse etc.), and emotional algorithms (e.g. mapping excitement levels) in the dance making process. This information was then used to create three-dimensional interactive material sculptural forms for the dancers to explore in rehearsal for the development of movement expression. Furthermore, the captured data from McGregor’s dancers obtained via the ‘XOX sensory wristband’ was subsequently employed by Studio XO to evolve costumes in the form of bespoke digital skins, each construction inspired by the individual dancer’s distinct characteristics.

Thus, in part, I would suggest McGregor’s collaborative approaches to movement development in this instance adopted a methodology akin in certain ways to that of Lecoq, as described above. Namely, the utilisation of physical material and sculptural forms as movement stimulus. However, Lecoq’s approach to the optional pedagogy provided at the LEM for actor training was distinctive in the fact that it was the performers themselves who built the sculptural and interactional object, whereas in *Atomos* it was the dancer’s captured body data that provided the building blocks. In my research design, the particular material performance technique I employ, involving wearable movement stimulus for dancers, whilst not requiring the dancers to build their own sculptural forms, or utilise quantitative data from their biofeedback, seeks to incorporate qualitative data from the dancers in an iterative process of prototype development.

Furthermore, with the collaborative approaches for the emergence of movement and sounding in the two DAP-Lab productions (*UKIYO* and *for the time being*, the intention, as I have outlined, is two-fold. It connects to movement and it connects to sounding where: 1) Choreography and wearable design intersect intimately and dynamically to shape the dance; 2) Sound design and fashion design converge in the development of wearable instruments (to be worn and activated by dancers in motion) for new compositional possibilities in interactive performance. Wearable design, thus, becomes an active agent in both the movement and the sound compositional processes which will be discussed further below and in the context of the two performances. In respect of composition pertaining to movement, the choreographer (Birringer) and dancers (introduced below), engage with the dress as a key aspect of the dance – the wearable design offering new material and

procedural strategies for both parties to embrace in the evolutionary stages of the dance and choreographic formation.

#### 2.4.2. Fashion and Choreography

In Chapter 1, I discussed collaborative relationships between choreographers and fashion designers whereby movement implications are presented by the garments, e.g. William Forsythe and Issey Miyake, Russell Maliphant and Alexander McQueen, Michael Clark and Stevie Stewart, Wayne McGregor and Gareth Pugh, Merce Cunningham and Rei Kawakubo, etc. In terms of the latter and theorising these garments from a fashion perspective, Francesca Granata's recently published book *Experimental Fashion: Performance Art, Carnival and the Grotesque Body* (2017) has a chapter devoted to Rei Kawakubo entitled 'Fashioning the Maternal Body: Rei Kawakubo'. Here she examines Kawakubo's subversive approach to padding the body in her spring/summer 1997 collection *Body Meets Dress* and subsequent collaboration with Cunningham for the dance *Scenario* (premiered at Brooklyn Academy of Music in 1997), arguing that this allows for a reformulation of the body to invoke the maternal (2017: 8). Claire Wilcox on the other hand refers to Kawakubo's padded garments as either exaggerating or completely deviating from the anatomical female form (2003: 32). Interestingly and by complete way of contrast, Caroline Evans (2003: 268-269) sees Kawakubo's collection, with its asymmetrically arranged goose down padding amplifying parts of the body – upper back, shoulder, hip and buttocks – as a re-interpreting by Kawakubo of a body traumatised by industrialisation to one envisaging multiple future possibilities.

What Kawakubo had produced, according to Evans, were a series of 'speculative prototypes, or an experiment in rethinking the human creature' (269). New technologies such as computers, mobile phones and personal stereos had begun to invisibly extend the parameters of the 'post-industrial' body and its consciousness in the 1980s (269). One could thus speculate, proposes Evans, that Kawakubo's padded extensions for *Comme des Garçons*, with their multiple protrusions and metamorphic potentials:

[...] were simply a series of poetic speculations on the theme of embodiment in the modern age. They began to sketch new possibilities of subjecthood, a subjecthood which was not concerned with containing the body but with extending it, via new networks and new communications. (Evans 2003: 269)

Thus, Kawakubo, according to Evans, was creatively anticipating the future of our bodily form in connection to technology. Her garments were conceptual thoughts externalised and materialised – what Evans terms ‘speculative prototypes’ or ‘poetic speculations’. Granata’s comments I suggest, are not too dissimilar in certain ways, when she proposes that Kawakubo’s garments allowed ‘for a remapping and reassessment of the self and the relationship between self and other... (2017: 46).<sup>10</sup> This notion was strongly felt emotionally as well as physically by the dancers who wore Kawakubo’s garments in Cunningham’s dance, who reported it to be both an unsettling and also liberating experience (49). Furthermore, as Granata goes on to explain, the exploration of body boundaries in Cunningham’s costumed dancers are most evident in the duets (49). She qualifies:

In the final section, immediately after the dancers change from black costumes into red ones, one of the dancers gives a puzzled and curious look at another dancer in the midst of a solo. At times observing, at times following her movements, his reactions seem to suggest a familiarisation and remapping of his own body and the body of the other. It reaches its climax as the two start dancing together and the male dancer lifts the female dancer into the air, creating unexpected shapes, where a viewer cannot quite tell where one body ends and the other begins. (49-51)

Here Granata describes two costumed bodies merging physically in motion, generating morphing forms, one body impacting the dynamics of the other in a remapping of one into two. It is an idea I explore primarily through the sonic and the aural rather than visually, in *for the time being* (2014). Here, two dancers perform a duet of transformational sounding in relation to proximity and distance: Vanessa Michielon in RedMicro Dress and Angeliki Margetti as the Futurian wearing her sounding ChestPlate. This particular dance and its iterative stages of development are discussed extensively in Chapter 5 (see sections 5.3. 5.3.2. and 5.6.3.). My approach here to fashion and choreography is distinctly different at the same time. In my case, the wearables comprise a major and integral part of the choreographic, movement and sound compositional processes, introduced at the outset of the making of the dance. In the case of Kawakubo and Cunningham, the music and the choreography were developed separately<sup>11</sup> from the costumes, the three elements only brought together at dress rehearsal (Granata 2017: 51). Cunningham operates on the basis of separateness of the various media in a performance. Thus, in the case of his dancers, they would not know about the costumes when the dance was created and there is hence no interdependency as this project proposes.

In terms of Evans, the speculative notion of Kawakubo as futurologist – her garment-bodies, so to speak, signposting a morphing body in a technological and networked future – is still exciting twenty years on. It is especially so in the context of this research project where I contemplate the incorporation of material and technological extensions to the bodies of dancers to facilitate an expanded reach in the performance environment impacting movement and sounding. As I have outlined in Chapter 1, our bodies are becoming expanded, developing relationally to digital and networked technologies. Moreover, as I have also previously highlighted, both the choreographic process and the dancer's body have the potential to be extended by the alternate and transforming visceral and virtual realities on offer. This is the framework in which I work in this project.

Thus, according to both Evans and Granata, Kawakubo's garments for the dance *Scenario*, derived from her 1997 *Body Meets Dress* collection, were both conceptual thoughts and material artefacts-in-motion when worn by Cunningham's dancers. In reinterpreting her designs from a fashion to a dance context for Cunningham's company, Kawakubo was attentive to the dancers' needs; seams were re-inforced and the garments given more stretch through a recommissioning of the Orimono Kenkyu Sha Fabric Company (Cutler and Tomasello 2015: 90). Yet, interestingly, according to photographer Mary Manning (2017: np) in her writing on the 'Merce Cunningham Trust' website,<sup>12</sup> watching a recent recital of the dance revealed to her that one of the dancer's costumes restricted her arms and this had an influence on the movement choreographed for her. This remark reveals to me, the importance of close-up observation and intimate relations with dancers, as I also experienced it throughout my research investigations and the analysis of a dancer's kinaesthetic ways of animating her extended garment-body and the visceral connection of the costume to the dance.

An altogether different positioning of garments in the choreographic process can be seen in *Gravity Fatigue* (2015), staged at Sadler's Wells, which represents fashion designer Hussein Chalayan's debut into the production of dance. The theatrical work is described as his 'first self-directed dance performance' (Morby 2015: np), in which he was assisted by (rather than collaborated with) Belgian choreographer Damien Jalet to produce this dance work.<sup>13</sup> Based on my own observations at the performance, Chalayan utilised a variety of design strategies to engage movement, such as stretch garments, in his 'Elastic Bodies' section, designed to extend and work between two dancers' bodies as a duet of push/pull, balance and counterbalance; long elegant dresses that appear to cling to magnets on the floor shape-shifting in the process in 'Rise Disembodiment', and dresses reminiscent of his

2001 folded paper airmail dress, in the ‘Delayed Presence’ section.<sup>14</sup> Much of the movement is noted to have been developed subsequent to Chalayan presenting Jalet and the dancers with the garments (Morby 2015: np), in a process Jalet describes as being in reverse of what he would normally do. He simultaneously acknowledges – from his past experiences<sup>15</sup> – the ability costumes have to generate dialogue (not sound or noise)<sup>16</sup> in the choreographic process and to alter the body and the perception of it (Jalet in Morby 2015: np).

#### 2.4.3. Sustained Collaborative Relations

Cunningham’s work with Kawakubo represents one type of collaborative method between choreographer and fashion designer. Some contemporary choreographers on the other hand, such as Michael Clark, who position the aesthetics of costume as integral ingredient to their dance, engage in ongoing and long-term creative partnerships with individual fashion designers to foster a sustained dialogue between their two artforms (see below). During his time at the Black Mountain College, Cunningham did however participate in sustained collaborative relations with fine artists such as Robert Rauschenberg, who also would create performance wearables for his dancers. The *Aeon* (1961) belt, for example, was a performance object created by Rauschenberg for Cunningham’s dancer Carolyn Brown. It consisted of a piece of rope with an assortment of objects attached – a left and a right shoe (although not a pair), a hat, an aluminium can containing a small ball, etc., and explored new modes of sound creation involving movement and wearables. It has been described by Abigail Sebably as a wearable collage of found objects, possessing sculptural, sartorial and aural qualities (2015: np).<sup>17</sup> On the choreographic process, Sebably explains that although customarily Cunningham did not accommodate the limitations of costume in his movement processes, the belt required a choreographic response from him (2015: np).

Michael Clark began collaborating with fashion designer Stevie Stewart for the creation of costumes in 1984, and this relationship still endures. In her introduction to *Fifty Contemporary Choreographers* ([1999] 2011), dance critic, author and choreographer Deborah Jowitt describes Clark’s work as ‘a mix of ballet-born vocabularies with pop imagery’ (Jowitt 2011: 14). Thus, Clark was challenging established structures, and more precisely, existing movement systems, fusing tradition with the new. Similarly, BodyMap, the fashion label Stewart co-founded with David Holah in 1982, was exploring new

experimental territories, its creations perceived as fresh and exciting, encapsulating the characteristic innovative spirit of 1980s London fashion (Bethune 2013: np).<sup>18</sup> Moreover, Rebecca Arnold refers to BodyMap as ‘eclectic’ (2001: 10). It can therefore be said that Stewart possessed a similar sensibility to Clark from the outset, enabling her to produce a characteristic design aesthetic that correlates well with the themes of many of Clark’s productions including most recently: *Come, Been and Gone* (2009); *animal / vegetable / mineral* (2013) and *to a simple rock ‘n’ roll... song* (2016).

In *Come, Been and Gone*, with its central themes of popular music, the flamboyant androgynous garments of Stewart complement Clark’s extrovert style – generating not only a strong and shared dynamic visual statement, but also simultaneously supporting and complementing the dancers’ movements kinetically, through their construction. As to the latter, I noted for instance horizontally striped jackets, pertaining to the tailored elements of the 1980’s, worn by dancers in the finale to David Bowie’s *Jean Genie* (1972): they had an element of stretch and offered further freedom of movement for repeated arm rotation via the openness of underarm seams (fig. 13).



Figure 13. Dancers perform in *Come, Been and Gone* by choreographer Michael Clark, Edinburgh International Festival, 2009. Photo © Jeff J. Mitchell/Getty Images Europe.

Additionally, I observed that with such close and integrated working relations as Clark’s and Stewart’s,<sup>19</sup> costume and design features can become responsive to movement and transformable in the choreography, audacious one moment, submissive the next. The comment from Zoë Anderson’s review below reflects this, when she discusses dancer Kate Coyne’s performance in *Come, Been and Gone*, to The Velvet Underground’s 1967 track



*Heroin*, wearing one of Stewart's specially crafted costumes. Furthermore, in such close working relations between fashion designer and choreographer, costume has the potential to allude to subtexts and narrative, as Anderson also suggests:

With *Heroin*, Clark could be commenting on his own drug history. The backdrop lifts, showing Kate Coyne appearing from the depths of the Barbican Theatre's backstage area. Her costume, designed by Clark and BodyMap's Stevie Stewart, is stuck all over with syringes. They flatten as she lies down, folding herself into angles. (Anderson 2009: np)

Here key design features, i.e. several whitened syringes injected into white half tennis balls, adorning the surface of Coyne's white stretch bodysuit, stand proud of her defined body contours, buoyantly bouncing, then instantaneously yielding to her movements, flattening beneath her folding body form. These analytical and physical thoughts I base on my own experiences of watching the performance and my knowledge of material properties as a designer. Interestingly, despite Clark's close working relations with musicians and visual artists as well as fashion designers, the actual costumes are not active in the generation of music or sound in productions such as this one. Furthermore, whether the costumes can be regarded as having been designed with the specific intention of influencing movement is difficult to determine – not all collaborative ventures involving fashion and dance are necessarily conceived or constructed in this way. Rather, it may also be viewed as a necessary conforming of fashioned costume to movement and, moreover, to the requirements of the choreographer's vision for the dance and the dancer's movement. This is a viewpoint Valerie Steele's *Dance and Fashion* (2013) foregrounds (see further below).

## 2.5. Wearable Sound

The concept of *wearable sound* for the project relates to the dancer's movement and micro-movements in costume having the potential to generate sound. It is another fundamental aspect of this research. The performer interacting with the costume or *choreosonic wearable* in space achieves such effects through various modes of activation of the integrated technological features – sensors, speakers, microphones, contact mics etc. – and is transformed into a dynamic sounding instrument-body. Yet, when I refer to the dancer's body as an instrument-body, I am by no means referring to the body in the metaphorical sense of interpreting it as an 'instrument', in the sense that Elizabeth Grosz

discusses (1994: 8): ‘a tool, or a machine at the disposal of consciousness, a vessel occupied by an animating and willful subjectivity’ (Grosz 1994: 8).<sup>20</sup> Neither am I using the term to steal away agency from the dancer’s body in an argument of mind/body opposition; nor do I attempt to enter into philosophical debate on ‘the body’ in this thesis. Rather, when I link body to instrument, it is in the musical sense, specifically related to electronic sounds and with the act of sounding in mind, the dancing body acquiring new modes of expressivity extended by the sound and without passivity implied. Likewise, when I discuss the sensory and experiential aspects of movement and sounding as initiators of new dance, I am not positioning the body as merely biological object understood only for its organic and instrumental functioning but rather for its ability to behave interactively and productively. These ideas will be discussed more concretely in my practice chapters.

Audio technologies and wearable technologies converge in my design practice, which takes key inspiration from the developments in sound art practices and electro-acoustic music of the twentieth and twenty-first centuries. Additionally, through an understanding of the characteristics and parameters of the technological interface systems, the dancer can manipulate the sonic textures. For example, simple hand and arm gestures can stop, start, amplify and distort sounds where sensor systems (transmitting to laptops and dedicated software) are involved, whilst the movement of the entire body can transport sound via speakers located on the performer and amplify it through microphones positioned in the space. The turn of a performer’s head can alter the sound emitting motion of an oscillating spring, whilst a partnering with other movers – exploring proximity and distance – can be sensed both physically and aurally. The dancers listen to their partnering; the audience *hears* the partnering.

Voice can also be received and transmitted, sampled and re-emitted via recording devices in the dress and so on. Technical accoutrements are not just aesthetic surfaces (on the dress) but become instruments on the body, instruments of the body, both functional and dysfunctional. Performer and dress combine operating akin to the *intonarumori* of Luigi Russolo (mentioned in Chapter 1) – his experimental musical instruments which collectively became his Futurist noise machines – insomuch as the aim is to generate and combine sounds rather than musical tones, to create what Russolo in his manifesto *L’arte dei rumori – The Art of Noises* ([1913] 1986), had imagined as a ‘noise harmonium’ of many different timbres, such as the ‘rustler’, ‘burster’ or ‘croaker’ (Brown 1982: 47). Composer, performer and musicologist Luciano Chessa (2012), suggests that: ‘The intonarumori is not an instrument that produces noises by imitation: the noise that the

intonarumori produces at the beginning of the transformation process is only raw matter awaiting elevation by the artist-creator' (140). I suggest that the same is true for the sound textures generated through wearable performance in this project; they are raw matter awaiting elevation to sonic-music compositions through remixing techniques of the sonic artist. As sound artist Brandon LaBelle explains:

A recorded sound could be objectified and scrutinized, magnified, repeated, re-recorded and played back so as to hear all of its hidden and potential details, uncovering the inner dynamic nestled inside every instant or particle of sound. (LaBelle 2006: 26)

In such scenarios as these, as I will show in this thesis, the dancer perceives the effects of the tactile and auditory stimuli, i.e. the touch of the garment or accessory shifting in relation to the sounds she understands her movements to make, her gestures vibrating the space sonically. The dress becomes a new interface for musical expression as sounds 'fuse with the sensorium as a whole' (Kahn 1999: 3). There are also instances in the work where the sound textures generated by dancer and wearable are deliberately kept as raw noise, without that more complex remixing techniques were used.

The concept of audible costumes emerged through an evolutionary trajectory of my first working with body-worn sensors and interactive digital performance (often focused on the manipulation of visual digital media output (*Suna no Onna* [2007-08])). At this point I was working with a composer (Oded Ben-Tal) who contributed tightly composed musical scenes, rather adhering to a purist vision than expressing an interest in live synthesis and unpredictable sonic occurrences that might be initiated from outside their control. Yet, I gradually began to realise through my experimentations, and new collaborations with sound artists not concerned with compositional purity, that subtle gestural movements of the body and new choreographic techniques revealed sounds that could be released and digitally processed from material textures, which would ordinarily be silent in their static state. I wanted to exploit these for their disruptive and yet creative potential: the scratching of the finger nails against a garment made from a stingray skin with the vibration of its tiny bones amplified I had previously noted (*Suna no Onna* [2007]); the small whirring sounds from two tiny wrist-worn speakers (figs. 14-16) connected to microcircuits activated through gesture (*Bourdon* 2011 [see Appenxix 3, p. 254.]),<sup>21</sup> or the distinctive slapping sound of a leatherette cloth (*RedMicroDress* 2012) vigorously animated by the dancer, moving in sharp angular motion suggested by Rodchenko's revolutionary posters of Russian vanguard woman from the early part of the last century (see Chapter 5).



Figure 14. *Bourdon* - Wrist speakers in collaborative development by Michèle Danjoux, musician John Richards and dancer Sosana Marcelino, Interaktionslabor, Germany, 2011. Video still © Interaktionslabor/DAP-Lab.



Figure 15. *Bourdon* - Sosana Marcelino explores the wrist speaker prototypes, each with inbuilt circuitry, accelerometer and tilt switch for motion sensing, attached to her left and right arms, Interaktionslabor, Germany, 2011. Video still © Interaktionslabor/DAP-Lab.



Figure 16. *Bourdon* - Gestural action with wrist speaker activating/de-activating tilt switch to make or break the sounding circuit, Interaktionslabor, Germany, 2011. Video still © Interaktionslabor/DAP-Lab.

## 2.6. The Shifting Research Landscape

As I have highlighted above and in Chapter 1, the premise that costume can orchestrate body movement in dance or become intertwined with the movement in a form of transformational wearing is not new. Nor is the idea that garments can offer shape-shifting potentials to the performing body via material embodiment (see my comments on Kazuo Ohno in Chapter 1[section 1.5.2.]), as well as through their structural properties – silhouette, proportions, design features, tactility, technologies etc., and physical materiality. Indeed, as Barbieri (2012) explains, one only needs to refer to some of the historical costume designs from the early twentieth century such as those created by Sergei Diaghilev for the Ballets Russes or Mikhail Larinov for Sergei Prokofiev's ballet *Chout*, where costume formed a key part of a period of artistic renewal, to understand its true significance (2012: np). In contemporary contexts, projects such as *MOVEment*, staged as a collaboration between AnOther Magazine and Sadler's Wells (London) in 2014, are positioned as providing an inspiring and timely update of the long-standing dialogue between fashion and dance in relation to the camera and the medium of film (Collins 2015: np). The project, devised by Jefferson Hack, co-founder and editorial director of Dazed Group, included collaborations between a number of fashion designers and choreographers: Prada/Tanztheater Wuppertal, Gareth Pugh/Wayne McGregor, Calvin

Klein/Julie Kent with Jonah Bokaer, Iris Van Herpen/Russell Maliphant, Chalayan/AyaBambi and Ryan Heffington, Alexander McQueen/Marie-Agnès Gillot and Stephen Jones Milinery/Jasmin Vardimon.<sup>22</sup> Whilst not about the ‘live’ element in performance as is the case with my collaborative work with dancers/choreographers, the result was a visually stunning series of performance pieces commissioned for the screen.

Contemporary fashion’s influence on the body’s actions in different artistic contexts was acknowledged in the touring exhibition *Dysfashional*, first shown in Luxembourg (2007), and its accompanying publication (by the same name) which I touched on briefly in Chapter 1. As stated by one of the curators, Luca Marchetti, the purpose of *Dysfashional* was as ‘a reaction against a “literal” notion of fashion, as uni-dimensional collections of clothing and accessories’ (Marchetti and Quinz 2007: 6). As part of the exhibition, five choreographers were asked to explore ‘complicated’ garment designs and re-invent gestures of dressing/undressing in a form of striptease. This, according to Marchetti and fellow curator Emanuele Quinz revealed a capacity of clothing to suggest movement in space through their physical forms and psychological actions on the body (84). As they state in the exhibition catalogue:

When a garment takes on a powerful emotional charge, it frees itself from its original function – that of providing a protective second skin – and becomes a precious object governed by its own rules. In a reversal of roles, it is the garment that dictates behaviour. Walking more slowly, avoiding sitting down, and standing straight, are just some of the constraints that a simple piece of cloth can impose on the body. It conditions the way we move, it becomes an ally or a traitor according to circumstance. (Marchetti and Quinz 2007: 89)

In this sense, the garment or costume can be argued to have agency and becomes an autonomous object. Quinz comments on this notion and on the *object as interface* in an interview appearing at the beginning of the exhibition catalogue, suggesting that the ‘zones of hybridity between subject and object are expanding. Boundaries become penetrable and the object is no longer simply an instrument or a surface of communication: it speaks’ (Quinz 2007: 6). This idea is especially important for the work I do with dancers and garments where the garment is perceived to have its own agency and performative power and the dancer is open to receive it.

Yet, over the years, as my research has revealed, and is noted by Jessica Bugg, whose design research encompasses fashion and performance and explores methods for embodied garment design (Bugg 2014: 67), clothing design for dance represents an area that has been

little documented. Moreover, limiting and often biased perspectives on a necessary subservience and adaptability of costume to performance, particularly in terms of movement possibilities, have been propagated.<sup>23</sup> Valerie Steele does acknowledge the close relations between modern fashion and dance as two embodied art forms in her introductory chapter to *Dance and Fashion* (2013: 7). However, there is little further attention given, throughout this entire edited collection, to a perspective that favours the influential role a costume can play in terms of movement and its development. Indeed, the voices of fashion designers Steele includes in her own writing, such as Narciso Rodriguez, go so far as to argue from their point of view, that costumes that cover up or distract rather than emphasise the dancer's body are 'wrong costumes' (2013: 87).

These more conservative perceptions on the role of costume in dance, I suggest, severely limit and, more precisely, diminish the potential agency of costume to affect change in any choreographic or movement sense. Furthermore, whereas Steele does briefly refer in her introduction to what she terms the 'avant-garde experiments' (35) of modernism in Paris in the early part of the twentieth century, she at no point addresses the notion of costume as co-creator of movement. Instead, she notes how experimental costume of that era might require modification or indeed be rejected by choreographers if it were considered to impede movement. Schlemmer's *Triadic Ballet* (1922) receives a brief mention here, described as yielding 'probably the most notorious example of dancers who had to function as moving sculpture' (35), thus providing almost negative connotations to the reader: Schlemmer's 'wrong costumes'. No further explanation or analysis of the costumes or their involvement in Schlemmer's movement studies for dance are given, whilst the pioneering technological dance-costumes of Fuller of this particular era receive no mention at all.

Yet, slowly, costume is receiving greater attention and recognition for its agency in performance disseminated through an expanding 'critical' discourse. The research landscape is itself dynamic and shifting; designers such as Di Mainstone (see Chapter 1), Bugg and Barbieri (mentioned above), alongside others, aim to advance their craft through practice-led research, scholarship, pedagogy and critical discourse – articulating their ideas more forcefully on the relationship between costume and performance. It thus becomes a significant time to question what it really means for costume to have critical intentions, such as assisting in the progress of making dance as is my research intention. Bugg, a fashion designer and Associate Professor/Deputy Head of Research in the School of

Fashion and Textiles at RMIT University, Melbourne, has been exploring the convergences between dance and dress for some years now in her design research practice. More recently, as she states in her article on ‘Dancing dress: Experiencing and perceiving dress in movement’ (2014: 67), she has focused on the dancer’s experience of wearing garments in movement (69). In her particular approach to dress in the context of the dancing moving body, Bugg aims ‘to develop an understanding of the role of dress in dance by focusing on the sensory, embodied experience and perception of the performer’ (67), whilst her intention is ‘to propose developed methods for designers across clothing disciplines to contribute in a meaningful way to the overall dance work’ (67).

Recent publications such as the special issue of *Scene* on ‘Critical Costume’ (2014), edited by academics Rachel Hann and Sidsel Bech, are beginning to ask more questions about this performativity and agency of costume. ‘Costume is critical. It is critical to making performance [...] critically overlooked within scholarship’, note Hann and Bech in their opening paragraph for the journal (Hann and Bech 2014: 3). Danjoux (2014b); Dean (2016) and Barbieri (2016a) address this notion and are particularly concerned with advancing practice. It is not, however, entirely clear whether Hann and Bech mean that costume is critical for the making of performance or that design can transport (self) critical perspectives on fashion.<sup>24</sup> Moreover, newly emerging journals such as the biannual *Studies in Costume and Performance*, founded and lead edited by Barbieri,<sup>25</sup> provide a dedicated platform to further promote the generation and dissemination of knowledge in what Barbieri and fellow editor Sofia Pantouvaki call ‘a nascent field of research’ in their editorial for the inaugural issue of the journal (2016b: 6). Thus, in research contexts the transformative powers of costume are becoming more fully recognised, addressed and supported as costume takes centre stage,<sup>26</sup> whilst the characteristics of design and the influence of the sensoriality of wearing on movement in performance are also becoming more studied.<sup>27</sup>

*Design-in-motion* is situated in the moving landscape I have just outlined, where the affectivity of wearing specially designed sounding costumes is studied for its potential impact on the way movement emerges in two specific dance performances. It therefore proposes to assist the progress of making dance through a design-led approach that has critical intentions in this new arena where costume fashioning is intent on developing a philosophy of its own within theatrical and media arts contexts. It challenges hierarchical and reductive dance-fashion perspectives such as those presented in Steele’s book on the



subject, examining the impact of garments and wearable technologies on the performing body. Not confined to purely creating ease of movement, yielding to or enabling movement, this thesis project foregrounds complex costumes in the choreographic process. In my work, costume will not be relatively unnoticed/invisible in regard to the dancer's shape or (out)line of movement execution, as can frequently be the case in contemporary dance where movement choreography seeks not to be impeded or tailored by costume, but it will be understood as an essential presence and movement impetus.

## 2.7. Conclusion

In this chapter, I have laid out the fundamental ideas guiding my *design-in-motion* approach and explained the notion and reciprocal nature of affective wearing and choreosonic wearables as motivator of movement-sounding in dance. My intention is not to seek a form of compliance within the dancer to the costume or impose a 'kinetic destiny' on the dance via dictatorial design means, as is suggested by Sally Jane Norman, Professor of Performance Technologies, in her commentary on Schlemmer's work:

The *Triadic Ballet* costumes were considered as programmatic entities, bearing within themselves their own temporally spatialised finality or kinetic destiny, through design that enforced the expression – or extrusion – of specific choreographic forms. For example, the awkwardly encased diver's bouncing steps were accentuated by pompom-weighted fringing around his torso, giving him a drolly graceless allure. The Spiral Dancer executed spinning-top fouettes across the stage whose spectacular diagonals were dictated by her dark lacquered skirt and spiral headpiece with contrasting edging [...]. (2015: 29)

Rather, I seek a more democratic design approach to movement, where new restriction offered to the body that has agency, in the form of a wearable that sounds when activated by the dancer, might simultaneously provide a liberating stimulus for the dance. Furthermore, I have substantiated and underpinned my ideas on the dynamic relations between dance and fashion and material interactions by way of examples whilst also providing a counter argument to the notion of 'wrong costumes'. Additionally, I have linked my design methodology to sound and auditory relations, explaining briefly my trajectory in terms of conceptualising the sounding/choreosonic elements of this research

project. Finally, I demonstrate how the research landscape for my type of practice-led investigations into a distributed agency between costume and movement is shifting and securing a more widely raised profile. I will now go on to explain more fully my research methodology for the project in the next chapter.

## Notes

<sup>1</sup> The LEM was adopted by Donatella Barbieri as part of the pedagogy for the MA Costume Design for Performance at London College of Fashion. In its ten years of existence, the programme has generated performative, interactive, tactile and dynamically spatial costumes for performance: <http://www.arts.ac.uk/fashion/courses/postgraduate/ma-costume-design-for-performance/>.

<sup>2</sup> Barbieri's workshop entitled *Wearing Space: physical exploration through movement and objects* at the Prague Quadrennial (2015 [pq/cz/en/program/spacelab-2015/workshops/costume-design]) demonstrates her ongoing pedagogic interest in LEM methodologies and their value to a costume-led performance making process. The workshop aimed to reveal the symbiosis between movement and material expression, and was conducted together with movement practitioner and writer Mary Kate Connolly, experimental costume designers Guilia Pecorrari and research assistant Helen Rogers.

<sup>3</sup> This physical and palpable act of wearing might thus 'result' in something but equally, it might 'influence' or 'make a difference to' (<http://blog.oxforddictionaries.com/2011/03/affect-versus-effect/>) the dancer both physically and psychically.

<sup>4</sup> Marc Nukoop's comments were made following an e-textiles 'Dance and Sound' workshop I attended in October 2014 at STEIM, Amsterdam, and in relation to the 'ConductiveCoat' prototype I developed (originally described in a separate chapter of the thesis, which was cut due to space limitations but is projected for publication in *Routledge Companion to Dance Studies*, edited by Helen Thomas and Stacey Pritchett).

<sup>5</sup> 'Kinaesonics' is a term used by musicians Julie Wilson-Bokowiec and Mark Bokowiec in their work with the Bodycoder wearable for sound exploring the intertwining relationship of body and sound from the musician's perspective. They discuss their work in co-authored publications (Wilson-Bokowiec and Bokowiec 2006; Wilson-Bokowiec and Bokowiec 2008).

<sup>6</sup> <http://waynemcgregor.com/research/choreographic-language-agent/>.

<sup>7</sup> 'Becoming' is a digital object developed in collaboration with digital artist Marc Downie (OpenEnded Group) and software architect Nick Rothwell (Cassiel).

<sup>8</sup> <http://waynemcgregor.com/productions/atomos/>.

<sup>9</sup> <http://www.xoxemotionaltech.com>.

<sup>10</sup> Granata notes this in relation to her ideas on Rei Kawakubo's garments as representations of the padded maternal and extended pregnant body in her chapter entitled 'Fashioning the Maternal Body: Rei Kawakubo' (2017: 36-53).

<sup>11</sup> Merce Cunningham and musician John Cage, his lifelong collaborator, are both renowned for this independent way of working. It links to the notion of indeterminacy and chance happenings which were core concepts to both their individual work and their partnership.

<sup>12</sup> <https://www.mercecunningham.org>.

<sup>13</sup> Documentation of this process where a fashion designer choreographs a work, assisted by a choreographer, is available on the Sadler's Wells website: <http://www.sadlerswells.com/whats-on/2015/hussein-chalayan-gravity-fatigue/>.

<sup>14</sup> Alice Morby's 2015 feature on *Gravity Fatigue* in *Dezeen* assisted me further with my analysis. See: <https://www.dezeen.com/2015/10/30/hussein-chalayan-gravity-fatigue-first-dance-production-london-sadlers-wells/>.

<sup>15</sup> Damien Jalet has previously worked with Givenchy's creative director Riccardo Tisci and performance artist Marina Abramović and choreographer Sidi Larbi Cherkaoui in the opera ballet *Boléro* (2013).

<sup>16</sup> Since my choreosonic wearables aim to disrupt the status quo of interactive dance performance-making and sound composition in this project, I also use the word 'noise' here in a more metaphorical sense of something which might disturb or disrupt something else.

<sup>17</sup> As was the case with Cunningham and Cage's collaborative working practices, Cunningham and Rauschenberg also did not share the same physical space but rather worked independently during their development processes; Rauschenberg also acted and performed as choreographer himself, for example in the unconventional *Pelican* piece (first commissioned in 1963 for the Pop Festival in Washington D.C. and enacted again in New York in 1965, including Carolyn Brown) in which he and Alex Hay 'danced' on roller-skates both wearing large parachutes on their backs.

<sup>18</sup> The work of BodyMap was featured alongside other experimental fashion designers from the 1980s alternate London fashion scene at the Victoria and Albert Museum's *Club to Catwalk* exhibition in 2013.

<sup>19</sup> I was able to gain insights into Stevie Stewart's and Michael Clarke's working relationship and processes through conversations I had with a professional work colleague Paul Rawson. Rawson, who is Programme Leader for the BA(Hons) Fashion Design course at Middlesex University, London, has worked as assistant to Stewart for the last six years.

<sup>20</sup> Elizabeth Grosz makes this statement in her introduction to *Volatile Bodies: Towards a Corporeal Feminism* (1994) whilst discussing the various detrimental lines of thought that she suggests may have been seen as the 'heirs to Cartesianism' (8). Here she explains that in one particular model of thought, the body is instrumentalised as a tool of consciousness and animated by a willful subjectivity (8), thus lacking its own responsive agency and ability to perceive.

<sup>21</sup> *Bourdon* was a midway development and exploration of a sounding prototype in the form of wearable wrist speakers with integrated amplifier and circuitry incorporating accelerometers and tilt sensors. It took place between the two case study performances *UKIYO* and *for the time being*, and was developed during a two-week residency at Interaktionslabor, Göttelborn, Germany in August 2011: <http://interaktionslabor.de/lab11/index.htm>.

<sup>22</sup> For film footage of these collaborative films, see: <http://www.anothermag.com/fashion-beauty/7275/about-movement>.

<sup>23</sup> This was the case at a 'Fashion and the Performing Arts' symposium I attended several years ago in London (2010), when I was first embarking on my PhD study. Costume should offer 'facility of

movement' to dancers was the resounding opinion at this event and few of the delegates were challenging this. 'Stretch is beneficial to dance', stated Jane Dalgarno, deputy head tailor of the Royal Opera House whilst discussing the Lycra component of the costumes in choreographer Jonathan Watkins' dance performance *As One* (2010). Many of the presentations and discussions during this event claimed that the main aim from the costumier's point of view was to find ways for them not to complicate or encumber the dancer's movement in performance.

<sup>24</sup> In this context of a notion of 'critical costume', I should mention that Rachel Hann invited me to exhibit work in the first exhibition she curated under this title (before the publication of *Scene*): *Critical Costume: Towards a Vocabulary of Scenographic Bodies*. A Symposium and Exhibition, 17-18 January 2013, Edge Hill University.

<sup>25</sup> The journal *Studies in Costume and Performance* is edited by Donatella Barbieri, Kate Dorney (Lecturer in Drama at the University of Manchester), and Sofia Pantouvaki (Professor of Costume Design for Theatre and Film at Aalto University, Finland).

<sup>26</sup> Barbieri also curated 'Costume in Action' at World Stage Design, Cardiff in 2013 (together with Pantouvaki and fashion curator Matteo Augello), bringing together, as it is suggested on the event's website, 'the most up-to-date thinking about costume to the unique gathering of designers, students and scholars'. Available at: <http://www.wsd2013.com/scenofest/costume-in-action/>.

<sup>27</sup> The *Somatic Movement and Costume Project*, for example, led by interdisciplinary performer, performance maker and teacher Sally E. Dean (<http://www.sallyedean.com/about/sally-e-dean/>), explores the notion of kinaesthetic body consciousness in relation to performance practice and what is worn. The aim of the project, according to Dean, is 'to create a praxis whereby costumes act as a somatic resource for moving, creating, teaching, performing and being, a resource that leads into multi-sensorial experiences' (2015: 156). Somatic Costumes™ for the explorations are designed collaboratively with visual artists and costume designers Sandra Arroniz Lacunza, Carolina Rieckhof and Marta Jiménez Salcedo, all graduates of the MA in Costume Design for Performance course at London College of Fashion. Dean also published an article connected to her research interests in somatic movement, costume and performance in the inaugural issue of *Studies in Costume and Performance*, entitled 'Where is the body in the costume design process?' (2016: 97-111).

## CHAPTER 3

### Research Methodology

This chapter explicates more fully the practice-led *design-in-motion* method I have developed for this thesis, which is dynamic, relational and interdisciplinary in nature. It is a method intended on investigating the impacts of choreosonic wearables on dancers' movements and the way sound is generated in the two live interactive performance case studies featured in this thesis – *UKIYO* and *for the time being*. The aim here is also to explain specifically the exploratory, integrative and phenomenological methods I have used to obtain data and provide research insights. It describes a predominantly qualitative research inquiry where I situate myself and the wearable designs I create, not just at the core of a movement process in mediatised dance, but rather more centrally within a processual framework of performance-making that involves musicians/sonic artists, choreographer, 3D computer engineers/designers, media artists, filmmakers together with the dancers. The design prototypes are posited as critical to the shaping of the performance. The chapter thus highlights a methodology that can activate and analyse this notion, where wearable design strategies emphasising forms, materiality, palpable tactility and sonic vibrational qualities can operate not purely as movement initiator for the dancer but moreover offer challenges to the compositional apparatus.

It is proposed that such initiation and provocation to the wearer do manifest that the design prototype has choreographic consequences for the artistic production as a whole. In other words, I have come to understand the design prototypes as instigators (enabling, encumbering, suggesting, intimating, suppressing, etc.) of versatile but specific movement responses the dancers in the DAP-Lab have offered during the choreographic process, a process where designer, choreographer and the dancers themselves share the authority of creation.

The above brief outline is a crucial aspect of the research design and methodology applied here as a whole: the principles for the *design-in-motion* process encompass the main theatrical dimensions of a dance composition created by the DAP-Lab ensemble,

interrelating the choreosonic wearables as both sonic and choreographic instruments which fashion, so to speak, the movement articulations of the dancers who become *sounding characters*. The garment prototypes therefore are conceived as character prototypes (which have iconic and narrative subtexts), and the movement possibilities suggested by the wearables affect the choreographic expression as well as the sequencing of scenes, in the same manner in which, for example structurally, a sonic composition or a dance concert may alter the dynamics or tempi of the movement and thus shift attention. I have also observed how some choreographers use verbal stimuli or instructions to generate movement; others may show or indicate gestural phrases inviting the dancers to explore and develop them. In a similar mode, I propose sensory methods and design techniques to touch and move the dancers in certain ways expanding their physical thinking and also making them curious to inhabit the design.

### 3.1. Research Design

Methodologically, *design-in-motion* not only affects movement vocabularies and sound diffusion techniques in the theatre but foregrounds the materiality of design research: it places the artefacts, processes and articulations centre stage in the search for new knowledge. Materials are used for the construction of the prototypes but also for the effects, and the affective feedback, they can produce. The questions that guide the research position the wearables at the start of a performance-making process. Here begins the testing phase which is at the same time a ‘sounding’ process as well as a movement activation. The dancer develops performance techniques for generating the choreosonics in character, and within real-time interactive scenarios where, for example, their gestures may also affect the digital projections (through camera interfaces, as with the case of GraveDigger in *for the time being*).

As discussed in Chapter 2, the interactivity involved in the choreographies created for this research effect sonic output and subtle dimensions of acoustic and electronic sound in motion. Composition methods drawn from new media arts, sonic and choreographic practices are thus integrated into the garment design process whilst both analogue and digital technologies are utilised in the conceptualisation and realisation of design for responsive performance. Without necessarily wanting to imply that the dancers are musicians or the musicians are dancers, it holds true for the work developed by DAP-lab that performers articulate the choreosonic wearables with distinct awareness of the double

role. A dancer may for instance become a vigorous and energetic scratch performer of cracked media, with noisy and discordant sonic outputs, as in the case of Anne-Laure Misme and the WorkerWoman prototype in *UKIYO*. Equally, she might slow down into an infolded, butoh-like movement, as if listening to internal sensations and vibrations caused by performing her weighty metallic (head)dress (TatlinTower, in *for the time being*).

The research methodology for the project utilises elements of experimental design, a method used frequently in psychology and the social sciences but is also pertinent for the type of human-centered design I use in a performing arts context where emotion and affect are now increasingly studied through the lens of kinaesthetic empathy and cognitive psychology.<sup>1</sup> Concentrating on qualitative approaches, where garments and accessories are employed as experimental stimuli for the performer, I seek to better understand the impacts of my wearable design interventions as provocations on: 1) Individual performers, and specifically their movements inter-relationally to the wearable design and the performance space; 2) the interactive performance-making process that unfolds as a result of introducing the wearable design as movement stimulus at the start of that responsive process.

Empirical evidence from my direct observations of the resulting wearable performance together with feedback from the dancers/performers and collaborators constitute the main data that helped me to push the experimentations forward. The core methods are derived from my knowledge of the design processes in fashion, conceptual drawings, illustration and 3D modeling on the stand as well as working on the body directly. In addition, other qualitative research methodologies in phenomenology (Kozel 2007) and the social sciences – for example the paradigmatic case study analysis advanced by Robert Yin (2009) – were consulted and drawn from, but I do not adhere specifically to any one model. Rather, moving between fashion and the performing arts and creating my prototypes for dancers challenged me to devise my own methods suitable to exploring the influences of the material facts of design on bodily movement and the emergence of kinaesthetic gesture specific to the sound character of the garment.

Primarily, my methods were developed over, and tested through, two major phases – *UKIYO* (2009-2011) and *for the time being* (2012-2014). These two interactive performances comprise a series of context-based prototype wearable experimentations (see fig. 17) and are described in detail in my next two chapters. Each single prototype aimed to offer its own unique provocation via wearable design strategy and intervention integrating

specific design features and technologies to encourage movement and interaction for the production of sounding and sound character. Each of my prototypes is thus designed as an investigation with an exploratory motive where the focus is to stimulate movement behaviour in order to influence the emergence of choreosonic character through the material forms and aesthetics of the garment, offering techniques of restriction and palpable sensation for the wearer. The prototype experimentations produced for the two research phases and productions (shown below) use different models for the exploration of sounding garment concepts integrating technologies,<sup>2</sup> as explained in depth later.

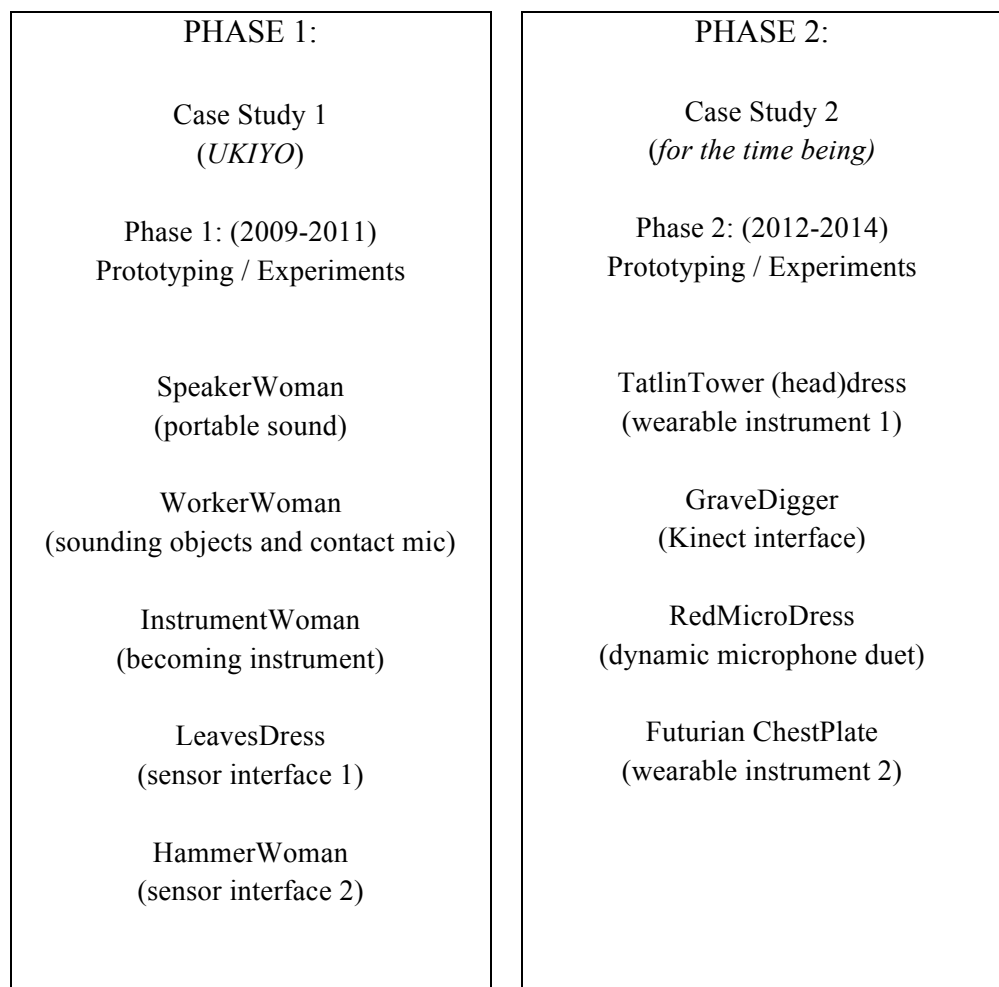


Figure 17: Research design incorporating two major case studies/performances (*Ukiyo* [2009-2011] and *for the time being* [2012-14]) and a series of context based experiments in wearable sound. Diagram © Michèle Danjoux.

*UKIYO* involves the design of sounding wearables for performance installation. The installation scenography invited close-up experiences between performers and audience members, and in some instances the dancers performed their sound characters literally only inches away from the spectators and listeners. On the other hand, *for the time being* was conceived as a dance-opera, a retro-avant-garde exploration of the notorious futurist opera



*Victory over the Sun* (1913), to be staged on the proscenium and allowing a more cinematic-theatrical perspective on the scenic rhythms and the live composition of sound in movement. In comparison to the open space installation of *UKIYO* that invited audiences into the movement area to experience a constantly shifting and resonant environment, the proscenium theatre staging in *for the time* being demanded a different style of engagement and projection of performer and sound. This influenced the design of the wearable and the wearable strategies. The development process for both performances took approximately eighteen months, and more than one version of each performance was created to further expand ideas and explore new prototypes, performer techniques and sonic outputs in the choreographic process.

Initially, primary research methods were established during a series of tests on sound (for wearables) to locate a systematic approach to the design of prototypes for movement/interaction studies.<sup>3</sup> These initial experimentations were underpinned and informed by my ongoing theoretical reading and studies of the work of other researcher-practitioners in related fields (see Chapter 1). The purpose of these early tests was to make tangible some of my conceptual thinking on designing and performing with sound as a key characteristic, and to test ideas practically and receive feedback from performers and sound artists early on in the research process. This led to several break-throughs which inspired a collaboration with artists in Japan resulting in the production of *UKIYO*. This installation was performed several times in different venues and thus also withstood the test of touring the garment prototypes and exposing the performers and their wearables to different scale dimensions of the venues where the work was shown.

Important transitional steps leading my research from Phase 1 to Phase 2, based on my experience of various electronics and performance workshops I attended (in 2011, also in subsequent years), are mentioned further below, and my test experiment with wrist speakers for *Bourdon* was already pointed out in the section on 'Wearable Sound' in Chapter 2 (section 2.5.). The design prototyping for the second large production, subsequently, was advanced to a much higher level of complexity in the period 2012-2014. This second phase sought to employ considerably more integrated methods of design involving collaboration in the development of my choreosonic wearables. The TatlinTower head(dress) and Futurian (sounding) Chestplate, for example, incorporated integrated micro-circuitry designed and built by musician John Richards; the GraveDigger prototype explored Kinect interface systems with digital artist Cameron McKirdy; and with the

RedMicro Dress, I utilised a real-time processing software (Ableton Live) in a close working partnership with musician Oliver Doyle. The aim for each of these prototypes was to incorporate a greater level of intelligence from both an aesthetic and technological perspective, therefore building on from the prototypes developed in Phase 1.

In terms of any conflict of interest and particularly in relation to the management structure of DAP-Lab and my role as researcher within the company, a necessary critical distancing was enshrined in the planning of the research project to enable independent analysis serving the needs of the research. This involved requesting support and respect of my position as a researcher within DAP-Lab by all DAP-Lab members and those involved in providing their professional and/or creative expertise to the building, development and exploration of the prototypes and advancement of the research. Furthermore, participant consent forms were completed by all research participants. Each participant was provided with a clear explanation of the research project at the outset of both phases of the research detailing what would be required of them as participants to the research. The research participants were also each given the right to withdraw without disadvantage to themselves at any point in the project and without impacting their status within the DAP-Lab ensemble. Thus, their involvement in my research project, was clearly defined as distinctive and separate to their role as a performer within the DAP-Lab company.

### **3.2. The Research Environment**

A series of DAP-Lab workshops have formed the main research environment<sup>4</sup> for me to conduct my research experiments. The DAP-Lab, primarily based at Brunel University, provided a suitably resourced space to support the research project. The interdisciplinary design and performance workshops we have conducted bring together a range of personnel with various skills, competences, interests and experience providing a rich source of collaborative potential. Hardware and software and other equipment are available for experimentation and study (sound system and mixing console, microphones, lighting, cameras, LCD projectors, motion capture technologies, sensor kits, etc.), together with suitable rehearsal space. DAP-Lab has also conducted research workshops in other locations (for example at the Interaktionslabor Götteborn, 2011 and 2013; Cynetart Dresden-Hellerau, 2013; MediaLab Prado, Madrid 2014 and 2015; STEIM, Amsterdam 2014). These multi-media workshops have allowed me to work directly with dancers,

choreographers and musicians on the exploration of choreosonic wearables, analysing the emergence of movement, sound and wearable relationally.

Furthermore, I have participated in several research residencies over the duration of this research project where I have collaborated with numerous artists from different disciplinary backgrounds. A ten-day research residency at Keio University, Japan (December 2009), two week-long residencies at Interaktionslabor, Germany (August 2011 and 2013) discussed in Chapter 5, and a four-day e-textiles workshop at STEIM, Amsterdam (October 2014) have all formed part of my exposure to new and fertile development spaces. Such hybrid environments and shared interdisciplinary contexts in specialist research spaces have provided me the opportunity to interrogate the emergence of wearable performance in different research contexts. These studies conducted over several years, and working directly with dancers, performers, choreographers, sound artists, engineers, programmers etc., have formed a core part of my research methodologies. Shirley McKechnie and Catherine Stevens note in their chapter on 'Knowledge Unspoken: Contemporary Dance and the Cycle of Practice-led Research, Basic and Applied Research, and Research-led Practice' in *Practice-led Research, Research-led Practice in the Creative Arts*, that 'a collaborative ensemble is a dynamical system' (2009: 93). The workshops and rehearsal tests conducted by DAP-Lab enable me to be a part of this type of system: placing myself as participant member and co-creator in the ensemble has been crucial to my research work and methodology.

It is important to note here, that DAP-Lab is a small not-for-profit creative research laboratory, technically more of an ensemble than a company. We are a dynamic group of people who come together due to our shared interests in exploring both artistic and research ideas and producing creative outcomes that can be showcased. The structure of DAP-Lab is essentially quite flat as opposed to hierarchical in nature. Its members are actively encouraged to contribute ideas and share their expertise and when we are working on a project, we meet approximately four to five times a term and generally at weekends. In my position, as co-founder and co-director of the lab with Birringer, my role has always been as a participant like any other member of the laboratory. During this research inquiry, I have additionally communicated with research participants independent of the lab and met separately with musicians and dancers to conduct prototyping, movement-sounding studies and case study analysis.

My investigations of some of the available literature on instrument design and human-computer interaction for this project (see Chapter 1), revealed to me that I needed more first-hand knowledge of electronics and software technologies. In direct response to this, I therefore also participated in several workshops directly related to these fields held at Brunel University's Artaud Forum and BEAM Festival (2011) as well as the Dirty Electronics labs conducted by John Richards at BEAM, the ICA (2011) and De Montfort University (2009-2014). The workshops in particular with musicians and hardware hackers have enabled me to enter their community, gaining the new perspectives and insights I required and a better understanding of what might be possible or on offer to me in terms of new instrument design. Moreover, I participated in movement workshops such as Skinner Release, karate, yoga, Qigong, Tai Chi and Artaud Method to build my firsthand knowledge of movement practices and somatics. Finally, I have published essays, written papers and presented at conferences throughout the research process to further test and advance my ideas on choreosonic wearables in performance over the course of this research project.<sup>5</sup>

### **3.3. Qualitative Research Methods and Data Collection Methods**

On a second level of this practice-led artistic design research, I have been concerned with investigating qualitative experiences of participants wearing sounding costumes in performance, combining methods such as prototyping, testing in development, observation, documenting (notes, photographs and video), interdisciplinary dialogue with sonic artists, programmers, dancers, choreographers and programmers, and one to one open discussion with dancers as a means of gathering data. The observation data was collected during the development workshops and specially designed labs I mentioned above, and through talking to dancers/performers directly – seeking to understand how they perceive their movement behaviours to have been influenced by the wearable performance design. Such interdisciplinary dialogues and documentation provide the ‘verbal data’ (Flick 2007: 147) of descriptions, analysis and reflective thought on what has been observed in the DAP-Lab workshops and during residencies. This enabled me to gather insights on visual and aural elements and the emotional, physical and intellectual stimulation to movement experienced by the dancers and how they were able to explore the space through the sounding wearables (see Appendix 2 and 5). The dancers were asked to specifically comment on how they perceived this to have impacted on their performance, their embodiment of sound and the garment, and how they developed a

*sounding moving character*. The development of sounding moving characters is a particular method I devised to explore choreosonic ideas for dance performance in a more theatrical way. They are essentially characters in performance that emerge through their movement and sound. They can then also be recognised in the performance space by their distinctive visual aesthetics, sounds and movement characteristics.

Participant observation, i.e. placing myself as researcher in the role of participant-observer, afforded me opportunity to gather ‘live data’ through the dancer’s language, utilising a form of immediate awareness and/or direct cognition as a principle mode of the research (Cohen, Manion and Morrison 2011: 456). The participant described the experience of the phenomenon of wearing sound in relation to movement and touch of the garment both visually (through actions) and verbally (through what they said). The data analysed became a form of extended field notes transformed from a ‘corpus of texts’ (Flick 2007: 78) that included verbal exchanges, photographs, video footage, email correspondence, reading and other forms of files such as those relating to sound recordings. This awareness was then used to influence my next stages of design research in line with the research questions regarding audible choreography and sounding garments. I will elaborate my role as a second-person phenomenologist below in the section on intersecting experiences when I discuss the phenomenological aspects of my work.

The diagram (fig. 18) of my methodological steps for qualitative inquiry through design prototyping and movement studies represents the overall pattern I used to test my question of how wearables can inform movement and choreographic practice, and how choreosonic wearables constitute a particular innovative avenue to test the range of the performing body as an expanded instrument. The two dance productions created with my ensemble (DAP-Lab) were also a means to further test my practice to yield answers to my research questions. Designing the sounding characters in *UKIYO* gave me substantial evidence of the potentials of wearable design to shape movement characterisation in a narrative performance context and provided the springboard for the developments I then undertook in Phase 2 (for *for the time being*).



Figure 18: Qualitative Inquiry Research through Experiments in Design Prototyping with Choreosonic Performance – case study analysis of sounding characters in *UKIYO* and *for the time being*. Diagram © Michèle Danjoux.

The project thus builds a particular form of composed dance-theatre, illuminating each sounding character and the role this character plays in the audio-visual environment of the installation or stage work. The cornerstones of this particular form, as I propose it here, are firstly the process of prototyping of costumes – involving iterative design techniques and incorporating interactive technologies and movement intelligence from dancers' bodies into the design process from the start of the composition. Secondly, as this method became central to the performance aesthetic of the DAP-Lab ensemble, the iterative design

techniques intermingle with improvisatory performance techniques that allow each dancer to find the particular articulations of sounding character and kinaesthetic awareness of their instrument. Through my observations and analysis, and drawing on some of the research I describe in Chapter 1, I modulate the instrument design and find solutions for each of the sounding characters performed by the dancers. The testing and modifications include perspectives gained from *musique concrète* and acousmatic sound art. In particular, these stem from Pierre Schaeffer's 'symphony of noises' (1948-1952), which involved improvised compositional techniques that utilised unconventional and concrete objects, i.e. material things such as rattles, vibrating metal strips, trains, alarm clocks, bicycle horns etc., as compositional tools (Kane 2014: 15). Small sections of the resultant emitted sounds or 'effects' were then recorded yielding 'sound fragments', which were then exploited for their infinite repeatability rendering them musicalised (16). These ideas encouraged me to pose questions about the nature and effects of the choreosonic wearables, namely, how the 'origin' or cause and the quality of disparate sounds and noise in movement are perceived by the listener (musician, dancer, audience), together with their compositional potential. The testing and construction process continuously builds on the experience gained within the DAP-Lab, and on the results of the critical and reflective observation tending to the data that were collected.

### 3.4. Wearable Performance

In the explorations of wearable performances I conducted, each performer was treated slightly differently in so far as their garment or wearable offered something particular and exclusive to them. This might for instance have been the ability to emit sound directly from the spine of the body via small speakers (InstrumentWoman [*UKIYO*]), manipulate sound in the real and virtual realms via body worn sensor interfaces integrated into garment (LeavesWoman [*UKIYO*]), or play a series of interconnecting circuits worn on the body as a wearable instrument (Futurian ChestPlate [*for the time being*]). Each performer therefore worked on the particular sounding character (what in dramatic theatre might be considered their 'roles') which emerged through the impact of the materials and the electro-acoustic, electronic and digital instruments on the movement behaviours, and thus the aesthetic quality of the performance composition as a whole. Matthias Rebstock and David Roesner (2012), delineate similar processes and collaborative constellations within contemporary music theatre and performance art involving digital media. My *design-in-*

*motion* research is situated within the same contexts but I expect it to feed back to fashion and critical fashion discourse as well.

Furthermore, since the research for the project consisted in its core dimensions of design for interactive performance with bodily extension, sonic elements, and electronics, it has also involved my study of two main performance disciplines that underpinned my work, namely dance and sound art. The range of qualitative approaches I used in the project for the analysis of the costumes and choreographic compositions were methods ultimately concerned with examining the aesthetic and experiential effects and affects of wearable performance design on the dancer. Ideas emerged and were tested in motion (in rehearsal) and discussed through the series of interdisciplinary workshops where I introduced concepts and ideas upfront together with images, sketches, materials, objects and prototypes for exploration. Additionally, I created PowerPoint presentations that included some of the theories I was studying for my project such as bodily extension and digital corporeal engagement (core concepts discussed in Chapter 1), and the notion of affective wearing as discussed in Chapter 2, to raise awareness and provoke discussion at the start of a workshop. During each workshop, I would situate myself centrally to the process of performance making to carry out my observations and documentation – a positioning most designers of costumes have not had the privilege to enjoy.

As practitioner and dance philosopher, Kozel pertinently suggests that the ‘body of the dancer is the site of discovery’ (Kozel 2007: xiv). This is especially true for the design research I have undertaken in this project where the movement appeal of the wearable is analysed through the dancer’s movement and gestural response, and the tactile and haptic reply. Here, I have observed and carefully registered whether the technologised forms worn on the dancer’s body have altered, enhanced or reduced her movement technique, thus enabling new expression and physical responsiveness away from any familiar movement vocabulary to emerge. I have become particularly drawn to movement expressions that do not necessarily look like dance gestures at all but pertain to a kind of lyrical interpretation of a tool or object, investing a strange, exquisite aura into a small metallic spring, a hammer, a vinyl record, a leaf, or a ceramic bowl.

The scope of the research investigation involved a number of participant dancers/performers: Helenna Ren (Chinese, classical ballet and contemporary dance), Anne-Laure Misme (French, untrained in any particular movement system), Katsura Isobe (Japanese, contemporary dance improvisation, butoh), Sosana Marcelino (French of



Portuguese origin, contemporary dance), Angeliki Margeti (Greek, contemporary dance), Vanessa Michielon (Italian, ballet, modern and contemporary dance), Yoko Ishiguro (Japanese, butoh and contemporary performance), Biyo Kikuchi (Japanese, butoh), Yumi Sagara (Japanese, butoh), Jun Makime (Japanese, butoh), Ruby Rumiko Bessho (Japanese, butoh), Hae-in Song (Korean, classical Korean kut and contemporary dance), Miri Lee (Korean, classical Korean and contemporary dance), Rosella Galindo (Mexican, contemporary dance), Marc Nukoop (Dutch, contemporary dance), Manaskarn Insang (Thai, untrained in any particular movement system), and musicians/performers: Caroline Wilkins and Emi Watanabe. Several male performers also participated in the productions (Olu Taiwo, Yiorgos Bakalos, Ross Jennings) but their costumes are not featured in this thesis. The research also included collaborative working practices in relation to the engineering and technological side of the design concepts and their realisation, and some of the sound and electronics artists need to be mentioned in particular: John Richards, Paul Verity Smith, Doros Polydorou, Christopher Bishop, Sandy Finlayson, Cameron McKirdy, Oliver Doyle, Jonathan Reus, and composer Oded Ben-Tal. This combining of knowledge, expertise and disciplines has offered me a way to more fully interrogate this emergent design field, which I understand to hold interest for designers, dancers/performers, choreographers and sonic artists alike. The contextual review (Chapter 1) revealed for instance that musicians and sonic artists have become more interested in a movement away from the computer keyboard and algorithmically generated sound (laptop performance) to a renewed interest in the gestural and how this relates to the instrument, researching gesture/movement in relation to sound and in some cases wearing new instruments on the body (see sections 1.6.3.-1.7.1).

### **3.5. Intersecting Experiences**

In addition to the design approaches described above, my methodological thinking also includes elements of phenomenology, focused on sensorial and corporeal experience, or as Kozel puts it, involving ‘a return to lived experience, a listening to the senses and insights that arrive obliquely, unbidden, in the midst of movement experiments’ (Kozel 2007: xvi). According to Merleau-Ponty, philosopher Edmund Husserl in his first directive to phenomenology referred to this as a return to the ‘things themselves’ (Merleau-Ponty 2005: ix). In regard to Merleau-Ponty’s thinking about intersubjective and intercorporeal reality, being and sensing in the world, and the chiasmic relations and viscous, in-between spaces between subject and object, performer and audience, seer and seen (articulated also

very succinctly in his late, unfinished work, *The Visible and the Invisible* (1968), it is apparent that one of my main interests for this project has been a phenomenological approach that involves hyper-reflection, a dynamic process where thought and movement can be in a state of flux. Merleau-Ponty explores this state at great length, and Kozel summarises hyper-reflection as a ‘vehicle by which concepts are drawn out of raw experience; they are sensed and intellectual connections are made, like partnerships between thought and action’ (2007: 22). Professor of philosophy and cognitive science Alva Noë, in *Action in Perception* (2006), refers to a similar notion of partnering between sensing and motion arguing that perceptual experience is dependent on movement. Both Kozel and Noë acknowledge the significant influences of Merleau-Ponty’s phenomenological writings on their work.

The hyper-reflective state ‘does not attempt to posit truths, but instead acts as a chiasmic, embodied, first-person methodology with the objectives of understanding, expressing, and extending lived experience’, states Kozel (2007: 16), where truth is better expressed as relevant action, acting, a verb form and enactment in other words, not an essence (24).

‘Performing a hyper-reflection while moving does not have to halt the process of movement; on the contrary, both can function through a state of flux’ (22).

Phenomenology as a first-person methodology functions in terms of the multi-sensory: ‘Hyper-reflection is the vehicle by which concepts are drawn out of raw experience; they are sensed and intellectual connections are made, like partnerships between thought and action’ (22). A phenomenological work can resonate within the body of the practitioner on cognitive, emotional and physical levels (24). It crosses between subjectivity and trans-subjectivity allowing experience to pass from one body to another (25) thus creating resonances between those bodies. Indeed, Kozel’s phenomenological approach builds predominantly on the work of Merleau-Ponty when proposing this notion of a sharing of knowledge between bodies. Merleau-Ponty acknowledges the inseparability of subjectivity from intersubjectivity when he states:

The phenomenological world is not pure being, but the sense which is revealed where the paths of my various experiences intersect, and also where my own and other people’s intersect and engage each other like gears. ([1968] 2005: xxii)

By way of extension, ‘heterophenomenology’ is a second-person phenomenology involving phenomenological interpretation by a situated researcher of someone else’s experience. This is where, according to Kozel, ‘the sensibility and interpretive power comes from the physical experience of the phenomenologist, in this case the second-person

phenomenologist or heterophenomenologist' (Kozel 2007: 58). Through a similar approach of first and second-person methodological perspectives I describe and interpret the experiences of the dancers I work with in my research project. Kozel uses the term 'connective tissue' relating to the physicality of the network of fibres within the biological functioning and sensing body as metaphor to facilitate an understanding of how phenomenology can be transferred from one person to others (28).

As I experience the dancer move, her internal impulses are externalised both visually and sonically, and I can record and replay her, and I can analyse stills to gain better insights – her connective tissue physically and metaphorically expanding out to reach me through what I sense and re-view. This type of method was chosen as it has been used successfully in a number of performative research contexts where the research findings might be expressed from non-numeric data and alternative forms to that of discursive writing – namely 'material forms' of practice such as still and moving images, music and sound, live action and digital code, dance, novels, and design (Haseman 2007: 151- 52). I can also ask the dancer for her own hyper-reflections on her experience of moving in costume as part of a larger production. This I have done throughout the research, both in semi-structured interviews and informal and open discussions held with the performers.

### 3.6. Conclusion

In summary, the purpose for my investigation into 'Choreosonic Wearables in Performance' has been to gain new insights into the phenomenon of *wearing sound* in relation to movement choreographies and structures of costume/wearable, and to understand better the 'felt' presence of technologies and other multi-sensorial affects of costume on the performing body. This research project is therefore predominantly concerned with advancing design practice for interactive performance where design can be a primary factor in the composition of movement and performance scenarios through playing a more integral part in the choreographic process.

Through the interlinking of practice and theory combining both concrete and theoretical interrogation of the kinaesonic and tactile connections of performing bodies to the felt corporeal presence of the costume/wearable design, the multiple research experimentations

I describe offer new possibilities for the connections between design, moving body and performance. Whilst the prototypes under investigation here are highly specific, I believe the research results can be valuable to the larger fashion, design and performance fields and their interests in better understanding the affective experience of wearing and the performative potentials for wearables. That also involves the repercussions of the practice on the research, and the research reflections and theorisations on the design practice.<sup>6</sup>

In the next two chapters, I will now discuss the realisation of my ideas in the context of *UKIYO* and *for the time being*, introducing wearable performance and the transformation of dancers into sounding characters in motion.

## Notes

<sup>1</sup> Recent studies in kinaesthetic empathy and cognitive psychology include: Reynolds and Reason (2012); Jola, Ehrenberg and Reynolds (2011); Fogtmann, Fritsch and Kortbek (2008); and Nöe (2006).

<sup>2</sup> The design aesthetics were inspired by Japanese performance culture, art and Eastern philosophies for Phase I (*UKIYO*) and Russian Constructivism and the Futurist opera *Victory over the Sun* (1913) for the second phase project, *for the time being*.

<sup>3</sup> During preproduction and production phases of *UKIYO* (2009-2011), all early tests focused on designs that explored elements of audiophonic cloth, sounding objects, portable sound, sensor interfaces and wearable speakers.

<sup>4</sup> Media artist Simon Biggs refers to the importance of the research environment where researchers work with hybrid practices in his chapter on ‘New Media: The “First Word” in Art?’ in Smith and Dean 2009.

<sup>5</sup> See: Birringer and Danjoux (2009a); (2009b), and (2013); and Danjoux (2010); (2011); (2013a); (2013b); (2013c); (2013d); (2014a); (2014b); (2014c); (2014d) and (2015).

<sup>6</sup> Robin Nelson has been an outspoken advocate of PaR methodology and its modes of ‘doing-knowing’, demonstrating how research questions in the performing arts can be rigorously worked through in a dialogical range of practices (including design) of which writing is only one, to produce substantial new insights. See Nelson 2013.

## CHAPTER 4

### ***UKIYO: [Moveable Worlds] (2009-2011) – An interactive performance installation***

This chapter examines the practice element of my research undertaken in the context of DAP-Lab's installation *UKIYO [Moveable Worlds]* (2009-2011) – an interactive performance installation and mixed reality environment, partially developed with colleagues at Keio University in Japan. Informed by a diverse range of historic and contemporary Japanese cultural practices, from traditional Kabuki theatre to butoh dance, from Hokusai to present day anime and manga, as well as Russian engineering science of the early twentieth century, the production of *UKIYO* involved a complex narrative of shifting perspectives in time and space. The European premiere of the work took place in June 2010 at KIBLA Media Art Center, Maribor (Slovenia). A more evolved and final version was performed in November 2010 at Lilian Baylis Studio, Sadler's Wells, London. The purpose and scope of this chapter is not, however, to describe the dramaturgy of *UKIYO* per se, nor to offer a detailed analysis of the workings of this performance as a whole. Rather, the descriptions and analyses hone in on the particular elements of dramaturgical exploration and development that pertain specifically to the choreosonic prototypes that reside at the core of this research.

Moreover, in this chapter I will further explore the notion of dynamic entanglement between wearable and improvised movement in interactive space – an interchange where the design prototypes are presented not purely as wearable manifestations of a particular sartorial style but as participants and active agents in the devising process, demonstrating how they can act as propositions for the dancer/choreographer. Notably, it is the animation of wearable instruments into sounding movement character I shall also be addressing. The intention is to illustrate how my particular *design-in-motion* methodology outlined in Chapters 2 and 3, utilising an intermixture of tactility, sonority and collaborative approaches, has yielded specific results both material (artefacts) and processual (the process by which movement and sounding are generated and a performance emerges). In the first instance however, the chapter outlines the rich interdisciplinary and multi-media environment in which I conducted early practice-based investigations into prototype

development whilst on research residency in Japan in December 2009. Key themes and parameters for my work are then briefly introduced, before advancing to more detailed descriptions of the main aesthetic research – Ukiyo-e; Sound Aesthetics; Retro-Futurism; Hokusai's Manga and Contemporary Anime and Manga – that provided its underpinnings. Strategies for wearable design and its relationship to the scenographic space are then discussed, in order to fully set the scene for the introduction and articulation of five sounding prototypes: SpeakerWoman; WorkerWoman; InstrumentWoman; LeavesWoman and HammerWoman.

Thus, fundamental contextual and background information relating to how the wearables have been developed and inspired is presented before shifting to describe the more concrete, three-dimensional and compositional elements of the work. In line with the intentions of this research project, all wearable designs were envisioned as aesthetic and sensory motivators of performance. It is therefore essential to discuss each prototype not in isolation as designed artefact, but interrelationally to the dancer – her movement behaviour and dynamic process of embodiment and metamorphosis through wearing, whilst also addressing her kinaesonic gestures and the notion of *sound wearability* for the overall performance installation. I do not intend to describe individual movements or sound in fine detail. Rather, one of the key purposes is to reveal, through reflective analysis of wearable performance, how the dancers' physical and sonic presence combine in real-time felt improvisations with costume – emerging as choresonic event. An outcome which is immersive, embedding the audience inside the intersecting lines of the scenographic space (see figs. 20, 23-25, 27, 31) as a direct result of the dancers' movements with the wearables.

#### **4.1. Interdisciplinary Approaches**

In December 2009, early in the research process for this research project, I attended a week-long workshop at the Mixed Reality Lab and Centre for Computing Ubiquitous Technology Embodiment (CUTE) at Keio University,<sup>1</sup> Japan, with DAP-Lab. *UKIYO* was a part-funded (Daiwa Foundation and British Council) collaborative research production developed by DAP-Lab in partnership with digital artists and researchers at Keio University in Tokyo. The cross-cultural research laboratory was directed by Johannes Birringer and coordinated in Japan by dance scholar Yukihiro Yoshida. It explored connectivity between real space and virtuality in performance. Our shared aim for the

residency was to advance initial interactive concepts and ideas for *UKIYO*. In attendance with DAP-Lab were dancers Katsura Isobe, Anne-Laure Misme, Helenna Ren, Olu Taiwo and performer/musician Caroline Wilkins, interactive media artist Paul Verity Smith, composer Oded Ben-Tal, 3D computer engineer/designer Doros Polydorou, Birringer as director, choreographer and filmmaker, and myself.<sup>2</sup> On the Japanese side there were several dancers involved (Ruby Rumiko Bessho, Biyo Kikuchi, Yumi Sagara, Jun Makime) as well as the interaction and animation designers Kabayan Takeshi Kabata, Gekitora, and Eng Tat Khoo. My wearable research was thus situated within this collective framework where the research objectives of the individual members of the DAP-Lab ensemble were dependent on their specific area of expertise and specialist knowledge: Birringer together with Isobe, Misme and Ren – interactive performance and choreography; Taiwo – code-movement, i.e. movement or choreographic ideas that have been translated into a digital medium, and gesture and the technological interface; Ben-Tal and Wilkins – sound and performing live electronics; Smith – sensor interfaces for image manipulation where, as he explained at the time, ‘the dancer becomes the editor’; and Polydorou – motion design of 3D digital objects and computer animation in interactive performance.

In terms of my own aims and objectives as outlined in the thesis, this was an important phase of personal research inquiry and intensive early design progress. My main intention, was to utilise this opportunity – the specialist facilities and rich pool of expertise – expanded by Keio University’s Mixed Reality Lab’s knowledge of interaction design, ubiquitous technology embodiment and augmented reality, to push my own research with dancers and wearables further.<sup>3</sup> The exposure to such expertise in the field of pervasive computing enabled me to explore initial conceptual ideas for wearables in a more concrete fashion through methods of knowledge exchange and practical collaborative hands-on prototyping and testing. Since the intention for *UKIYO* was to create an experimental performance that would be driven in part by the interactive costumes, this intensive working method involving dancers, and supported by others’ specialist skills and knowledge, proved to be of immense value to me in conducting early speculative design research involving wearable technologies and human computer interactions. I worked particularly closely with computer engineer and media artist Eng Tat Khoo, a researcher from Professor Adrian Cheok’s Mixed Reality Lab, who assisted me in exploring portable wireless methods of sound transmission – Bluetooth and radio frequency – with dancer Misme. These ideas were later translated into the WorkerWoman prototype and sounding-movement character Misme performed in *UKIYO*. Moreover, I was able to investigate

sensor interfaces for sound and image manipulation with Smith, Ren and Ben-Tal, and the creation of a 3D world for Isobe to build through wearable gesture, incorporating sounding, with Polydorou. The sensor explorations facilitated the advancement of Ren's HammerWoman sounding-movement character and Isobe's LeavesWoman in the Creation Scene (Act II).

## 4.2. Frame of Reference

*UKIYO* is a term derived from Japanese culture where it refers to a floating world of impermanence and indulgence, of transience and fluctuations of the Edo-period (1600 - 1867). According to Gian Carlo Calza, author of the book *Ukiyo-e* (2005), the term has a Buddhist origin and during the medieval period denoted suffering relating to conditions of impermanence. But in the seventeenth century, the character for 'suffering' was replaced by one for 'floating' and the word no longer denoted discomfort but rather pleasure and ephemerality (Calza 2005: 6). DAP-Lab adopted this term as title for its mixed reality work. The aim was to examine themes of ephemerality, but in DAP-Lab's case oscillating between real and virtual realms. In *UKIYO*, the performers performed with and through media within the programmed environment that combined a system of visualisation that had memory (machine learning) together with indeterminate behaviours. Crucially, *UKIYO* sought to explore the multilayers of sensorial perceptions in a tactile *audiovisual world*, bringing the performers in close proximity to the audience thus offering a more intimate encounter between the two parties.

The wearable concepts were a central element to the performance with prototypes operating as performative interface for the dancer. The emergence of movement in and through space was viewed as a visceral experience from the perspective of the dancer – each prototype aiming to offer its own unique palpable sensations of felt sensation (e.g. weight, texture, restriction) in wearable performance. Moreover, design statements combined physical touch with distinct sounding characteristics and visual aesthetics to produce a particularised audiophonic, amplificatory and kinaesonic wearable experience devised to motivate performance. In such integrated contexts, the wearable (which in other dance-theatre contexts might be considered the costume), I claim, can thus become the choreographic affector and stimulus transforming embodied movement into externalised forms of sounding character as described further below.



In my design research for this project, I asked: 1) How the functions and aesthetics of body-worn technologies enhance the dancers' bodily capabilities to interface with the environment as transmitters, receivers, and enablers of sensory information flow, and how I can harness these. 2) How one can develop new design processes for wearables in the context of different dance vocabularies through the utilisation of twentieth and twenty-first century analogue and digital technologies impacting on aural perception – and thus how wearability can enhance the dancers' and listeners' active *performance of the audible*.

As LaBelle notes on the atmospheric conductivity of sound which can be heard and moved between bodies as it subtly contours the physical space:

A sound appears here, and then is echoed from over there, passing from one source to another, and from one body to another; a concentration of energy is gathered, a mirroring that, while being extremely subtle, collects and accumulates into an ambient presence that contours the spatial environment. (LaBelle 2006: 305)

In relation to LaBelle's notion of sound energy transfer and the shaping of the spatial environment, I will address how the wearable strategies for this research have provoked a certain type of energy flow – and the kinds of 'echoes' evoked in the passing/passage that LaBelle suggests above – to enable a dancer's sonic presence and unique audible textures to be propagated in space. In the process of my explanations, the relationship of performer to wearable and its contribution to choreographic concept will be highlighted through analysis of wearable performance. Thus, a method of offering sounding wearable strategies as proposition to the dancer-choreographer and as stimulus for the creation of improvised movement in (interactive) space will be revealed.

### **4.3. Aesthetic Research (*UKIYO*)**

The term 'research', as I apply it here, represents the activity I have undertaken as a designer for the purposes of providing creative and conceptual stimulus for the prototypes in *UKIYO* and their development. These investigations have been concerned with the analysis and recording of both visual and textual information and the creative interpretation of these findings into design. A standard design activity in the fashion design process, in my case it has also encompassed a dynamic dimension incorporating movement influences for performance, in addition to the artistic and thematic ones to be discussed below.

#### 4.3.1. Ukiyo-e

Ukiyo-e were the prints representing a world that existed towards the end of the eighteenth century in Japan, and they were amongst the things that inspired my designs. Aesthetic research influencing the choreosonic wearable design concepts for *UKIYO* encompassed observations and analysis of both visual and sonic art worlds. Historical and contemporary Japanese artistic culture relating to the visual and performing arts provided an important and rich source of inspiration. Such as the internal shape shifting aspects of butoh dance along with traditional elements of Nō and Kabuki theatre – the latter with its spectacular exaggerated (*aragoto*) style of acting and associated ukiyo-e depicting iconic moments from actors' performances, and especially the woodcuts and engravings of Katsushika Hokusai (1760-1849). Each fueled my design thinking and the generation and exploration of ideas, and here I mean the emergence of design concepts and the methods by which they were to be materialised and explored in performance.

During my time in Japan, I had the opportunity to attend a Kabuki Performance at the Kabuki-za theatre in Tokyo. As Calza explains, it is a form of theatre that arose to satisfy new audiences in Japan's Edo period:

The Kabuki theatre is the child of a proto-modern society and it reflects the feelings and enthusiasms of the new urban classes. The austere solemnity of Nō, the ancient and aristocratic form of entertainment catering to the tastes of the medieval nobility, was replaced by a style involving dramatic and hyperbolic gesture. (2007: 48)

Attending the Kabuki-za theatre, I witnessed firsthand, over the course of many hours, the long-established traits of traditional Kabuki theatre: The exaggerated physical expression of the flamboyant *aragoto*<sup>4</sup> style of acting involving highly stylised movements and gestures – accompanied by voice and sound,<sup>5</sup> the differentiated voices of the various characters, the visual excesses of elaborate costume, hair and makeup, the drama and humour. Furthermore, the stage design – *hanamichi*<sup>6</sup> enabling the actors to advance into the space of the audience – indicated a technique that had inspired the scenographic design for *UKIYO*. This experience proved insightful and inspirational leading me to formulate sounding costume concepts and characters for *UKIYO* in a similar quirky and exaggerated manner. I envisioned a series of highly stylised characters for the exploration of the interconnectivity of movement, sound and wearable design, each in possession of their own distinctive and extreme visual, sounding and movement aesthetic. The aim would be

for the carefully crafted materiality and visceral qualities of each audiophonic costume to stimulate idiosyncratic movement behaviours in the wearer-performer for the generation and portability of their own unique sound or audible identity – leading to character development within the interactive and mutable realms (discussed below).

#### 4.3.2. Sound Aesthetics

As previously explained (Chapters 1 and 2), sound art and noise music of the twentieth and twenty-first centuries provide the key influences for sound aesthetics in my work. Moreover, the notion of more conceptual instrument design<sup>7</sup> and unorthodox extended techniques of playing, often associated with these more alternative music genres, has been significant to my own design of costumes as wearable instruments. Cage's *Prepared Piano* (first developed in 1938)<sup>8</sup> for instance, with its exposed strings and integrated objects to alter sounding, is a prime example. Moreover, the varied analogue and digital instruments of sound art and playback systems, and the notion that 'all objects that make noise can become sound instruments' (Weibel 2012: 5), further drove the sonic aspects of the designs. In *UKIYO*, I was proposing to extend sound art to also encompass the 'wearable' arts and fashion, producing a unique range of visually distinctive instruments that could be played via extended wearable means, whilst also connecting to a particular sound aesthetic. The previously mentioned *intonarumori* (c. 1910-1930) of Russolo and his manifesto ([1913] 1986),<sup>9</sup> Schaeffer's sound based compositions and *musique concrète* (beginning in the early 1940's), Caleb Kelly's writing on *Cracked Media: The Sound of Malfunction* (2009) together with LaBelle's theorisations on *Background Noise* (2007), *Acoustic Territories* (2010) and the relationality of sound were amongst the things that influenced my approach to sound and the integration of sounding concepts into costume concepts. LaBelle notes on molecular and bodily movements arising from *auditory relations* that:

Sound is intrinsically and unignorably relational: it emanates, propagates, communicates, vibrates, and agitates; it leaves a body and enters others; it binds and unhinges, harmonizes and traumatizes; it sends the body moving, the mind dreaming, the air oscillating. (2007: ix)

This notion of the propagating condition of sound and, as LaBelle puts it, 'the process by which it operates' (ix), has motivated my own explorations of this medium, and its

dynamic relationship to space, in the context of the wearable experiments in both *UKIYO* and *for the time being* (see Chapter 5).

#### 4.3.3. Retro-Futurism

Other significant influencing factors to the aesthetics of the wearable instrument designs and sounding characters for *UKIYO* were the retro-futuristic designs from the Cold War period of 1945-1970. The book *Fear and Fashion in the Cold War* (2008) by Jane Pavitt features early wearable technologies, some incorporating electronic media from the 1960s which were responding to and exploiting important technological developments and new materials with heightened functionality of the time such as Mylar, Kevlar, Teflon, Gortex and fiberglass. Examples such as Walter Pichler's *TV Helmet* (also known as *Portable Living Room* [1967]), Haus-Rucker-Co's *Environment Transformers* (1968) and Krzysztof Wodiczko's *Personal Instrument* (1969) for amplification of the world that surrounds the wearer were amongst those included. The aesthetics of these wearables with their highly visible technologies and the desire of the creators to explore these technologies in ways that 'could bring about an expansion of consciousness' (Pavitt 2008: 90) provoked my imagination. I had seen the exhibition *Cold War Modern: Design 1945-70* at the Victoria and Albert Museum, London, for which Pavitt was lead curator in early 2009 and had found many of the exhibits on display useful to my aesthetic formulations. Experimental fashion designs by Paco Rabanne crafted from unconventional materials such as plastic and metal, an Apollo Mission spacesuit, and product designs by Charles and Ray Eames and Dieter Rams were amongst these.

Designers were responding to the advancements of the Space Race and computer age which provided a means by which they could imagine utopian futures or, alternatively, express dystopian concerns (Pavitt 2008: 10). Conflict, nuclear fall-out, pollution, the threat of surveillance and issues of communication were all concerns of the day (see Pavitt 2008: 10-16). I drew parallels between the combined emphasis placed on an avant-garde visual aesthetic and functionality of the wearables and personal electronic devices of this era of change and instability – exploiting the dual and contrasting role of clothing to operate simultaneously as spectacle and tool – and the designs I was envisioning for a floating world (*UKIYO*) in flux. Hybrids of clothing and architecture, for instance, such as the spaces, helmets and clothing designed by Haus-Rucker-Co, led me to contemplate

hybrids of clothing and instruments extending out from the body to the media-enhanced performance environment as filters for media, mediators of information.

#### 4.3.4. Hokusai's Manga and SpeakerWoman (Act I)

Returning to Japanese culture, I was particularly influenced by a book entitled *Hokusai: First Manga Master*, essentially a whole series of image plates from the *Hokusai Manga*<sup>10</sup> organised thematically – ‘Landscapes’, ‘Animals’, ‘The Human World’ and ‘Mythologies’ with supporting text by Jocelyn Bouquillard and Christophe Marquet (2007). Primarily I was interested to observe Hokusai's depiction of the human body in motion interacting with tools and other objects (kettles, cooking pots, jugs, axes, bells, weapons such as guns and sticks, etc.), undertaking different activities, generating particular gestures and postures (often ironic) – extended, becoming one, in unity with these instruments. This connected to my intent to explore extensions of the performing body (see Chapter 1, 1.2.-1.2.1.). Additionally, Hokusai's drawings of animals engaged in human activities, especially ‘The secret village of the mice’ (fig. 19), where rodents transport rice balls and baskets of gold coins linked to the notion of bodies interacting with material objects in motion.

One of the methods of transportation of goods seen in these images – via baskets held at either end of a pole carried across the shoulders – was to stimulate the development of the SpeakerWoman character. This would be in terms of both the quirkiness of visual aesthetic and the portable and laden method by which the performer (Helenna Ren) would physically move her sound in and across space – through her ‘acoustic territory’ (LaBelle 2010). As moving body and instrument, Ren transports a cargo of sound via two large spherical speakers extended from her shoulders, suspended either end of a martial arts bō (fig. 20). The mythical, allegorical elements in Hokusai's work featuring such incongruous scenes thus informed my design strategies and approach for the generation of character.



Figure 19. 'The secret village of the mice'. Photo © J. Bouquillard and C. Marquet, *Hokusai: First Manga Master* (2007).

Moreover, his stylised techniques of depicting narratives and legendary figures (guardian divinities, goddesses and warriors etc.), and his representations of fantastical creatures in fictional worlds – often with supernatural or special powers – further provoked my designer's imagination. I imagined creating a series of visually distinctive and highly stylised faux mythological or legendary bodies, infused with retro-futuristic characteristics of contemporary anime and manga, and the Cold War aesthetic I had studied – each a fusion of wearable instrument and animated performing body. Furthermore, each character would inhabit their own fictional world emitting their own unique sound –materialising and transforming through an intertwinement of wearable design and bodily gestures – making audible their narrative. The individual character's narrative would be told through their sound and motion and distinctive visual aesthetic – wearing their design-in-motion.

Hokusai's method of construction as suggested by his album of preparatory drawings was to make a skillful assemblage of separately designed visual motifs drawn on small sheets of paper (Marquet 2007: 15). In *UKIYO*, the plan was to use a similar method for my three-dimensional constructions, utilising distinctive motifs connected to technologies of the sonic realm such as speakers and microphones, vinyl discs, audio cable and so on, and assemble these very visibly into wearable design outcomes as key contributor to the design aesthetics<sup>11</sup> for the emergence of sounding movement-character. When Ren first wore her SpeakerWoman prototype and started to learn how to balance the bō and handle the weight and motion of the two large speakers, one hanging from each end of the bō (like the buckets of a milkmaid), she had to learn how to carry herself in a particular manner, moving in a measured and restrained fashion, lowering her centre of gravity. Her sound was portable rather than wearable and her performance was not a dynamic *bōjutsu*<sup>12</sup> performance of rapid thrusting, swinging, striking staff, but rather a slow and careful encumbered one of bodily movements ironically burdened and constrained – rich with pathos and poignancy as one anonymous audience member confided to me of her experiences and observations.



Figure 20. Helenna Ren as SpeakerWoman (Act I), wears pvc trouser suit, shin pads and foam asymmetric hat and carries martial bō with suspended spherical loudspeakers. *UKIYO*, KIBLA Media Arts Center, 2010. Video still © DAP-Lab.

Simultaneously to carrying her weight of sound-containing spheres, Ren was generating a stylised impression of a woman in a rice field (akin to Hokusai's mice) who carries heavy baskets during her laborious task: a labourer weighed down by the spherical speaker

objects moving through the landscape, delivering sound intimately to those (audience members) who situate themselves close by. Her sound becomes a public event, beyond her, as LaBelle would say, ‘inside the heads of others [...] it moves from a single source and immediately arrives at multiple destinations’ (2007: xi). Movement choreography – if for a moment referencing the 1960s postmodern dance revolution of the Judson Dance Theatre (mentioned in Chapter 1) and the emphasis these choreographers placed on non-virtuosic, mundane, task-related actions – in this sense is immediately tied into a clear sensual address, a direct motioning, carrying, and rotating of a functional object. But the object (the two speakers on either end of the *bō*) in the case of SpeakerWoman is also intended as a poetic allegory. These spherical speakers and the sound they emit point beyond the dancer into space, into the *hanamichi* landscape of the stage, and the stage’s extension into virtual reality. Birringer had devised a scenographic space for the installation that would incorporate a series of separate but interlocking passageways or *hanimichi* (white dance floor strips of a particular measured length). Each female character had their own *hanimichi* which in fashion terms was almost like a catwalk to showcase the *design-in-motion* concepts. Moreover, each character had their own unique sound and method of activation, which provided ‘a means to activate perception, spatial boundaries, bodies [...] and the energy waves of forms of broadcast, transmission, and other modes of radiating out’ (LaBelle 2006: xii).

In her white PVC workwear, contrasting elements of volume and flatness in its construction (as utilised in Eastern cutting techniques for garments), with her highly visible amplification tools, Ren becomes a retro-futuristic apparition from an imaginary rice field which is not there. It can only be imagined, like a moving sculpture in an expanded field (Krauss 1979),<sup>13</sup> that hovers on the horizon of a non-discursive world without dialogue or reason. This is not entirely true, however, as narrative is implied in Ren’s gestures together with the handful of rice she carries in her left fist on the night of the first public performance. As she moves along her white corridor, turning slowly around her axis, she drops the rice grains onto the floor, and these could be heard as the tiniest audible sounds – one could argue as minute grains of articulated narration. She bends her knees, rotates from her waist then straightens, and one leg juts forward as if in a slightly ‘somnambulist parody of the goose-stepping march of North Vietnamese soldier women’ as interpreted by Birringer in his observations of Ren’s movements (2010b). Ren’s SpeakerWoman characterisation thus appears to combine soldier with labourer, and in an apparitional sense also a slowly moving, hanging puppet figure that seems animated from above – each move suspended awaiting the next. Hers is a dance that *sounds out* – in the



sense that her motions (and subsequently the rotations of the spherical speakers) send out the music in all directions of the moveable universe, as if she were, herself, a playback device, an omnidirectional speaker radiating sound. It is spatialised sound, between left and right speaker, emitting composer Ben-Tal's soft orchestral textures with dark sinister undertones, combined with metallic recurring echoing hissing sounds, an intermittent rattle, and susurrant sound of a mouse pulling a small tin can around the room.

Ren's SpeakerWoman exemplified my early experiments with choreosonic wearables as extensions of the performing body, where design and movement were intertwined from the outset – mobilising dancers' bodies through sounding and encumbering effects of clunky material objects placed on the body (figs. 21-22). In this instance, the use of 'readymade'<sup>14</sup> technologies (two large white spherical speakers), rendered portable/wearable, aimed to visibly and palpably amplify the interrelations of technology to the body. Moreover, the excessiveness of design statement, extending beyond pure visual to tactile and aural modes of sensory experience and expression for the dancer, and audience in close proximity (and at a distance), was core to a process of motivating movement-sounding and design experiments in *UKIYO*. Additionally, virtual, physical and imaginary factors combined to shape the movement landscape of the performer – the wearable experience situated firmly within this multi-stimulatory performance context. In the case of Ren's SpeakerWoman, gestures were initiated, and a relational demeanor to the wearable that became highly exaggerated and stylised as she transported her sound to an audience, intimately moving in close proximity, whilst also sounding out to a more distant crowd. This generated an almost satirical performance by her, as her oversized sound emitting accoutrements and exaggerated movement behaviour united to animate her character.



Figures 21-22. Helenna Ren interacting with her oversized sound emitting accoutrements, 2010. Photos © Michèle Danjoux.

#### 4.3.5. Contemporary Anime and Manga

Hokusai's art, especially his preoccupation with myths and legends, strange scenes and caricatures, is a precursor to techniques of stylisation and creation of character in contemporary forms of Japanese anime and manga. The science fiction themes they employ: futuristic yet simultaneously portraying elements of nostalgia and nostalgic values – humans facing extinction and a fascination with the Colonial Industrial Revolution and machines; mystical warriors wearing special armour ('Cloths' – *Saint Seiya* [1986-89]); body morphing protagonists (*One Piece* [1997]); interactions between humans and mutant species resembling humans but have distinguishing features such as horns (*Elfin Lied*), and so on (see Brophy 2005) – they supported a notion of transformation I was keen to explore in the ideas for morphing female characters who become sounding instruments.

'In anime, thinking about technology is inseparable from thinking through technology (not only using technology but aligning thought with its operations)', postulates Thomas LaMarre in *The Anime Machine: A Media Theory of Animation* (2009: xxx-xxxi). Whilst a main focus in his book is on the question of movement in animation, I drew certain parallels with the animation of bodies in dance. LaMarre argues that discussion of animation should dwell less on formal image analysis or the 'illusion of life' – i.e. calling attention to the potential for an experience of the uncanny that arises when something that is supposed to be inorganic or inert comes to life – but more on movement as primary in the compositing (the movement between layers within images that then becomes spread across frames). This technical understanding of what he calls the *animetic machine* is intriguing to me since *animation* with its frame by frame approach very closely ties into the structural dynamics of creating a choreography for dance. In the case of the work with wearables and the creation of movement characters, small units arise out of minute kinetic motility of the *design-in-motion*, building to fluid mutations of cloth, space, sound and embodied form.

Muto Junko (2005) discusses the way actors' voices and *yoruri* music are captured in many early period actor prints and as a result 'sound out'. Junko states that:

This is because the spectacle of a Kabuki performance is not the plot as it unravels, but elements of an actor's individual performance, such as long stage speeches and dance poses, and that is what is captured in the prints. The print artist wanted to draw out the voices and the sounds from the actor print and they devised ways to let us hear them. (14)

This could be achieved through painting and other graphical techniques that stressed postures and movement quality such as vigorousness and strength. In my work, creating a collection of sounding characters, I wanted to apply this notion slightly in reverse, contemplating what techniques of design, in addition to creating a distinctive visual aesthetic, might stress certain types of movements to the performer, and how her body might then be animated to move frame by frame, in order to ‘sound out’ in motion. In other words, I was keen on exploring design that affords the dancer’s individual performance with the wearable instrument a particular sensation of an extended body (including a phantom limb, in the case of HammerWoman [see section 4.5.4.]), enabling her to sonically, visually, and dynamically project her particular character through her movement behaviours and gestures which can then be captured, processed and re-emitted digitally in this generative performance making process. I will be discussing some of the particular techniques I used in relation to my prototypes later in this chapter.

#### **4.4. Wearable Design Strategies**

In *UKIYO*, experiential wearing is integrated into the choreographic process – the encounter with garment interwoven with that of movement. In the work, there is an intermingling of each dancer’s own aesthetic sensibility, skill and individual creativity. In other words, the dance habitus she embodies and her own kinaesthetic intelligence are integrated into her being and thus brought to the work. Each dancer is intimately involved in the creation of wearable movement. As I proposed in regard to the SpeakerWoman character enacted by Ren, the generation of sound-in-motion brings new vibrational qualities to the dancer: she can inhabit the space differently and sense her presence in a multisensorial way – bringing choreography into the world through the senses.

Furthermore, the forms and structures of her garment/wearable I suggest can be proactive in initiating her movements and gestures in space via a process of mutual extension – a notion I addressed in Chapters 1 and 2 providing examples. Moreover, as I indicated above, the palpable sensations of a costume, and the interactive possibilities it invites through its physical properties and material qualities (such as the *bō* across Ren’s shoulders and the spherical speakers dangling from it at either end), touch the dancer, impact her proprioceptive and kinaesthetic sense, move her from the outside in – through what she feels, sees and hears in her body. To some extent, this ‘hearing’ is actuated through touch and the kinaesthetic sense; at the same time, the dancer hears what her ‘amplified objects’ (Ren’s basket speakers) stream.

Wearable design strategies in performative contexts, I therefore suggest, create distinct movement scenarios. The integration of audio technologies into design concepts, such as speakers extended from both shoulders or alternatively positioned down the spine for instance, proposition movement to unfold differently as sound is transported through space. Wearable performance thus leads to new spatial and temporal relations of sound to movement. Further below, I will be highlighting other design strategies and features I have used to encourage the dancer/performer to explore a more intimate engagement between herself and audience members via her behaviour invited by the wearable.

#### 4.4.1. Wearables and the Scenographic Space

Crucial to the emergence of design concepts for sounding characters was the design of the scenographic space. It consisted of five *hanimichi* (runways) where the performers could move closer to the audience, in a delimited narrow space, and stand face to face in intimate proximity. Simultaneously, the audience members were also free to move across the performance space thus becoming more active participants in how they experienced the work, creating their own perspectives and distances. Such notions of proximity and distance, of close-up encounter and more distant sensing were at the forefront of my mind as I devised and explored *design-in-motion* strategies during the process stages of the work.

As audience members enter the performance space, they are welcomed to this special world of interlocking pathways and tunnels by a male actor (Yiorgos Bakalos): ‘welcome to the Reduit’, he calls. All other performers are motionless, silent and idle as if deactivated, waiting like avatars ready to be animated.<sup>15</sup> The Reduit is meant to be an allusion to a hidden labyrinth (a fortification in the Swiss Alps) here represented as the labyrinthine arrangements of *hanamichi* corridors. The reference to mountains which also feature so frequently in Hokusai’s prints, is made more apparent through projected digital slides during the opening prologue performance by Bakalos. The performers are envisioned as different sounding characters rendered so through their relations to their wearable performance design and to the spatial locations they occupy and transverse. They perform their sounding instruments enacting a process of intertwinement and becoming; each entering their corridor one at a time, they transform into strange hybrid mythological creatures of past and future fictional worlds which I will discuss below.

#### 4.5. The Sounding Characters

*UKIYO* deploys various models for working with ‘wearing sound’, sound activated by the sonically extended and amplified body-in-motion for a more expressive augmented performance where immediate haptic and abstract aural qualities of the materials are intertwined for multi-sensorial experience. Rather than just building costumes, accessories and performances, I want to argue for a method of creating sound characters generated by exploring what effect garments can have on micro-textures of sonic transformation and on how one *hears images* or makes connections between sounds and image textures in time and space. When I speak of hearing the visual form of the wearables, I am particularly concerned with the ‘audio-visual media’ quality (Rainer et al 2009: 223) of the costume and the way it is perceived as sounding out, promising and creating an audiophonic *Gestalt*.

The final sections of this chapter introduce four more sounding characters from *UKIYO*: WorkerWoman; InstrumentWoman; LeavesWoman and HammerWoman, each exploring distinctive characteristics of sound and visual aesthetic, and each named after the main objective ‘sound actions’ or garment-instrument they are associated with. In addition to the concrete and structural element there was an intended psychological element to each of these characters, as is perhaps also already explicit in the naming I chose for the characters (which was to an extent inspired by the literature and historical sources our ensemble investigated during the rehearsal process). *UKIYO*’s narrative and historical reference systems were layered, and these layers combined images and physical gestures reflecting, for example, Russian engineer A.K. Gastev’s motion and strike pressure experiments with workers wearing prostheses from the early twentieth century; sound references to poet and playwright Velimir Khlebnikov and *zaum*; our ensemble also developed black and white film noir scenes inspired by Christian Kracht’s novel *Ich werde hier sein im Sonnenschein und im Schatten* (2008) located in an imaginary communist Switzerland that is defending itself against enemies. The latter were developed by Birringer who filmed scenes where an African engineer (played by Olu Taiwo), explains the plasticity of oral/aural languages to a military officer (played by Mamen Rivera); other film animations reference Hokusai and Japanese sci-fi manga and anime, and some of the latter were the outcome of collaborations in Japan with Yukihiro Yoshida’s team in 2009. The intention was for the intertextual aspects of the various narrative strands, inherent in the garments, and made clear to the performers at the outset, to touch and transform the wearer not simply through

tactile qualities but also their hidden narrative potentials to take the performer to a different place as her movement-gestures emerged.

#### 4.5.1. WorkerWoman (Act I)

In the context of *UKIYO*, the WorkerWoman (figs. 23-25) character in performance becomes a factory worker and revolutionary figure of the Industrial Revolution, through her tough dynamic movements and pseudoindustrial noise – a provocative symbol of a bygone age and, at the same time a symbol of change, transformation, and futurism. This sounding movement-character references *musique concrète* with her material sounds, and an expanded understanding of musical composition originating through, as LaBelle puts it: ‘the manipulation of audio machines and recording media, the cultivation of sound objects and their intrinsic dynamic’ (2006: 26). The character is noisy, strong, and kinetic, and her powerful, compulsive-obsessive movements aim to draw the audience closer into a mechanised world that does not stand still, inviting them to feel in their own bodies the kinetic rhythms of her muscular and physical sensations and dirty, gritty, thunderous and often brutal sounding.

Tools and technologies are appropriated in new and subversive ways which I will explain below, for this experimental retro-futuristic prototype, as compositional means, to affect transformational change in performance, whilst the extended sound practices of *musique concrète* and ‘cracked media’ (Kelly 2009: 4) are utilised to achieve ‘the sound of malfunction’. The title of Kelly’s book refers to the manipulation and destruction of sound mediation technologies in live performance (Kelly 2009: 3), popular from mid-twentieth century into the twentieth-first,<sup>16</sup> in order to create novel sounds and an extended sound palette from the defective media. This relationship of destruction to sounding and the generation of noise music I found in my studies of cracked media, and the physical effort required to destroy something in performance became significant in the development of the WorkerWoman character.



Figures 23-25. Anne-Laure Misme as WorkerWoman (Act I), performing in *UKIYO*, KIBLA Media Arts Center, 2010. Video stills © DAP-Lab.

The dancer, Anne-Laure Misme, equipped with various clunky sound generating accoutrements (metal cage/mini crinoline [incorporating curved speaker grills], speakers, contact microphone with transmitter and 12" vinyl disc), actively explores the technologies that extend her body physically and sonically. Misme, fully immersed in the process of



making *UKIYO*, understood well the interconnectivity and enfolding of her sounding movement-character within the larger hybrid narrative and sonic landscape, i.e. her historic references, the abstract representation of dynamic change – past to future, revolution and mutability. In creating *WorkerWoman*, I had a loose concept for the distorted and dysfunctional sound I desired for this character, involving interferences and elements of analogue and digital hacker culture, to pull up new sounds and compositional strategies. The overall critical importance of instrument design *and* software coding cannot be emphasised too much, and in my research, up to this date I have benefitted especially from handbooks that detail the fundamental electronic processes as well as the basic tools involved in making custom-built interface instruments which could be small and flexible enough to be worn or integrated into the garments.<sup>17</sup>

The materiality of this prototype connected elements of the old with the new in terms of technologies thus looking back, whilst simultaneously looking forward in a retro-futuristic fashion. I had explained this to Misme as I developed the prototype, involving her in a process of staged introduction and exploration of the technologies – dysfunctional speaker breasts, followed by wireless Bluetooth speakers, speaker grills, vinyl and contact mike with wearable transmitter. Like the *Barong Analog* (2006), wearable synths of industrial designer Stanley Ruiz I had encountered at the Osage Gallery, Hong Kong in 2008, *WorkerWoman* would combine her interactions with the technologies in live performance with experimental improv/noise (Ruiz 2001), noise that would be generated by performer and musician combined in a form of shared noise harmonium alternating between the digital and the analogue.

The wireless portable speakers with unstable Bluetooth transmission became motivational worker tools for Misme, offering unpredictability of performance and flow. The two inverted dysfunctional speakers worn provocatively on the body (as speaker breasts integrated into bra design) intentionally and paradoxically emitted no sound at all – cracked media taken to its most extreme – broken and unsounding (fig. 23). Unexpected sounds were forced by Misme's energetic actions from a flexing 12" vinyl LP (a long playing disc I had given to Misme later in our process) – accentuating its materiality – as her motion and interactions shifted sound production from standard playback methods of recorded sound on vinyl, through sonic rhymes of air displacement, to detecting and amplifying hidden vibrational sounds 'existing below the line of audibility' (LaBelle 2010: 134). This was made possible using the clip-on radio microphone – to amplify sounds which may have been too delicate on their own to impact the performance space – attached



to one of Misme's fingers, with wireless transmitter mounted on her arm. The result was a noisy but still inherently musical sound originating from Misme and her dynamic motions. When she dragged the mike over the vinyl, as one would a stylus across the grooves, the sounds were amplified, according to the trained musician ears of Sandy Finlayson, my collaborator on sound: 'to the point of distortion' (2011: email).

In her capacity to become 'noise machine', in the Russolo's 'Art of Noise' sense, Misme 'obliterates notions of tonality in favor of a radicalized noise palette' (LaBelle 2007: 26). As she pushes the vinyl across her white *hanamichi* strip, down on her knees – generating the sounds of friction of a laborious task, running her microphone finger over its grooves – Misme becomes visibly stimulated by her capabilities to manipulate the sonic landscape. Her movements become more forceful, vigorous and energetic – generating a dark booming crescendo of low frequency sound and hum. She becomes a noise turntablist – without stylus to delicately traverse the grooves – scratching and applying forceful pressure to the vinyl disc, flexing it in a manner that would eventually cause it to crack.

For this particular prototype, Finlayson, recorded a series of samples directly from the progressively damaged, 12" vinyl Misme was mis-using, and looped these segments. Using the specialist software Ableton Live for real-time music processing, the sonic outputs of Misme's physical efforts were intermingled with the live electronics generated by Finlayson – using these sound loops as compositional material – in a shared creative process of real-time improvised performance for distinct auditory experience.

Acoustically, the design intention for this character's noise-making performative role was to explore disturbance as a tool for audience engagement and excitement. Atonality or disintegration of harmonic structure is additionally superimposed over the top of the soundtrack of a 'cracked' bandoneon (played by Caroline Wilkins and processed/recomposed by another musician, composer Oded Ben-Tal), producing sounds through cracked technology 'filled with noise, as unintended and extra-musical sounds are pulled from the technology as it is pushed to the edge of breaking' (Kelly 2009: 34). Moreover, recorded sounds of metal-working lathe and damaged vinyl intermingle, as changing playback speeds and dramatic jump effects combine with Misme's heavy breathing and other noises of her highly physical performance in character.



Figure 26. Anne-Laure Misme in rehearsal exploring wireless portable speaker as motivational tool at Brunel University, 2010. Video still © DAP-Lab.

Misme was a particularly interesting performer to work with since she had little to no formal dance training and therefore had no associated dance habitus pre-existing in her body. I noticed that possibly more than with any other performer I had worked with on this project, Misme was prepared to learn with and through her body wearables and portables, letting the ‘instruments’ guide her character’s noisy movement. As Misme confided to me in conversation during our shared development process, she was fully aware of her movement limitations. Yet, the motivation to develop both kinetically and sonically as a character, through performance wearables and interactivity, provided all the stimulus she required to unfold. Furthermore, Misme recognised in her movements that WorkerWoman required an almost savage physicality to generate her ‘noise-sound’ (Russolo 1913) and responded accordingly in a performance, where I observed she embodied a raw energy and focus that gave her character an immensely forceful stage presence – the amplified sound of her scratch performance, in a process of becoming, reverberating across the entire theatre.

#### 4.5.2. InstrumentWoman (Act II)

Caroline Wilkins as InstrumentWoman is a Kyōgen character of ‘mad words’, relating to instrumental sound theatre traditions of Japanese Nō and Kabuki. As Timothy Moore, scholar of classical antiquity explains: ‘Kyōgen plays are comic skits created between the fourteenth and the eighteenth centuries... and still performed as interludes during performances of traditional Japanese Nō drama’ (2002: 189). Comically, Wilkins explores her performer-musician’s physical body in relation to her extended bodily instrument in space – two small speakers protruding from her back emitting sound, long cables tethering her (fig. 27). In performance, Wilkins as InstrumentWoman enacts a series of transformations through improvisation and spontaneous interactions with her costume in space, the various sound generating elements of her performance combining to produce musical sequences. Key sound sources are her bandoneon, Wilkins’ voice and pre-recorded birdsong, combined with an interactive costume incorporating wired and wireless systems of amplification into its design.

After detailed observations of Wilkins playing her instrument in rehearsal, noting how her body/bodily gestures had evolved with the bandoneon – my intention was to suggest this same relationality and inseparability between Wilkins and her wearable instrument in motion. In Act II, the golden pleated silk dupion dress she wears with neoprene and leather collar, featuring two integrated speakers (figs. 27-28), thus aims to evoke a similar evolutionary state of becoming one. This I partially achieved through subtly and suggestively echoing some of the material and structural qualities of the bandoneon – textures, colours, weight and concertina capabilities, into my design. Sunray pleating allowed for a subtle opening and closing of garment silhouette by Wilkins. Such manipulable design features impact Wilkins’ movements, her garment-body able to radiate out into a distinctive trapeze-like shape one moment – pleats opening out with extended body gestures – and then diminish in size the next. Moreover, she can remove her dress in performance and fold it away into a flat small strip – a technique I had learned from my studies of the art of Japanese paper folding (origami) and the transformation of 2D to 3D structures and vice versa. Wilkins describes the intimate relationship of performer to bandoneon in a very personal organic way in her own thesis when she compares it to ‘an elongated human lung’ breathing in response to the player’s arm movements (2011: 54).<sup>18</sup> In the case of InstrumentWoman, there developed an intimate breathing together of responsive body and dress equally organic. This is substantiated by what Wilkins later

confided of her own stimulatory experiences of her wearable instrument encounter in flux:

The pleated nature of the garment, its color and shape made me feel very expansive, regal, creature-like. Movements such as opening/shutting ‘wings’, bending like a tall bird, turning on my axis, were effective. The strips of black neoprene became ‘tails’, the wires an extension of them. The weight of the speakers made me stand very erect in a kind of counter-balance. I have worked a great deal with costumes in the past, mainly from my experience with Lecoq theater, involving clown, commedia, buffoon and neutral mask. It was a different experience, though, to work with an extended, sound-producing garment. (Wilkins 2013: email)

The other method I used to enable Wilkins to grow with her wearable instrument in the way she had grown with her bandoneon was to allow her more time to work independently with the costume outside of scheduled rehearsal time. Wilkins comes from a musical theatre background and was very receptive to this idea. She later told me how useful this had been in helping her to ‘crystallise a body language’ for her sounding character through an intensive process of engagement, ‘folding the garment into the body and vice versa (through the use of a mirror), creating shapes and sounds [...]’ (Wilkins 2013: email). She could draw on this later in performance. Dress and bandoneon thus shared certain similarities – the playing of the instrument, as folding and unfolding of the physical and energetic features through a fusion with the body – resulting in a poetic metaphor for the unfolding of the golden persona of InstrumentWoman.

As the performance progressed, attention shifted for Wilkins from her sonically expressive sweeping fingers – knocking, tapping, pressing keys either side of the resonant bandoneon case (contact mike on its surface) – releasing a cacophony of percussive sounds (scratching, clicking, ratchet-like sounds), to the anatomical intimacy of her sound shaping mouth (relayed through the head mike she wore), to the structures of her golden pleated trapeze dress – its collar feature extending into spinal column adorned with the two square mounted speakers (figs. 27-28 [to sound out voice and live electronics]). As I observed and listened, it appeared that mouths within mouths, so to speak, had opened up for Wilkins. As she expressed in a paper co-authored and presented at ARTECH 2010<sup>19</sup> with composer Ben-Tal, who had worked on the sound for this prototype, on her embodied experiences of music/sound in relation to *UKIYO* as intermedia performance space, this is created through the various loudspeaker sources:

The voice becomes an extension of instrumental sound, employing a wide range of techniques including speech, pitched and non-pitched sounds, Sprechstimme, etc., with the effect of spatial difference, of far and near, macro-/microscopic, created by a 'dialogue' between the different loudspeaker sources. (Ben-Tal and Wilkins 2010: 18)



Figure 27. Caroline Wilkins (left) as InstrumentWoman, with HammerWoman in *UKIYO*, KIBLA Media Arts Center, 2010. Photo © Michèle Danjoux.

Exploring the small voice of birdcall coming from the speakers mounted on the spine of the neck accessory worn by her, Wilkins' character begins to transform into a state of 'becoming bird' through the combined sound-gestures. Becoming bird, in the butoh sense of visualisation,<sup>20</sup> enables Wilkins to transform her role, alongside the silent dance of the guest Japanese performers at Sadler's Wells Theatre – performing in close proximity, acting as subconscious ghosts in Act II. She reaches into the spiritual dimensions of Qigong<sup>21</sup> performance of energies (mixing fire and water), combining the Western technological notions of the virtual with a metaphysical Eastern consciousness. Once again, the scene involves intrinsic fusions between performer, musician and costume design in the creation of sound character and narrative.

The speakers in this prototype are compact but also relatively heavy and need to be counterbalanced on the collar which is softly padded. The presence of these transducing technologies adds a sense of weight and burden to this character, almost choked at times by the pull on her collar, restricting flow, as she spits out onomatopoeic words. The audio cable that extends from the speakers to the amplifier is cut to a set length, just sufficient to allow Wilkins to advance three quarters of the way along her *hanimichi*, and then the tethering wires begin to contain her movement creating a sense of incarceration of this mad woman of mad words and gestures who cannot advance any further unless she is to remove her asphyxiating collar that begins to restrict and confine her so. The wearing and removing of the collar and negotiation with wires are indeed a pertinent part of her performance, the wires creating their own sound and resultant choreography, as they are dropped furiously to the floor in frustration; and the discarded collar – as if via a process of exaptation – provides a new eerie object presence, as it remains long after Wilkins has gone – tiny voices, barely audible traces, still emitting from the transparent membranes of its two golden speakers (fig. 28).



Figure 28. Discarded collar feature in black, cream and gold leather and neoprene with two integrated speakers and audio cable, 2010.  
Photo © Michèle Danjoux.



#### 4.5.3. LeavesWoman and Creation Scene (Act II)

LeavesWoman explores the dance of creation and the deeper metaphorical dimensions of real and digital objects coupled with bodily experience and simultaneous existence of corpo/virtual realities. Developed in collaboration with 3D designer Doros Polydorou and dancer Katsura Isobe, this prototype probes interaction with the virtual realm, mediated through wearable sensor technologies integrated into garment concept, for the gestural creation of a 3D world. It builds on navigation strategies and techniques used in computer game worlds offered through the expertise of Polydorou and his doctoral research into: *Immersion and Interaction: Creating Virtual 3d Worlds for Stage Performances* (2011). In our shared work for *UKIYO*, Polydorou was interested in designing ‘a three-dimensional space linked to the physical body of the performer through technological mediation’ (2011: 11), whereas I envisioned an immersive audiovisual experience for Isobe and audience alike that would be accessed via the intimate and intuitive interface of her sensortised dress – LeavesDress – as interface and mediator.

We began our intensive explorations for the Act II Creation Scene during the shared residency in Japan in December 2009. Whilst Polydorou’s concerns in our collaborative approach lay with aiming to formulate: ‘an approach towards the creation of a gesture activated and body movement controlled real time virtual 3d world in dance performance contexts’ (Polydorou 2011: 2), mine were focused on researching the design of a wearable that would link to some of the organic and ephemeral themes I had noted in Hokusai’s artwork whilst also motivating and activating such gestures and movements in the performer. Polydorou has a chapter on *UKIYO* in his own thesis where he discusses the 3D virtual world he designed and its transformation through Isobe’s actions, in the LeavesDress, from lifeless concrete surface into what he describes as: ‘a beautiful landscape, with mountains, grass, trees and lakes and populated by the eerie walking tree and mysterious black figures’ (2011: 78).

At the start of DAP-Lab’s research residency at Keio University, and in relation to my design research proposal, dancer Katsura Isobe had affirmed in dialogue with me that choreosonic wearables – where sounding might result as a consequence of her movements – were a stimulating proposition. She had noted that unlike dance where the start point for body rhythms are musical rhythms, her own philosophy supported the notion that movements and the subsequent dynamics of dance could emerge via other motivating factors and ideas such as engagement with objects or aiming to disrupt audience

expectation. She confirmed that she was inspired to begin working with me, exploring how she could find sound through her movement improvisation, how to generate sound through the gestures of her costumed-body in performance.

The changing relations between objects, garments and bodies in space stimulated Isobe's imagination whilst her body movement became the physical manifestation of the dialogue between her inner self, her body and the performance environment. By this, I mean her internal bodily sensations - experienced through a dynamic process of wearing and engagement with her environment, which transformed her movements and were thus revealed on the outside. This externalisation and physical manifestation of bodily sensation seen from such a phenomenological perspective, I relate to my research on phenomenology (see Chapter 3, section 3.5.) and also butoh dance. In relation to the latter, specifically to the work of Kazuo Ohno, who claimed garments were key to both his internal and external transformation in performance (Chapter 1, p. 42). Moreover, I set out to counteract any existing preconceived and limiting notion of costume as passive or subordinate element in contemporary dance performance – defining it rather as something that is simultaneously dynamic, responsive, directive, actively sensed and responded to by the dancer in specific contexts. This is the tactile wearable stimulus of costume's contribution – provoking somatic experience influencing movement style – and thus to the emergence of units of movement that become crucial for the choreographic process, as it might, for example, involve constraints or encumbrances.

Isobe's experience as an experimental dancer is extensive. She had originally studied modern ballet, graduated in BA Dance and Dance Education at Ochanomizu University, Tokyo, and MA Scenography (Dance) at Laban Centre, London. Additionally, she had trained in contact improvisation with teacher Thomas Kampe and performed in interactive dance installations such as Carol Brown's *SeaUnSea* (2006).<sup>22</sup> I had worked with Isobe in a previous interactive production (*Suna no Onna* [2007/08]), so was familiar with her responsive style which she was able to adapt. She was already adept with working with sensor technologies and knew the potentials and the limitations they offered to her as a dancer.

The concept for *LeavesWoman* thus first evolved in December 2009 during DAP-Lab's visit to Keio University to work with our collaborators there. My impetus came from nature and the iconic ephemeral image of the Ginkgo leaves falling to the ground, which I



had explored with Isobe, creating a carpet of yellow. Outdoors transitioned to indoors, and Isobe, now in the studio, was enveloped in a sensual world of leaves (which we had collected together and brought inside). Wearing the nature, she slowly tuned into her organically extended body – touched by the texture and smell of the fresh leaves, alert to their sounds as movement initiators, her bare hands and feet slowly moving through crackling textures. Wearing one bend and one pressure sensor, wireless transmitter on her left arm, Isobe was equipped to explore and enjoy amplified sounds within sounds (fig. 29), as she manipulated via the data she generated in real-time, the organic and rendered sounds of recorded rustle of the leaves (worked on for their compositional qualities by Ben-Tal). She thus delved into the epidermes of leafiness in a poetic sense, similar to LaBelle describing the anatomy of a recording as ‘scrutinized, magnified, repeated, re-recorded and played back so as to hear all of its hidden and potential details, uncovering the inner dynamic nestled inside every instant or particle of sound’ (LaBelle 2007: 26).

Performing in a mixed reality state (real and virtual), Isobe immerses herself in the imaginary world she creates whilst simultaneously activating a new visual and sonic dimension for the audience members to enter through the data she generates using her sensor-costume (fig. 30). Sound/image synchronicity and causal or semantic forms of relationships between image and sound dissipate, for Isobe no longer inhabits a world of scrutinised leaf sounds but instead a world of noise music – a pitch bending, dense sonic collage of samples, stretched and compressed multi-layered frequencies, deep and low-down drones vibrating the space. She is aroused by the various sensorial aspects of the costume, what she refers to in her own blog as its ‘essence: smell/tactile texture/sound/colours and shapes’ (2010b). The perfume of the leaves, their fragile and delicate texture, the cracking sounds they make and their ephemerality all offer personal associations for her – ‘memory, secret, regret’ (2010b).



Figure 29. Katsura Isobe in early explorations of leaves and sound activated through gesture (makeshift transmitter worn on her left arm) at Mixed Reality Lab, Keio University, 2009. Video still (c) DAP-Lab.

In the completed work, Isobe is clothed in a Ginkgo dress, a simple tunic with carefully preserved leaves (brought back from Japan), delicately worked into its net of fine silk tulle, and incorporating *Eowave Eobody 2HF* sensor interface (figs. 30-33). She describes the garment as her ‘second skin. The boundary between my flesh and outside body, which is vague with this delicate fabric’ (Isobe 2010a). Rendered sounds create an extension of the sound environment of this virtual and evolving world as grass grows, branches form and water flows. Audio samples for the Creation Scene seek to reflect each evolutionary section of a world forming – the cracking earth, growing trees, inhabitation and so on. Recorded sounds of church bells ringing somewhere in the distance hint at a population rooted on the ground, but once stretched out over many minutes, all original meaning held within these sounds is gone, replaced by high pitched and airy abstract sonic textures of the sky. Data is sent via one sensor integrated into the dress to a dedicated laptop running Max/MSP for the real-time manipulation of the sonic landscape, while the other hand-held sensor generates data for the visual realm.

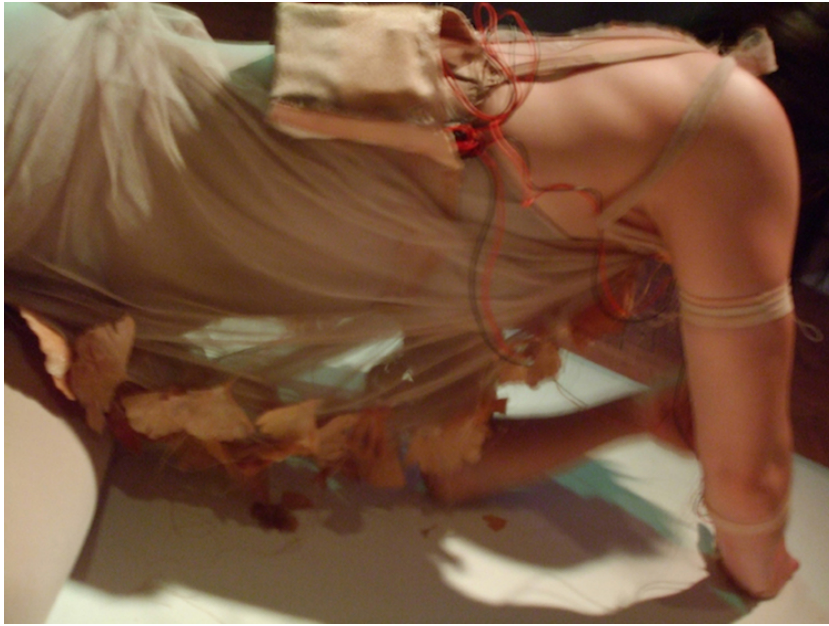
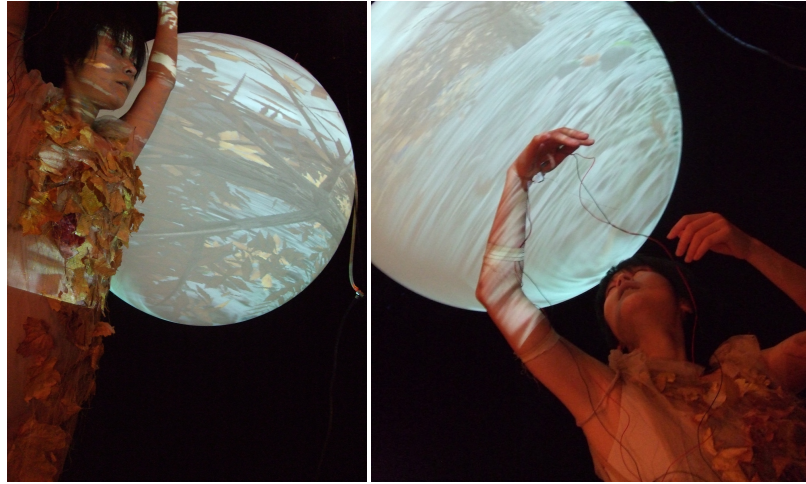


Figure 30. LeavesDress – close-up of simple tunic of silk tulle with preserved Ginkgo leaves and early sensor interface performing in *UKIYO*, KIBLA Media Arts Center, 2010. Photo © Michèle Danjoux.



Figure 31. LeavesWoman – Katsura Isobe dancing the 3D Creation Scene (Act II), in *UKIYO*, Lilian Baylis Studio, Sadler's Wells, 2010. Video still © DAP-Lab.





Figures 32-33. LeavesWoman interacting with virtual world, 2010. Photos © Michèle Danjoux.

Antonio Damasio, in his writings on organisms (bodies and brains), discusses internal interactions and external sensory stimuli of the organism where interactions extend into the environment, stressing the importance of the conscious body in such contexts, the body that is aware of its own emotional state for flexible response based on a particular ‘history of interactions with the environment’ (Damasio 1994: 138). This acute sense of bodily self-awareness and alertness I observed in Isobe as she visibly listened through all her sensory channels, perceiving through her entire body, her movements often animal-like, suspended somewhere between the rhythmic and the arhythmic as she navigates real and virtual spaces (figs. 34-35). I will elaborate on this further below.



Figures 34-35. Katsura Isobe’s gestural movement with her sensorial wearable – generating data for the transformation of the virtual world projected onto spherical weather balloon, Lilian Baylis Studio, Sadler’s Wells 2010. Video stills © DAP-Lab.

When I asked Isobe again how she had kinaesonically experienced her LeavesWoman performance, she revealed two interesting aspects that she had not shared initially. First, that the sensorial and tactile elements of the costume had animated her differently to those of its integrated technologies. With regard to a remark she made in 2010 – ‘it is easy to control the sensor on the hand’ (2010b: np), Isobe now explained that whilst her hand gestures had adapted to trigger one of the sensors (which extended into her palm), her “‘felt” sensation of the costume; fragile, light, lithe, indirect, uncontrollable’ (Isobe 2016: email) had on the other hand directly influenced the movement quality of her whole body, which she also noted became ‘light, lithe, flowing, subtle and detailed’ (2016). Second, in terms of Isobe’s performance of the audible, she claimed that she could not ‘feel’ herself to have been particularly affected by the sound, perceiving her sounding out a consequence of what was happening in the visual. When I asked her to explain specifically what she meant by this, she acknowledged that it had been very difficult for her to control the effect of the second sensor (due to its positioning), so ‘decided to just let it be’ (2016: email) – the sound thus flowing less from her intention and more as a result of her entire body movement in the dress.

The quote below from Polydorou illustrates the interrelationship between the body, movement, data generation, real and virtual 3D environments such as the one he created for *UKIYO*:

Perception comes in the form of raw data from the performer [...] The embodied performer, embedded with technology capable of digitizing his or her inputs, a ‘body-in-code’, extends his/her form with interfacing technology (e.g. wearable sensors or camera vision systems) and releases both consciously and unconsciously data signals which are being received by the system. These signals, which are then forwarded to the space schema, can tell the system sets of information such as the location of the performer in the physical space, movement patterns and movement intensity. Furthermore, as the physical body and the physical space are now interconnected with the virtual realm, the performer can interact directly with objects from the virtual space. By using a variety of sensorial instruments directly on the performer’s body, acting as interface devices actuated by movement, movement quality/effort or touch, he or she can make a tree grow with a single raising of the hand. (Polydorou 2011: 60-61)

His explanation highlights the various complexities posed to Isobe in her interactions as LeavesWoman, her entire costume a sensorial wearable instrument and not just the sensors. Throughout the scene, crowded by the audience which amplified the intensity Polydorou describes above, Isobe’s presence seemed diminished while the affect of her gestures on the virtual world grew disproportionately with each gestural seed that she

planted. She performed underneath a spherical weather balloon that was hoisted up as the third screen in the scenic environment, not a flat screen but a kind of globe onto which the Creation Scene and its evolving seasons of becoming were projected. Isobe indeed, as Polydorou suggests, uses the movement of her hand – in which the leaves sensor was placed – to affect the 3D images. What is particularly interesting in this choreographic interface is the fluctuating balance or relationship Isobe performs between focusing her attention on the visual interface on the one hand (as she may or may not be able to glimpse the projected virtual landscapes she forwards), while also sounding out, not specifically through a conscious awareness of her second sensor but through her entire body, and her sensory design-in-motion (rather than ‘body-in-code’, the term that Polydorou adapts from Mark Hansen’s research into *Bodies in Code: Interfaces with Digital Media* [2006]) on the other.

#### 4.5.4. HammerWoman (Act I)

One other important character in *UKIYO*, which I mention here – investigating aural and visual aesthetics and how these can be shaped by drawing the audience into closer proximity and visceral experience of *sound wearability* in performance – is HammerWoman (figs. 38-39), also performed by dancer Helenna Ren in Act I. The inspiration for this prototype derived from looking back at earlier movement-sensitive machines, prosthetic devices and perceptual techniques which have been investigated by media-archaeology studies. For early rehearsals on *UKIYO* the DAP-Lab ensemble looked especially at Siegfried Zielinski’s excavation of Aleksej Kapitanovich Gastev’s engineering experiments in his Moscow Institute at the beginning of the twentieth century (Zielinski 2006: 227-53). Gastev deployed early graph-writing machines that were able to quantify motion, and two images caught my attention which were then used for rehearsals, one showing the measuring of a woman worker with a prosthetic arm wielding a hammer (fig. 36), the other displaying a diagram of the strike force of the hammer (fig. 37).

The force of a movement here takes visual form (an analogue representation) which anticipates what nowadays is called motion capture. In the visualisation, the motion is plotted into dots and lines, curves and trajectories, seemingly abstracted but also visibly drawing a temporal event, curves of movement that also evoke the kinegraphic and kinesiological method that Rudolf von Laban would later use in his studies of human movement (1924), or that Oskar Schlemmer, following Kandinsky, used for his drawings

and choreography of *Figure in Space* (1921) and *Space Dance* (1926) – compositions which consisted primarily of dancers moving from point to point and assuming pose after pose (Norman 2001: 152; Tringham 2011: 55). The method depicted in Gastev's diagrams or in the photographer Muybridge's rapid-movement stills at the turn of the last century, indicates discrete 'frames' of perception, measures *of* movement and not *in* movement. Thus, a representation of movement in its discrete elements becomes possible, and the succession of (sometimes imperceptible) movement shapes can be made visible. The diagrams trace movement analogous to drawing movement, but they also function in the sense of early analogue technologies of recording, for example when phonograph records were created to reproduce sound through the vibrations made as the needle moves along the grooves on the record. The grooves are analogous to the sound waves originally produced. Edison's early recording of the sound of his voice was made by the indentations the vibrations of his voice made on a sheet of paper passing over a rotating cylinder.

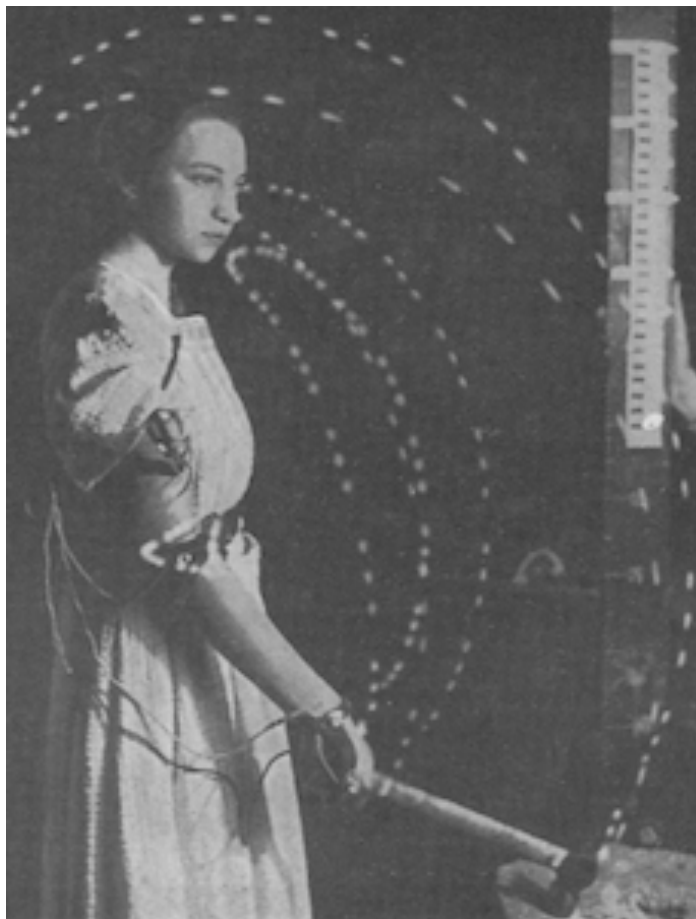


Figure 36. Strike and pressure: A demonstration of the chronocyclographic method on Gastev's Moscow Institute (C.I.T.) by a female worker with an artificial arm. Two photophorescent dots are fixed on the hammer so that the movements can be recorded photographically as curves. On the right side of the picture, an assistant holds a measure to provide a scale, 1926. Photo © R. Fülöp-Miller, *Geist und Gesicht des Bolschewismus*.

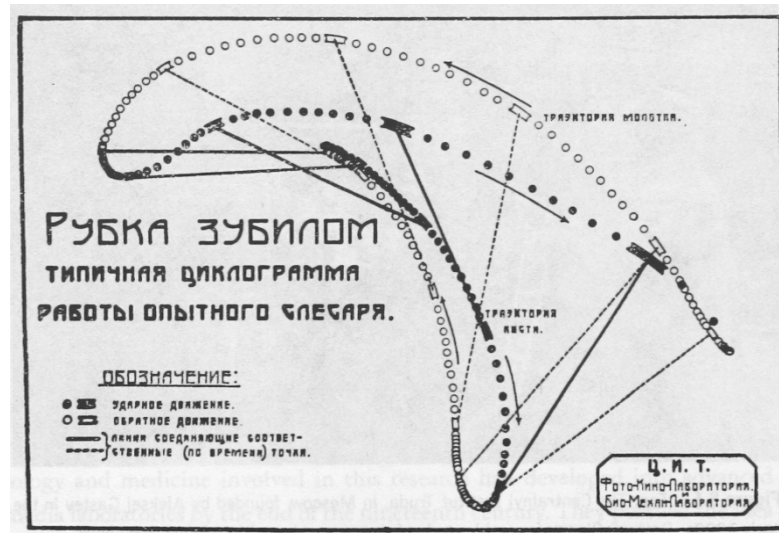


Figure 37. Diagram of the movements of a worker wielding a hammer, 1926. Photo © R. Fülöp-Miller, *Geist und Gesicht des Bolschewismus*.

The indentations on the paper were analogous to the original vibrations, and when I studied Gastev's diagrams I became interested in asking how movement and gesture could be made by audio-phonic instruments in *UKIYO*, embedding an analogue process visibly and sensually into the environment of the current interactive technological systems, diverting the computational parameters a little and subjecting them to the corporeal, and thus more unpredictable eventfulness and dexterity.

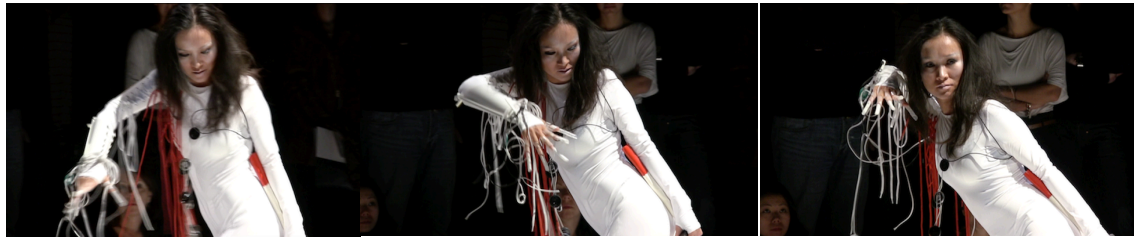
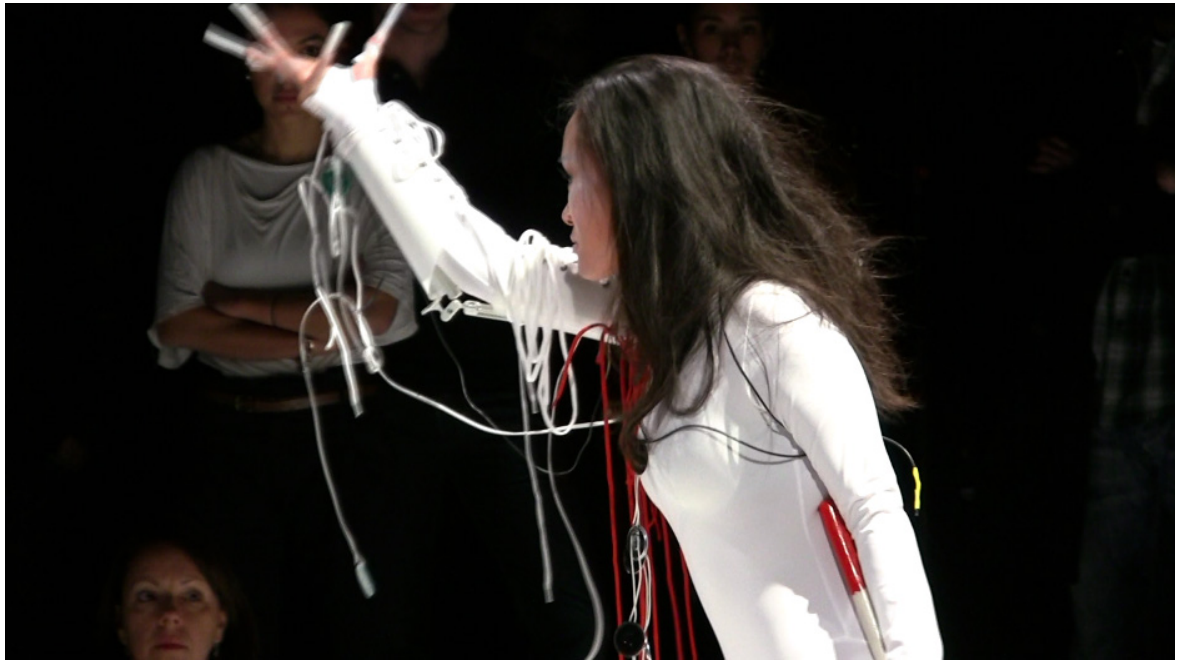
In December 2009, whilst in Japan, I also visited the science museum in Tokyo where I found on display an artificial arm (circa mid-nineteenth century), made for a sixteen-year old female. It resembled a corset in its construction with sturdy toughened leather casing, eyelets and lacing. Two metal rods attached to the casing, hinged at the elbow, offered a means to articulate the arm and a large metal hook provided a substitute for the human hand. After studying this prosthesis in detail, I set about creating a bespoke retro-futuristic arm accessory for dancer Ren, equipped with bend sensor – to access a new sonic realm. The arm was constructed out of white polypropylene, following the form of the historic example I had studied, but updated in terms of its materiality, with rigid plastic rods hinged at the elbow. The synthetic casing was eyeletted and fastened with red lacing (fig. 38). The bend sensor was positioned at the hinged elbow joint to gather information from Ren's movements thus employing the method of arm movement and articulation viewed in the Gastev example to gather data (figs. 39-40). Ren assumed the HammerWoman character by exploring the wearable 'phantom limb' – her right arm which wielded the hammer was encased by the polypropylene (acting as) prosthesis and became her instrument, the worker tool that she used to beat the floor and generate a material image,



born of Gastev's female worker. The auditory and synaesthetic vibrations of the movement of arm and hammer, along with the sound effects also created by her sensor device (sending data to sound software) embedded in the prosthesis, and thus the enhancement of the vibrational sensing body in movement, came to encapsulate the core of my research.



Figure 38. Helenna Ren as HammerWoman wears lycra all-in-one body, necklace of tiny speakers and hinged polypropylene prosthetic arm with integrated bend sensor, eyelets and lacing feature, with hammer as motivational tool in *UKIYO*, Lilian Baylis Studio, Sadler's Wells, 2010. Video still © DAP-Lab.



Figures 39-40. Helenna Ren as HammerWoman performs her sound in close proximity to the audience in *UKIYO*, Lilian Baylis Studio, Sadler's Wells, 2010. She bends her polypropylene prosthetic arm thus activating the integrated bend sensor to send data, via the transmitter she is wearing, to a dedicated laptop for sound manipulation and emission into the performance space. Video stills © DAP-Lab.



Figure 41. Helenna Ren kneeling, exploring the performative aspects of her gestural right arm movement – experiencing the feedback of its auditory and synaesthetic vibrations in *UKIYO*, Lilian Baylis Studio, Sadler's Wells, 2010. Video still © DAP-Lab.

#### 4.6. Wearable Technologies: Vibrational Augmentation

In seeking to understand better the internal and external architectures and augmentation of the body through wearable technologies, I have discovered that it is not sufficient to focus merely on the notion of the visual ‘spectacle’ of the body-wearable with its memorable appearance. Additionally, I must attend more fully to the emotional, vibrational sensations and inter/intra-psychological dimensions of wearing, i.e. to the impact the wearables have beyond the visual on (con)sensual bodies – serving as extension of the senses, as discussed in Chapter 1. This meant that in my design process I moved from the initial morphogenetic possibilities –initially analysed through image stills and sequential digital photography of the body movement – to the listening body in the interface. The body incorporating all bouncing, reverberating sounds into the animated ‘pouring’, conjoining material and virtual oscillations into immersive experience of imaginary space: the crackle of leaves, the dropping of rice grains onto the floor, the exhale of the bandoneon, the clicking of magnets against speakers, the thumping of hammer on the ground, the sweeping of vinyl grooves with a finger next to a microphone, the rustle of paillette sleeves. All these sounds became animations of the space and a ‘hearing’ of the ukiyo-e of the animated dance.

The kind of mapping necessary to locate sounds in space and replicate the physiology of auditive processes, argues Frances Dyson, is immensely complicated (2009: 139). Choreography of wearables here becomes transmuted. Sound waves are no longer discrete units – thus favour a ‘non-cochlear’ (Kim-Cohen 2009) mode of listening, not aimed at eliminating the ear (its fluid mechanisms as sensory organ) but extending beyond it to a wider form of listening and sensory engagement where other factors such as internal sensation come into play. The dancers realign ears with their entire body, the bones, the pores of the skin: the whole body becoming an ‘acoustic sensorium’ and skilful transceiver of vibrational waves and sensation (Rainer et al. 2009: 158). This echoes the metaphysical concerns Antonin Artaud expressed in his search for the ‘complete, sonorous, streaming naked realization’ (Artaud [1964] 2010: 37) of the Theatre of Cruelty. In the quote below, which became of key significance to me in my work with dancers, Artaud draws attention to vibrational touch of sound and its subtle affect:

Snakes do not react to music because of the mental ideas it produces in them, but because they are long, they lie coiled on the ground and their bodies are in contact with the ground along almost their entire length. And the musical vibrations communicated to the ground affect them as a very subtle, very long massage. In my work, I have proposed to treat the audience just like those charmed snakes and to bring them back to the subtlest ideas through their anatomies (58).

Artaud is concerned with the visceral experiences of the audience, whereas I translate this notion to the affectivity of the tactile vibrational quality of sound as palpably sensed and responded to by the dynamic anatomy of the dancer as well.

#### 4.7. Conclusion

The production discussed here does not simply evoke a design practice that utilises interactive media technologies. Rather, it is essentially an exploration of design concepts becoming visible and audible, where technology is selected and manipulated to emphasise the importance of the aesthetics and the fundamental nature of performance in an immersive environment. In the wearable design experiments for *UKIYO*, the relationship of the aesthetic to the technical in the creation of audible wearables was prioritised, seeking to touch the dancer in ways that might: 1) Influence the evolution of her movement; 2) Provoke her to intimately involve the audience in her narrative landscape, here inspired by the Japanese ukiyo-e tradition as well as by my study of revolutionary Russian engineering for HammerWoman. Structures, forms and materiality of wearable (and sometimes portable) design aimed to stimulate and motivate a particular movement, bringing forth palpable sensations of wearing in the dancer.<sup>23</sup> Body and dress coalesced as the different energies transferred between these two entities. Small units of movement arose – each reciprocal gesture of performer-body and dress leading to larger phrases – and the emergence of the dance began. An emergence that was further augmented through the responsiveness of the interactional performance architecture to the dancer's wearable performance. Analogue and digital methods combine as new spatial bodily relations are established and manipulated through dancing-the-wearable and wearing-the-dance.

On the subject of experiential wearing and such interrelations – discussing the costume as if it were a musical instrument – Caroline Wilkins, after her *InstrumentWoman*

performance, explained the phenomenon in her feedback to me:

I would define this as a constant shift between the animate and inanimate, as though the musical instrument, through its innate structural flexibility, takes on its own directional movement and obliges the body to follow accordingly. There is almost a sense of ‘loss of control’ on my part as I negotiate its physical mass and presence as a moving object with that of my own body – a state of flux between the two. (Wilkins 2013: email)

Hence, the sensual material design of the garment linked the tactile (the instrumental musical quality) to the acoustic perceptions gained of the character. At the same time, this aesthetic direction, and the visual staging for the design, is completely integrated with the different performance techniques, styles and habitus the performers each brought to the dance or, as Olu Taiwo, another performer in the ensemble, would call it, to the ‘physical journal’ (Taiwo 2009) of the performance artists who participated in the creation of *UKIYO*’s mixed reality.

The physical journal according to Taiwo is a notion that refers to the dancer’s body and corporeal being, the metabolic system and dynamic, kinaesthetic sensibility. Each performer-body, one could argue, also inhabits its unique and particular vibratory potentials and energy fields (down to molecular level). In addition to Taiwo’s corporeal, physical emphasis, I think of the design of the wearables described in this chapter as metabolic, so to speak, insofar as *UKIYO* represented the first expansive attempt to set in motion these designs inside the creation of a shared space of performers/audiences mingling, shifting space along the sounding pathways. The metabolic, in this sense, happens in an energy field which is an immersive social space of experience as well – both at development stages and during final exposition. During the actual performance, the audience is so close that they can practically touch the costumes and feel the movement happening in their immediate proximity. Hence, they very closely enter into the framework of my *design-in-motion* and partake of its poetics in the most immediate way.

## Notes

<sup>1</sup> The Mixed Reality Lab and Center for Computing Ubiquitous Technology Embodiment (CUTE) is a joint venture between Keio University, Japan and the National University of Singapore (NUS). Partly funded by the National Research Foundation (NRF), the CUTE Centre's remit is to research 'the general area of Interactive Digital Media targeted at addressing the future of interactive, social and communication media' (<http://cutecenter.nus.edu.sg>).

<sup>2</sup> In addition to our ongoing online rehearsals, a further physical laboratory with Japanese research colleagues was held in the UK, at Brunel University in April 2010. Public performances in European sites and online followed in 2010 and 2011.

<sup>3</sup> Here I refer to a building of interest in wearables for interactive performance that extends out of my MA studies (2007-2008) and DAP-Lab's performance *Suna no Onna* (2008), as well as the earlier telematic performances we had done with the Japanese partners. See: Birringer and Danjoux 2009a and Birringer and Danjoux 2009b.

<sup>4</sup> This Kabuki technique was originated by Ichikawa Danjuro I (1660-1704). *Aragoto* utilises extremes in costume, dialogue and movement to emphasise character traits – good or evil (Scott 1999: 91).

<sup>5</sup> In an all-male cast – the *onnagata* imitating women, and musicians and their acoustic instruments are on stage.

<sup>6</sup> *Hanamichi* are the raised passageways for actors of Kabuki theatre to enter and to exit the main stage. They were conceived as a device to not purely transport but more significantly allow the actors and the audience to occupy one same theatrical space through this passage (Junko 2004: 10).

<sup>7</sup> I examined some of these instrument designs firsthand when they were exhibited as a part of *Sound Art: Sound as a Medium of Art*, at ZKM (2012).

<sup>8</sup> John Cage composed his first prepared piano piece *Bacchanale* in 1940 for African-American dancer and choreographer Syvilla Fort.

<sup>9</sup> In connection to *The Art of Noise* Futurist manifesto, Russolo argued in a letter to fellow composer Francesco Balilla Pratella for a new musical aesthetic of 'noise-sound' linked to an increased proliferation of machinery. Furthermore, Russolo proposed that the human ear was adapting to new industrial soundscape and thus demanding more in terms of acoustic sensations (Russolo 1913). See <http://www.ubu.com/papers/russolo.html>.

<sup>10</sup> The *Hokusai Manga* was a series of fifteen volumes of the Japanese artist's works containing almost four thousand of his rough sketches. It was published in the Edo period between 1814 and 1878 and its original function was to provide a teaching tool for craftsmen and artists to develop the skills of drawing.

<sup>11</sup> I would later depart from this method of designing in favour of a subtler, less visually overt design approach to the integration of sounding and playback technologies, as is evidenced in the later work I created for my practice-based research in the performance *for the time being* (see Chapter 5).

<sup>12</sup> *Bōjutsu* is the name given to the martial arts technique of working with a bō or staff as opposed to empty-hand fighting.

<sup>13</sup> Rosalind Krauss (1979) writes about ‘Sculpture in the Expanded Field’ in a postmodern context where landscapes and architecture and other complex material forms enter the realm of sculpture – thus removing the separateness of different mediums.

<sup>14</sup> I use the term ‘readymade’ in connection to Dadaism and the Dadaist artists who recontextualised ordinary found/manufactured objects as art – deleting original functionality. In particular, Marcel Duchamp and his sculptural works such as *Fountain* (1917) and *Bicycle Wheel* ([1913] 1951). In my case however, I am not removing the useful and original function of the object (speaker [as playback device]) but rather amplifying its status through integration into mobile performative contexts.

<sup>15</sup> The concept of the avatar was an idea initiated and developed by DAP-Lab during their residency at Keio University in 2009. Here the possibilities of connecting the physical space of dancers to the Second Life space of virtual performer-avatars was explored for its performance potentials.

<sup>16</sup> Artists/composers utilising this experimental method of noise creation involving the deconstruction and destruction of audio technologies and playback devices (turntables, vinyl, compact disc players etc.), include: John Cage, Nam June Paik, Christian Marclay, Yasunao Tone, and more recently Otomo Yoshihide to name a few.

<sup>17</sup> Of particular value to my prototyping processes was Nicolas Collins’s *Handmade Electronic Music: The Art of Hardware Hacking* (2006), a book that derived from a course he had devised (at the Department of Sound at The School of the Art Institute, Chicago) for introducing students to some electronic alternatives to the computer, ways to bridge the gap between the sound world of a generation raised in an electronic culture and the ‘gestural tradition of the hand’, as he calls it.

<sup>18</sup> In her PhD thesis Wilkins explores the notion of embodiment relationally to the process of creating new sound theatre involving media technology and live interaction (Wilkins 2011: 1). Moreover, her research investigates what she terms ‘medial extensions of embodiment’ that have emerged through human-machine discourse (1).

<sup>19</sup> The 5th International Conference on Digital Arts, 22 & 23 April 2010, School of Architecture, Universidade do Minho, Guimaraes, Portugal.

<sup>20</sup> During our time spent in Japan, the DAP-Lab ensemble, including Wilkins, had opportunity to study elements of butoh firsthand with master Hironobu Oikawa at the Maison d’Artaud in Tokyo.

<sup>21</sup> Qigong is an ancient Chinese health care system based on an holistic approach to the body – combining breathing, postures and focused intention. The Qigong system we applied in *UKIYO* used a mixture of training methods, taught to us by our Japanese collaborators, combining dynamic, static, meditative and interactional patterns.

<sup>22</sup> For a co-authored essay on this particular work see Brown and Ramsgard Thomsen (2008: 228-246).

<sup>23</sup> Verbal feedback from the dancers/performers during the rehearsal stages of the work indicated that this was the case – that my designs did bring forth ‘palpable sensations of wearing in the dancer’. Some of the dancer/performer quotes I include in this thesis also support this fact (see Chapters 2, 4 and 5).

## CHAPTER 5

### *for the time being: [Victory over the Sun] (2012-2014)*

This is not a lament it's the cry of a bird of prey

*My vol'nye  
Razbitoe solntse  
Zdravstvuet t'ma!*

We are free /  
Broken sun /  
Long live darkness!

*proshlyi ukhodit  
bystrym parom  
I zadvigaet zasov*

The past leaves /  
at a fast pace /  
and shoots the bolt

(from *Victory over the Sun*, Act II)<sup>1</sup>

This chapter advances further the examination of the practice-based elements of my research, undertaken here in the context of DAP-Lab's interactive dance opera *for the time being [Victory over the Sun]*, between 2012-2014. As such, *for the time being* embodies the next level of my *design-in-motion* research project. Furthermore, inspired by the experimental Russian Futurist opera *Victory over the Sun* (1913), with its libretto by Aleksei Kruchenykh and Velimir Khlebnikov, costumes and abstract set design by Kazimir Malevich and experimental music score by Mikhail Matiushin, DAP-Lab's dance opera forms an umbrella for this chapter which introduces new prototypes for choreosonic performance. Here, wearable performance concepts that intertwine design inextricably with motivations for movement character and sound composition are pushed further. The new prototypes: TatlinTower (head)dress, GraveDigger, RedMicro Dress and Futurian ChestPlate, represent choreosonic wearables aimed at stimulating dialogical partnering between dancers in costumes, affecting both the sound and movement choreography mutually. Rather than solely characterising the wearables as choreosonic, the term is also



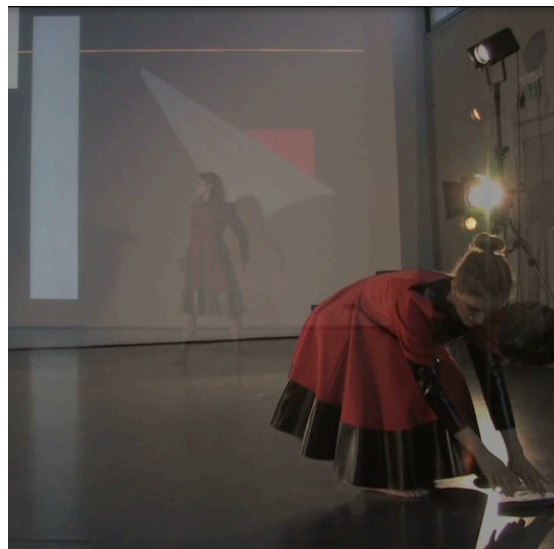
now applied to a particular type of *audible* choreography, i.e. choreosonic performance that connects partnered movement-sounding which can be digitally processed in real-time. This subtle but significant shift in the work, and the examples I provide below, aim to more fully highlight the centrality of wearable design in multimedia dance theatre involving integrative and collaborative methods of performance-making.

Moreover, building on ideas first explored in *UKIYO*, and thus connecting to themes of sound dysfunctionality and the noise aesthetic, this chapter further develops the notion of the wearable as instrument and interface for disruptive sonic expression, where noise occurs in relation to perception rather than as objective fact (Hegarty 2007: 3). The four new prototypes – inspired by the paradoxically revolutionary and creative aspects of the original opera, and Russian avant-garde art from the same era – are positioned as experimental instruments, compositional tools and the basis of sonic material for DAP-Lab's dance opera. Furthermore, they seek to embody an aesthetic typical of Russian art of the time, as described by Rosamund Bartlett and Sarah Dadswell (2012) in their edited collection<sup>2</sup> as 'simultaneously Utopian and Totalitarian – liberating and yet restricting' (2012: 1). I will discuss design and performance strategies involving collaborative approaches, wearable-partnering and other methods for the interrogation of the prototypes in relational and mobilising ways as part of this chapter. Before addressing the historical, theoretical and performative dimensions of these sounding wearables, I open with an evocation of a dance involving one of the interactive prototypes – RedMicro Dress performed by dancer Vanessa Michielon – in order to draw immediate, visceral attention to an expanded notion of dress in performance as proposed by the interdisciplinary approach and design methodology delineated in this thesis (see Chapters 2 and 3).

### **5.1. Wearable Dance: Interaktionslabor Göttelborn (2013)**

The dancer, Vanessa Michielon, enters the refurbished industrial grey warehouse space on the site of a disused mine in Göttelborn, Germany. Slowly she marks the outlines of a perimeter through her linear movement and her placing of small rocks on these outlines. The space is bright (daylight, August 2013 [and also spotlit]), and the weighty presence and subtle momentum of her red neoprene dress with black leatherette trim, square shoulder-line, narrowing sleeves (elbow to wrist) and circular cut skirt is palpably sensed by Michielon, as her comments, discussed below, will reveal. At this point, however, she is one solitary chromatic figure, relatively small in a vastness of monochrome, the

brilliance of her red dress, its hue saturated and pure, appears more vibrant in the composition – vividly enlivening the surrounding tonalities of grey<sup>3</sup> as intended. The gestural shifts and angular movements of Michielon in the RedMicro Dress carve their geometries through the space as she picks up and sets down the rocks as if she were examining each stone, needed for the building of an imaginary house (figs. 42-43). This short solo movement sequence ensuing from the setting described here of Michielon in the RedMicro Dress prototype, was created whilst I was on a ten-day research residency at Interaktionslabor.<sup>4</sup> Some of the members of DAP-Lab had joined me to work on an expanded version of our new interactive operatic dance theatre production *for the time being [Victory over the Sun]*. This exploration represents a second iteration of wearable performance for the RedMicro Dress which I discuss in both earlier and subsequent iterative forms later in the chapter.



Figures 42-43. Vanessa Michielon in RedMicro Dress, building her imaginary house in the ‘Tenth Country’ scene rehearsal from Act II, *for the time being [Victory over the Sun]*, Interaktionslabor, Germany, 2013. Video stills © Interaktionslabor/DAP-Lab.

Working within the context of DAP-Lab's free adaptation of the 1913 libretto, where only certain key aspects of the original libretto, namely its transition from old world to new by virtue of the killing of the sun, were adhered to – opened up a range of approaches to the application of interaction design to wearable characters. This chapter addresses the various methods I used to invent such characters for dance performance that would emerge choreographically through a combined visual, sonic and movement aesthetic, drawing on the affective power of the garment/costume engineering for the dancer and historical-futurist associations.

Furthermore, as had been the case with *UKIYO*, the garment design concepts for the work – incorporating sound generating technologies to be activated by the dancers in motion, were presented to them and the choreographer (Birringer) as choreographic provocations for the dance. However, the sounding wearables that come under scrutiny in this chapter are devised in a more mobilising, dynamic *relational* manner, almost as if they could be imagined, using a metaphor drawn from drama, as dialogical design prototypes. I stress the word relational here in order to emphasise this very fact, namely that the prototypes now engage in dialogue with one another. Costumes and characters in *for the time being* are meant to inter-act, in an architectural scenic and sonic environment, thus creating a more amalgamated *mise-en-scène* of collaborating entities rather than being featured, so to speak, in their own spheres (as in *UKIYO*).

Additionally, narrative, albeit a highly modified one from the original *Victory over the Sun* libretto, was significant to the emergence of wearable characters for this new experimental piece. Previously, in *UKIYO*, sound characters were not so much enmeshed with the main performance narrative but rather formed their own abstract subtexts running in parallel or in a distributed field. Whereas in *UKIYO* each constituted a distinct entity conceptually and also physically – set apart by their individual *hanamichi* – now the wearable design and various narrative strands became far more integrated and interconnected.

Investigations of choreosonic performance in the context of *for the time being* were aimed at enfolding elements of the libretto into the formation of wearable character while also emphasising the materiality of performance. This relationship will be expanded on later in the context of each prototype. RedMicro Dress and other wearable concepts described below thus extend the design methods considered in the previous chapter for the unfolding of movement in dance theatre.

At the time of Interaktionslabor 2013, which yielded the scene described above, the first production of *for the time being* had already been staged at Watermans International Digital Arts Festival, London in May 2012. A second subsequent public performance and iteration would take place later at the Lilian Baylis Studio, Sadler's Wells, London in April 2014. Between the two main productions, my aim had been to advance my own research practice further. Interaktionslabor, together with a series of self-funded, specially equipped DAP-Lab workshops with dancers/choreographers, sonic and media artists held at Brunel University between 2012 and 2014, provided the research environment and collaborative opportunity for me to do this (see Chapter 3). The dance that emerged from the summer 2013 investigations, to be discussed below, was thus created in-between the two public performances. It arose specifically out of the continued research investigations into choreosonic performance conducted for this PhD, focusing in this second phase more deliberately on partnering or dialogical movement with sounding.

## 5.2. Concepts of Dress in Performance

In contrast to Chapter 4, I deliberately began this chapter with an evocation of the study conducted in 2013 for 'Tenth Country' in Act II of *for the time being*, in order to draw immediate attention to the presence of dress – its vitality and potential plastic expressivity as design-in-motion. The dress does not exist here to merely adorn the dancing body, nor is it intended to dance alone.<sup>5</sup> Rather, its objective is to activate the dancer's various gestures and movements in the space, in a heightened performance of dress, whilst itself becoming activated by the dancer. In this way, and referring back to the theories contained in Chapter 1, I propose the wearables now to become more dynamic media and bodily extensions. The auratic presence of the wearables positions them I suggest akin to *animate entities*,<sup>6</sup> a term that for me captures well the performative aspects of the dress and the energy transference and experiential exchange they engender between the dancing bodies.

The study for 'Tenth Country' and the detailed dancer feedback from Michielon (further below) allow for a more interrogating level of inquiry for the project. Since Michielon had been particularly keen to engage in a more in-depth physical investigation of the wearables and to articulate her experiences, I decided to conduct a focussed series of wearable movement studies with her. The investigation centred on her responses to two of the prototypes – RedMicro Dress and the TatlinTower (head)dress. It predominantly involved meeting with and filming Michielon outside of the main rehearsal time. Here, I asked her

to simply explore the palpability of the wearables and respond physically through a series of short movement studies which were filmed and later analysed (figs. 48-55). Michielon then provided immediate verbal feedback. Additionally, I asked her to reflect for a few more days and to send written feedback on her experiences. Some of the excerpts below come from Michielon's own writings together with her email correspondences with me.

Through this chapter, with its more detailed and integrative studies, I want to demonstrate how this second practice-based research-creation – *for the time being* – and associated prototypes intensify the conceptual and artistic application of *design-in-motion* for the choreographic (see Chapter 2). The approach I took with Michielon enabled me to gain new insights on her intimate relationship to the performative life of the dress and material extension. It complemented well my other phenomenological and heterophenomenological studies with the dancers, providing further layers of knowledge I could analyse. On the one hand, Michielon moves in contact with the sensory tactile and aural stimuli of the dress, listens acutely through her body, responding to inner cues and sensations experienced, allowing these to expand how she might move (figs. 48-55). On the other hand, somatic experience in my design work also extends outward into her partnering interactions that enable or affect other dancers/performers (figs. 76-78). Thus, for the purpose of this research, the 'choreographic' – as an adjective – corresponds well and in a complex interrelated way to the designed and devised performance potentials my garments proffer the dancers and their emergent characters, but more importantly the choreographic is intrinsically intertwined with the choreosonic attributes of sounding wearables.<sup>7</sup>

In this thesis, through the examples provided, not only do I suggest that wearable performance design concepts offer a significant dimension for the generation of the choreographic, becoming instrumental in the aesthetic and technical, kinetic, sonic and dramaturgical composition of intra and inter-actional performance, i.e. in and between bodies. More importantly, in addition to further addressing the intertwining of dancer and wearable prototype and the performativity of individual movement characters, i.e. their ability to affect change in the performance space, my research concerns in this case study advance to the garment's potential as *relational/transitional* – its discernibility moving from one to two. The transitional choreographic raises a new dimension of questioning about how one garment worn by one dancer can influence the sounding and movement of another. The RedMicro Dress and Futurian ChestPlate prototypes specifically aim to explore such contiguous relations between dancers in wearables, where

the dynamics of proximity and distance and the interconnectedness of performers' movements generate sound (figs. 76-77). This notion will be expanded more concretely below. Designed for both solo and duet performance, the final version of the chestplate, performed in 2014, had evolved into a fully functional electro-acoustic instrument integrating interactive circuitry – incorporating proximity, bend and light sensors to effect sounding of the instrument (fig. 74), and two small amplified wearable speakers into its makeup. When partnered with RedMicro Dress, sonic responses from the chestplate can be explored synergistically between the two dancers, their relational movements emerging concurrently, as the sensors respond to their movements and proximity.

Although amplification of analogue and electro-acoustic instrument sound was always part of my research, working more closely now with musicians and electronics engineers (than previously in *UKIYO*), opened up new possibilities for my technology-enabled designs. For example, RedMicro Dress, whilst devoid of its own sounding capabilities, can act as a transceiver – a receiver and transmitter – simultaneously detecting and relaying sounds, picked up in close proximity by its small integrated microphone (fig. 44), to a larger diffusion system.



Figure 44. RedMicroDress with integrated wireless microphone system – transmitter at the waist and tiny mic located on the left back shoulder for partnering and interaction, 2012. Photo © Brigitt Angst.

In the case of the above example, the small speaker system of the Futurian ChestPlate with its limited amplification is enlarged sonically and thus also aurally through this improvised partnering. Both phases of the prototype twinning described above were supported by sonic artists Sandy Finlayson and Oliver Doyle who I had developed close working relationships with during the second (2012-2014) research phase.

### 5.3. RedMicro Dress in the Tenth Country (2013) – Act II, Scene VI

In the original 1913 version of *Victory over the Sun*, Malevich, pioneer of geometric abstraction, utilised this painting style for the design of sets and idiosyncratic costumes for a cast of many characters – ‘Nero and Caligula’, ‘Traveller’, ‘Sportsmen’, ‘Man with Bad Intentions’, ‘Motley Eye’, ‘Aviator’, ‘Trouble Maker’, ‘Enemy’, ‘New Man’, ‘Member of the Chorus’, ‘Reader’ etc. However, the visual aesthetics for these characters on the whole interested me less than those of fellow artist El Lissitzky – a series of architechtronic visualisations produced a decade later in 1923, for an unrealised mechanical version of *Victory over the Sun*. Nevertheless, the geometric forms – square body, rectangular arms, triangular skirt of Malevich’s ‘Pallbearer’ character in black and red (fig. 45), proved inspirational for RedMicro Dress prototype. Essentially, the dress adopted the same geometric characteristics in its construction – square bodice, angular shoulder line, circular cut skirt (rather than triangular). Additionally, and as the name suggests, the primary colour for the dress was red, a saturated and pure hue, sharply contrasted with black.

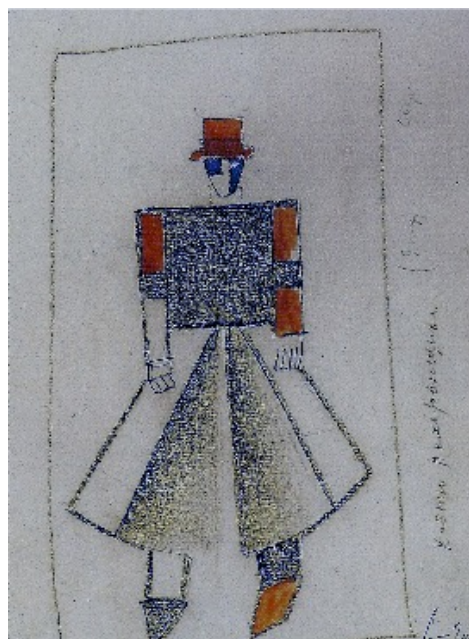


Figure 45. Pallbearer, Design sketch for *Victory over the Sun*, Kazimir Malevich, 1913. Photo © R. Bartlett, R. and S. Dadswell, *Victory over the Sun: The World's First Futurist Opera*.

The ‘Tenth Country’ is a reference to the original *Victory over the Sun* and a mysterious stage direction near the end of Act II, after the sun has been killed and the futurian strongmen are constructing a new world, speaking in a new, non-rationalist language of strange neologisms. The stage direction reads:

ACT II  
Fifth Scene

TENTH COUNTRY

*Exterior walls of houses appear but the windows go toward the inside in a strange way as if they are pipes drilled through the walls. Many windows.*

*(Victory over the Sun, Act II)*

At the beginning of this chapter, and relating to the stage direction above from the original 1913 libretto, the dancer Michielon is introduced building her imaginary house in the Tenth Country (figs. 42-43). I resume this evocation now with her standing inside the square she has marked with her white painted rocks – the house she has built. In her next four-minute movement sequence Michielon’s angular arm gestures and precise method of traversing her rock perimeter drew my attention – her dynamic relationship to the dress and her moments of posed stillness exemplifying an observable intermingling of the fabrics of the textural and textual. She lifts and replaces stones, first stretching out and then contracting with each new position she assumes in the space – her actions becoming audible as she begins to exert her kinetic presence more forcefully on the dress – the dress simultaneously responding. The black leatherette of her garment creates subtle slapping sounds as she sharply defines a series of shapes moving slowly but decisively along the outlines she has fashioned. Then, she halts her activity and bends her body back, raising her face upward, lifting and bending her right arm whilst her left remains outstretched, in a deliberate transmutation to static and familiar sculptural tensile archer’s pose, adopted from Vsevolod Meyerhold’s biomechanics.<sup>8</sup> Meyerhold’s acting system, based on the efficient, precise utilisation of poses and externalised gestures as expressive means, proved stimulating for the constructivist sensibility embedded in this scene.

This short solo performance in RedMicro Dress by Michielon transitions into a duet as she is joined by a second performer (Emi Watanabe) who is wearing a blue and black costume and playing the flute – the Futurian (fig. 46). On the large wall behind the performance, a thin line of light appears, like the hands of a clock dial moving slowly in a circle. Other geometric forms are projected onto the wall: a red square tumbling down on the left, on the



right there are squares and rectangles of white light on white wall. The scenographic space thus expands through this use of virtual reality projection, augmenting the environment for the next stage of the duet. The formation of the second character – the Futurian – is as yet incomplete. This character remains embryonic, secondary yet significant to the concept of wearable partnering; in the process of emerging.



Figure 46. Vanessa Michielon in RedMicro Dress with flautist Emi Watanabe in the Tenth Country, scene rehearsal from Act II, *for the time being* [*Victory over the Sun*], 2013. Photo © Michèle Danjoux.

Michielon's dress in the Tenth Country, in addition to its material qualities, colouration and distinctive visual aesthetics, has a particularity designed for partnering and interaction – an integrated wireless microphone system with transmitter at the waist and tiny mike located on the left back shoulder (fig. 44). The perceptible and motivating sensations of the RedMicro Dress that had guided Michielon's body thus far, and prior to her partnering with Watanabe, as described in her comments below, are herewith augmented further by these built-in technologies offering new potential energies for a shared *kinaesonic*<sup>9</sup> choreography to emanate – an aspect of the work I will be discussing more fully as this chapter progresses. Figure 47 (below), a signal flow schematic produced by sonic artist collaborator Oliver Doyle, shows the routing, via laptops, to the in-house audio system from the RedMicro Dress Lavalier microphone. The location of the wearable mike – on the back of the shoulder – renders it unintentional or unusable for the wearer, at least not in the

conventional sense. Rather, it is there as a sound-capture device intended for another performer or interloper, in this case Watanabe in her role as ‘Man with Bad Intentions’ and ‘Futurian’, characters derived from the original *Victory over the Sun* libretto, wearing the embryonic chestplate.

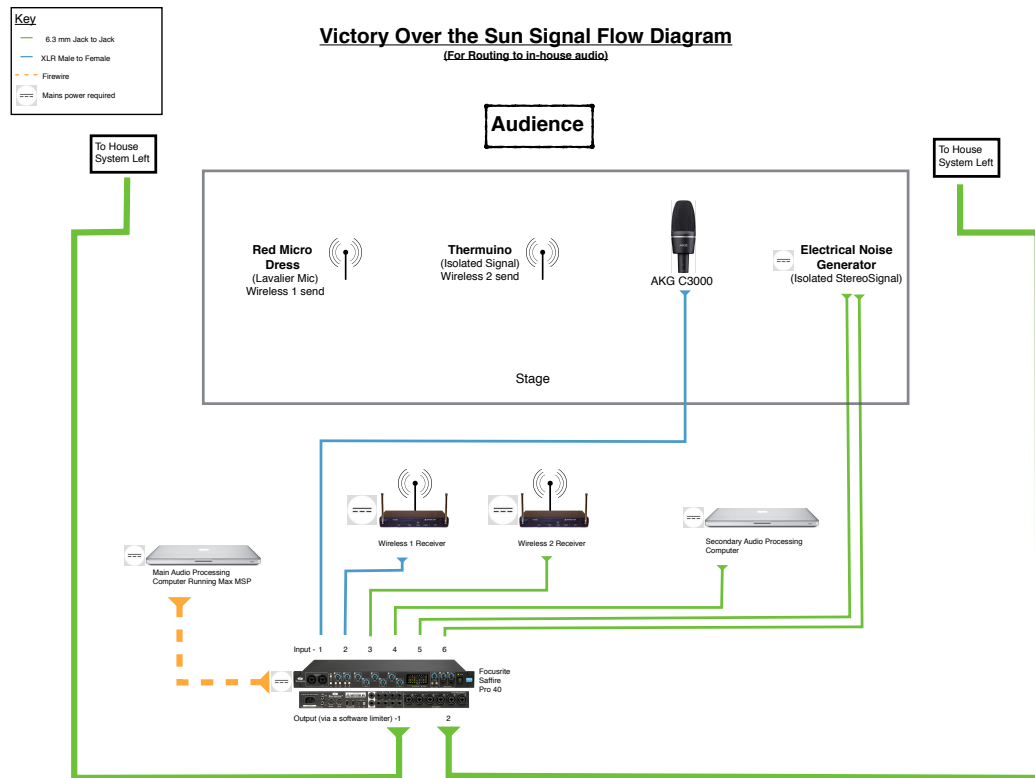


Figure 47. *for the time being [Victory over the Sun]*, Signal Flow Diagram (for routing to in-house audio) produced by sonic artist Oliver Doyle, 2014. Diagram © DAP-Lab.

### 5.3.1. Wearable Material Performance

In the case of Michielon’s solo performance in RedMicro Dress for the opening segment in Tenth Country, it became clear from her feedback that the tactile and material qualities of the wearable were directly linked to the types of movements she created. When I asked Michielon about her encounter with the structural and tangible aspects of RedMicro Dress as movement initiator she first disclosed her enjoyment of the process and then the distinct analogue provocations it provided to her movement process where restrictions did not in effect restrict but rather became suggestive of new movement to her:

Yes, I enjoyed a lot using this dress, and I think that in this case, the fact that some parts of the dress were a little bit rigid, this is not a limitation in a negative way, but it's maybe a suggestion to create specific shapes. For example, I felt like using my elbows in this way [shows right angles with the arms bending downwards], making angles with my elbows and/or keeping them really straight; this kind of costume suggested to me to make lines or to make geometric forms instead of circular forms. And also, the skirt – it is not so light, I mean it's a little bit heavy and it makes a kind of sound when you move it; this suggested to me to walk with different speeds to see how the skirt slaps in a certain way or to try and stretch my legs to make it stretch too. I think limitations are suggestions: they are not obstacles in a negative way but they just give you a frame to develop specific kinds of shapes and movements. And in this way, I think it really helped me to create shapes/futurist shapes and to re-create in a way the pictures (Rodchenko and Russian productivist posters) that we used for the brainstorming because it really suggested to me these kinds of positions, that was helpful in a way. (Michielon 2013: np)

Interviewing Michielon after observing her in the conjoining of body and dress in motion revealed to me the combined contribution of the felt experience of dress and the visual stimulus of historic research (Russian Cubo-Futurist and Constructivist art and propaganda posters [Alexander Rodchenko, Varvara Stepanova] of the early 1920s) which we had studied together (fig. 46). Both contributed to the motivation for her movements. Additionally, Michielon comments on factors relating to aurality, albeit percussive sound at this stage as opposed to digital, specifically the sounding of the leatherette cloth, animated through the dynamics of her leg movements to elicit sound from the garment. She thus highlights a two-way process of exchange in her wearable live performance, with RedMicro Dress a multisensorial agent provocateur in her movement process, moving her and moved by her in a reciprocal process of exchange. This personal state of experiential wearing in relation to the multi-sensorial qualities of the costume, specifically sounding and tactility, is hinted at again in an email correspondence with Michielon, where she comments once more on both sounding potential of cloth in motion and palpability (fit) adding to a 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 2014: email)

Michielon, who is Italian, is trained in ballet, modern, contemporary and community dance. Moreover, with a degree in Media Engineering and a PhD in Cultural Heritage, both obtained from the University of Turin, Italy in 2008 and 2013 respectively, she describes herself as a dancer and researcher. Michielon has worked freelance with a number of small dance companies such as The Very Secret Dance Society led by choreographer Raffaele Irace with whom she has been a guest dancer since 2011. One of the pieces she performed with Irace, *Lunar* (2013), involved collaboration with costume designer Sonia Biacchi, known for her highly sculptural garment forms for dancers. Alongside two other dancers, as one of a trio, Michielon performed inside a rigid confining cocoon-type dress designed by Biacchi, which limited her movement forcing a repositioning of dynamic emphasis as she notes: '[...] we basically could not use the legs [...] because they were quite restricted, so we concentrated particularly on the upper body while we were wearing these dresses' (2013: np).

Furthermore, like some of the dancers I have worked with on this project (Helenna Ren, Katsura Isobe, Angeliki Margeti), Michielon had experience of interactive dance which I have grown to understand through my research requires a certain physical and mental processing and approach to working with the technology and its parameters. In 2015, Michielon completed a further Master's degree in Dance Performance at Trinity Laban Conservatoire of Music and Dance, and is now London-based. Her somatic (self)awareness in and through the dress and her ability to articulate inner sensations proved exceptional to me; seldom have I experienced such perceptivity on wearing in either dance or fashion contexts. However, I also discovered that some dancers, in contrast to Michielon, prefer not to communicate extensively verbally. In these cases, a more open form of discussion worked better for both myself and the dancers. Furthermore, here, the research inquiry was informed more precisely through insights provided by my detailed observations, visual documentation (photographs and video) and ongoing analyses of the dancers' body movements throughout the research process. This was the case with Margeti who performed an earlier version of RedMicro Dress at Watermans, London, in 2012 (fig. 56-58). Michielon, however, was very vocal and proved to be one of the research participants offering the greatest spoken insights, and for this reason I decided to interview her more formally with semi-structured questions allowing for flexibility of response (see Appendix 5, pp. 258).





Figure 48-55. Design-in-motion: A study of Vanessa Michielon's gestural movement in an exploration of combined historical and sensory tactile qualities of RedMicro Dress, Brunel University, London, 2014. Video stills © Johannes Birringer.

With her particular combination of background, training and skills Michielon was able to apply a level of reflexivity to her evaluation of her experiences and articulate these very clearly. Consequently, I was able to enter a more penetrating level of inquiry with her. The feedback and analysis of wearing in motion I received from Michielon significantly advanced my understanding of her particular perceptivity and motivations to the movement process. As a result, in my interrogations of Michielon, I began to grasp more fully how, for instance, the touch and momentum of cloth could activate and perpetuate the motion of her body, how this was reciprocal in nature as she sensed the impacts of her movements on the dress, and how structure assisted posture and encouraged or inhibited gesture.

Even with its detailed feedback from Michielon, this case study is much larger than a study of one participant, as my findings and what I am able to surmise come as a result of conducting explorations with a number of dancers; indeed, *for the time being* allowed me to test some of the prototypes by having them worn by different dancers (e.g. figs. 56-59).



Figure 56. Angeliki Margeti in RedMicroDress performing with the dynamics and momentum of the dress with shovel from Act II, *for the time being [Victory over the Sun]*, Watermans, London, 2012. Photo © Brigitt Angst.





Figures 57-58. Angeliki Margeti in RedMicroDress performing with the dynamics and momentum of the dress with shovel from Act II, *for the time being [Victory over the Sun]*, Watermans, London, 2012. Photos © Brigitt Angst.

### 5.3.2. Partnering and Duets

RedMicro Dress, as dynamic amplificatory device for wearable partnering, expands the personal experiential dimension of wearing from one to two via a process of exchange and sharing between dancers. Not only are singular body and dress invited to combine in motion – a compound body of interacting physical entities in a state of becoming, but effects propagate forthwith from one body to another, as Michielon is joined by flautist Watanabe – the Futurian, a disruptive character with bad intentions. Their bodies draw closer in proximity and as they do so, the sound of Watanabe’s flute is captured by Michielon’s small dynamic microphone system. Wirelessly, the device transmits the sound to sonic artist and collaborator Oliver Doyle who can then amplify and distort its aural presence in the space through processing the sound live in Logic Pro and PD software patches (fig. 47 [above]). With this foundation, the dance between Michielon and Watanabe becomes a dance of proximity and distance, of detecting, capturing, distorting, amplifying, relaying and overlaying a polyphony of sounds that can be experienced by dancer and audience alike as was the design intention.

What this 2013 rehearsal in the industrial hall revealed to me was the emergence of a subtle relationship between the red and blue garment characters, their shapes and architectures, and above all their evolving proximal spatial relations. Watanabe moved across the plane in an almost straight line, crossing from right to left, at one point being very close directly behind Michielon who danced around the perimeter and then cut a diagonal. In that moment, their paths intersected, they touched and the shoulder microphone picked up the high, piercing sounds of Watanabe’s flute playing. The signal was sampled and played back by the sound technicians (Elliott O’Brart and Cameron McKirdy), now processed and mutated into lower registers, until the sound echoes and reverberations began to fill the vast space with deep granular blurts and splatters. As Watanabe moved on and left the close proximity to Michielon’s dress, the amplified and processed soundings gradually subsided and became weaker, until the disseminated sound stopped altogether and only the whispers of the live unamplified flute were heard.<sup>10</sup>

In an earlier version of this scene, in the first staged performance of *for the time being* at Watermans in 2012, dancer Helenna Ren is the interloper character with bad intentions exploring the notion of proximity and distance in relation to wearable design (see Appendix 4, pp. 256). Partnering with Angeliki Margeti who on this occasion danced the



RedMicro Dress, Ren performs a Chaplinesque slapstick dance, humorously awkward, 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, her 'ill intentions', together with the tiny sounds emitted from her dynamic small speaker via the wearable microphone system integrated into the RedMicro Dress (figs. 59-60).

This is a partnering on more than one level, since it involves bodies dancing with technologies and at the same time bodies dancing with sound-propagating bodies, in a gender-twisted duet driven by sound-capturing, manipulation and amplificatory potentials. Punning on early sound technology at the beginning of the twentieth century, the small sounds coming out of Ren's speaker were short-wave radio noises and unintelligible, garbled speech, as if the duet and the play between 'word' and gesticulation here depended, in a comical sense, on silence and a comprehension without voice (of the silent film era).



Figure 59. Dancers Angeliki Margeti in RedMicro Dress and Helenna Ren as Man with Bad Intentions with small wired speaker, approaching Margeti's small microphone system, *for the time being* [Victory over the Sun], Watermans, London 2012. Photo © Brigitt Angst.



Figure 60. Angeliki Margeti and Helenna Ren in close proximity. Ren's breath and her grunts are captured and transmitted to the laptop via the small microphone system integrated into Margeti's dress, *for the time being* [Victory over the Sun], Watermans, London 2012. Photo © Brigitt Angst.

The 2013 Interaktionslabor performance experiment described at the start of this chapter, featuring Michielon in RedMicro Dress, which took place fourteen months after the 2012 premiere of *for the time being*, was conducted to investigate further choreographic and sonic potentials in the dialogue between movement, wearable design, sounding, space and digital/mixed-reality performance environments for this scene. During the 2013 laboratory, Japanese flautist Watanabe, as Futurian in a state of evolution, performed the duet role dancer Ren had previously performed. Pairing Watanabe, an instrumental musician, rather than a second dancer with RedMicro Dress, enabled a more focused and specific testing and sampling of sound – the live flute, through the mike worn on Michielon's RedMicro Dress. This allowed the study to centre less on the comical (as with the previous version) and more on compositional issues of sounding, proximity and distance in relation to RedMicro Dress.

At this stage in the research process, Watanabe was wearing an early prototype of the chestplate, not yet sounding, her flute replacing the antecedent dynamic small portable speaker and breath/voice Ren had used in the 2012 version of this scene. The objective, however, was not to have a musician ultimately paired with a dancer for this scene, but to return to a partnering between two dancers, as was the original intentionality – one generating sound, the other receiving and transmitting it, as had been the case with Margeti and Ren in 2012. To achieve this, I determined that the chestplate would need to become a fully functional electronic and wearable instrument in itself – a sounding accessory to the blue neoprene costume Watanabe had worn in 2013. Thus, the next step with regard to this prototype, and the staged emergence of the ill intended interloper Futurian ChestPlate character, was to invite musician and sound artist John Richards, who had previously worked with me on the construction of the TatlinTower (head)dress prototype (see below), to collaborate again, immediately after Interaktionslabor 2013.

Moreover, taking up the idea of ‘movement propagation’ (mentioned by Michielon in her second quote above), the intention was to explicate a more complex and dynamic futurian ‘heavy metal’ stage of *movement and sound propagation* linking to my ongoing interest in noise music and Richards’ ‘Dirty Electronics’ sound aesthetic. The reference to a subgenre of rock music developed in the late 1960’s and early 1970’s is used with caution, and at the same time ironically – bringing in the notion of highly amplified and distorted sound and extended instrument playing, the intention to create a certain phantasmagoria of android design. This takes the idea of animation explored in *UKIYO* much further whilst also emphasising the materiality of the postdramatic,<sup>11</sup> namely the tactile plasticity of audible and less audible movement in gestural duets in my work.

#### **5.4. The Past Leaves/at a Fast Pace: *for the time being***

Unlike the participatory and immersive architectural design of *UKIYO*, which invited the audience to step into the *hanamichi* world of dancers and corridors to experience close-up and intimately, *for the time being* offered a more distanced perspective. In contrast to a crowded space of audience mingling with performers, the open stage setting of *for the time being* allowed a vast spaciousness for the dancers’ imaginations and movement relations with objects.

An interest in early twentieth century Russian avant-garde art had been aroused by several exhibitions I saw in London, and by visits to St. Petersburg (2009-2013)<sup>12</sup> – the city where the experimental Russian Futurist opera *Victory over the Sun* (1913) was first performed. A study of art books focusing on this era – Compton (1978), Lynton (2009), Milner (2007; 2009a; 2009b), Rowell and Wye (2012), Stern (2004) and Borchardt-Hume (2014) – offered additional insights and provided design inspiration for the characters I would develop. The early part of the twentieth century was a time of revolution and social reform in Russia, and this was reflected in the art of the time. This new era ushered in an experimental time for Russian art and a breach with artistic traditions and preoccupations of the past. Radical artists, in the most extreme instances, sought to create something original and utopian, and this consequentially led to the emergence of new associated art movements – Suprematism, Futurism and Constructivism. *Victory over the Sun*, premiered at the Luna Park Theatre in St. Petersburg in 1913, was thus an artistic performance coming out of a rebellious time that sought to dispose of established values.

Furthermore, Russian theatre also had its radicals who rejected existing practice in their quest to redefine theatre as art, for example, the previously mentioned biomechanics of Meyerhold, where strong emphasis was placed on the external mechanics of motion rather than any psychological factors. Indeed, Meyerhold's particular gestural approach to performance, relating to a body's movement interactions with object and machines while focusing strongly on sequences of physical positions and forms – positing that affective states ought to be created physically – partly informed the performative architectures of my wearables in *for the time being*. However, this was juxtaposed with a more phenomenological notion of wearing, as previously discussed, in order to provide certain tensions and potentially conflicting provocations to the dancer and thus, complexity to the emergence of her movements.

Structurally, the original version of the opera had a prologue by the poet Khlebnikov and was divided into two parts, Act I and Act II. The first act reflected the old order and mode of existence, a time before the revolution, and culminated in the 'killing of the sun' – perhaps imagined as a kind of total eclipse to a sunless world. 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. I exploited this particular idea in my interpretation of the Gravedigger character assigned the role of killing the sun in DAP-Lab's dance opera. In *for the time being* this iconic scene is performed by Ren this time in GraveDigger costume (fig. 72) interfacing with Kinect camera and a projected

virtual sun on screen, which I will discuss below. In 1913, *Victory over the Sun* created uproar and was considered unequivocally ambiguous and perplexing by audience and critics alike – nonsensical with its indecipherable text, strange language and unconventional actions. Bartlett and Dadswell state that:

The only aspect that is straightforward in *Victory over the Sun* is its unquestioning embrace of the Future (which actually proves to be rather bleak), and its unrelenting attack on rationality and convention, embodied by the sun that dominates and rules our lives. (Bartlett and Dadswell 2012: 1)

This very paradoxical and contentious nature of a performance, rich in visuals, with strange neologisms of the imaginary transrational *zaum* language by poet Kruchenykh and multiple subtexts, is what first captured the interests of DAP-Lab and began to inspire the design process. The confusion and experimental nature of the piece was in effect most appealing and inspirational to my own work where I wanted not to feel confined by any expected notion of the value of garment or costume in performance. Rather I preferred to question what a garment can do through its encounter with the body in such enmeshed and perplexing contexts. Moreover, the transdisciplinarity of historical pioneering artists, such as Malevich, liberated rather than confined by discipline, inspired me to cross over and advance further beyond any demarcated disciplinary boundaries, defining myself not purely as fashion designer, but as movement initiator and designer of wearable instruments (see Chapter 2).

## 5.5. Historical Context – Exhibitions

In addition to the focus on art, science of the time was making significant advancements; new theories and findings were being made regarding the transmission of sound. In 1901, Italian physicist Guglielmo Marconi had proved that radio waves could curve, and additionally around this time had developed the first commercially successful radio communication system. Thus, modes of communications to the masses were being expanded through an emphasis on audibility. Yet, despite this new focus on wireless telegraphy and the propagation of sound via the airwaves at the turn of the last century, the museum exhibitions I have experienced relating to this era tended to be silent. The drawings, paintings, diagrams and photographs I witnessed in *Building the Revolution: Soviet Art and Architecture 1915-1935* (2011-2012), however, stimulated my interest in the apparent hidden or forgotten dimension of sound, raising issues of audibility versus

inaudibility and modes of sound activation that could be applied to wearable design.

Artist visualisations such as Gustav Klutis's *Design for Loudspeaker No.7* (1922), and Liubov Popova's *City of the Future* (shown in a photograph of her maquette), inspired me to imagine hearing such objects sonically – the broadcasting of propaganda, transmission of radio signals and intraurban noise.

The Royal Academy [RA] exhibition's main intention was to examine Russian avant-garde architecture constructed during a period of extreme social change in Russia, witnessing the formation of the Soviet state after the 1917 Revolution. It placed emphasis on the establishment and development of new building types through a synthesis of radical art, architecture and social policy – displayed through projects by artists and architects. Large-scale photographs of extant buildings or maquettes of proposed architectures were juxtaposed with relevant constructivist drawings and paintings, historical photographs and periodicals, and many of the works had never been shown in the UK before. Amongst the featured artists in addition to Popova and Klutis were Malevich, Vladimir Tatlin, Lissitzky and Ivan Kluin, together with architects Konstantin Melnikov, Moisei Ginsburg, Ilya Golosov and the Vesnin brothers, leaders of Constructivist architecture. However, only a very brief mention of *Victory over the Sun* was made in connection with Malevich's suprematist paintings (featured extensively in the Malevich exhibition at Tate Modern in 2014). A reconstruction, specially commissioned from Jeremy Dixon (Dixon Jones Architects)<sup>13</sup> of Vladimir Tatlin's *Monument to the Third International*, known as *Tatlin's Tower* (1919-1920), had been installed in the RA's Annenberg Courtyard outside and provoked me in particular. Expanded by a broader study of Russian avant-garde art and also noise music, I visualised a sounding wearable experience for a dancer consisting of a TatlinTower (head)dress (fig. 63). This (head)dress would transform the dancer into a radio transmitter and audiovisual symbol of the revolution – simultaneously restricting movement whilst amplifying sonic presence in the performance space – a character to potentially define a segment of DAP-Lab's new work. The realisation of this wearable prototype and sounding movement character will be discussed below.

Other exhibitions that stimulated my research were *Rodchenko & Popova: Defining Constructivism* at the Tate Modern (2009), along with *Russian Revolutionary Posters* – propaganda images, printed after the October Revolution (on display in the Tate Modern from 1 July 2013 - 24 August 2014). Additionally, and worth noting for its post-production influences on my thought processes, was the exhibition *Russian Avant-garde Theatre: War, Revolution and Design 1913 – 1933* (2014 – 2015) shown after DAP-Lab's second

version of *for the time being* in 2014. On display, in the Theatre and Performance Galleries at the V&A, were more than one hundred and fifty designs for theatrical productions by radical and well-known figures of the early twentieth century Russian avant-garde. These included set and costume designs conceived between 1913 and 1933 by artists who worked in a variety of mediums – painting, architecture, textiles, photography and graphics – and joined collaboratively on theatrical productions to create a rich variety of design. Also present were the sketches and lithographs for *Victory over the Sun*, and amongst these were Malevich's design for one scene depicting a large black and white square divided diagonally – the concept for the set, a forerunner of Malevich's famous non-representational painting *Black Square* (1915), a work which embodied the aesthetics of the Suprematist movement originated by the artist. Moreover, one could view, firsthand, illustrated versions of his costume designs – depicting a series of voluminous creations in bold blocked colour with bulky silhouettes that reshaped the human figure. Other featured artists included Rodchenko, Tatlin, Lissitsky, Popova, Alexandra Exter and Varvara Stepanova. There were also several references to director Meyerhold. The opportunity to view these works<sup>14</sup> within the context of this exhibition, curated to promote innovative and pioneering collaborative performance practices, was tremendously insightful for me and has proved invaluable to my reflexive process for writing this chapter.

Finally, and with regard to the sonic dimension that has fuelled my work, the co-curators Jane Pritchard and Geoffrey Marsh of *Diaghilev and the Golden Age of the Ballets Russes, 1909-1929*, Victoria and Albert Museum, London (2011) curated sound as part of the exhibition. This provided an enhanced sensory experience – the aural of musical concepts of the early twentieth century offered alongside costumes and choreography<sup>15</sup> for avant-garde dance theatre – from which I could learn about the various historic styles of experimental musical composition commissioned by the Ballets Russes. In addition, the collaborative dimension of the various works represented was highlighted by this exhibition and the radical nature of the composers' sound for the time – Achille-Claude Debussy's blocks of shifting sound influenced by Javanese music, for the creation of atmosphere and effect in *L'Après-midi d'un faune* (1912), costume design by Leon Bakst; Igor Stravinsky's layered rhythm heavy with erotic quality in *Le Sacre du printemps* (*The Rite of Spring* [1913]), premiered in Paris in the same year as *Victory over the Sun*, featuring Nicholas Roerich's set and costume designs; Erik Satie's pioneering and playful assemblage of acousmatic sound into musical score for *Parade* (1917) – pistol shots, typewriter and ship's siren, with costumes and set design by Pablo Picasso; hence sounds

that were not musical, but composition that employed a new combination of aural effects and auditory sensations.

The sound content of this exhibition stimulated ideas for future choreosonic or kinaesonic studies. Of most notable impact were Satie's explorations of dissonance – his shifting elements of tonality and rhythmic structure, employing techniques more akin to sound and noise music than musical composition. Specifically, his incorporating of concrete sounds, such as gun shots, into his compositions inspired me to think more about the contribution the concrete sound produced by the dancer-wearable could similarly make to an overall sound work. Matiushin had also utilised concrete sounds such as cannon fire and engine noise in his experimental music score for *Victory over the Sun* (Sarabianov 2017: np). In *for the time* being, the prototypes TatlinTower (head)dress and Futurian ChestPlate would be conceived as wearable experimental instruments for the production of noise sound. In the case of the former, the repetitive sound of an integrated rotating spring – actuated by the dancer's hand gestures – beating onto a metal structure mounted on her head, would generate sonic textures for a musician to incorporate into their sound composition.

## 5.6. The Prototypes

The prototypes TatlinTower (head)dress, GraveDigger, and Futurian ChestPlate present three different models of choreosonic wearable for devising dance and the collaborative composition of experimental real-time sound in responsive multi-media performance environments. Figures 61-62 show the positioning of all four prototypes and their interactions in the overall performance structure: TatlinTower – 'Prolog' and Act I, scene I 'Trio'); GraveDigger – Act I, scene 3 and 4; RedMicro Dress and Futurian ChestPlate – Act II, scene 6A 'Duet' and 6B 'Solo'. Whilst, each aims to explore the production of sonic textures through bodily gesture and the tactile-kinaesthetic intelligence of the dancers (a skillful and learned object/instrument handling as proposed by Jaana Parviainen detailed in Chapter 1), each fashions the integration of technological and gestural interface differently.

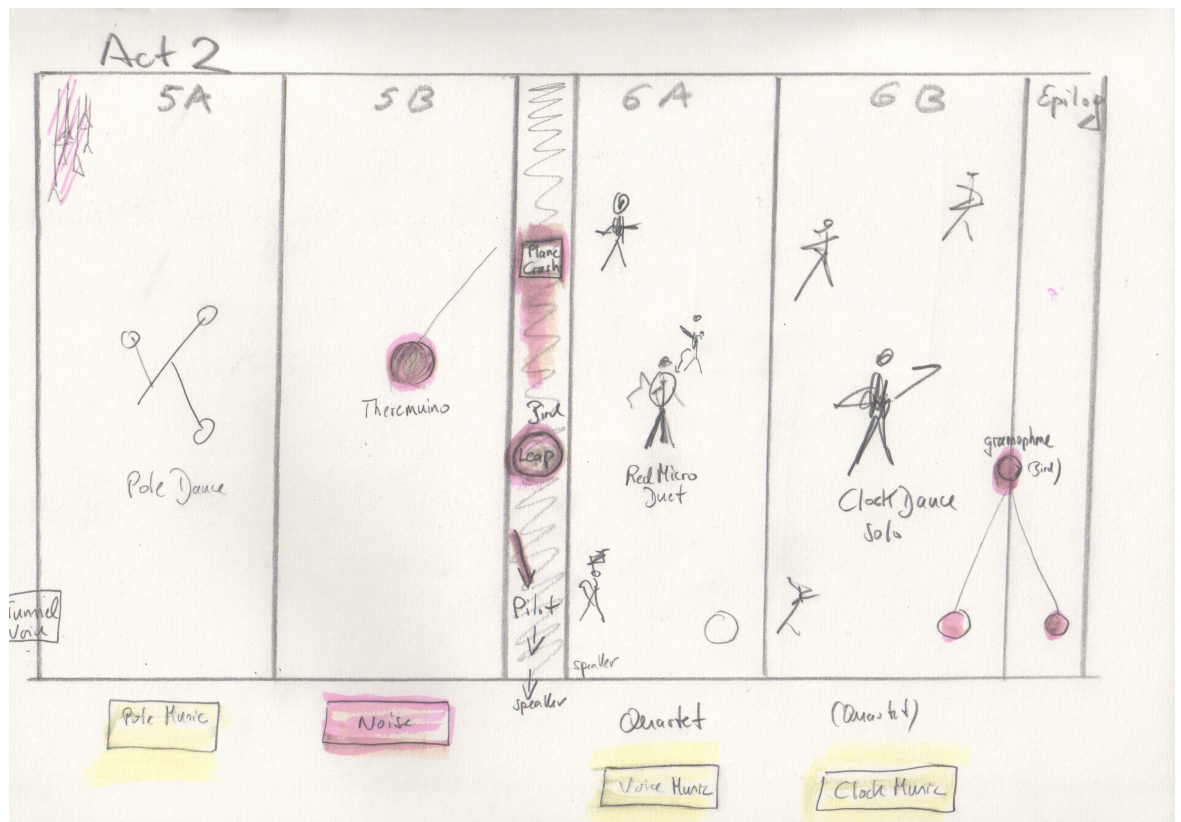
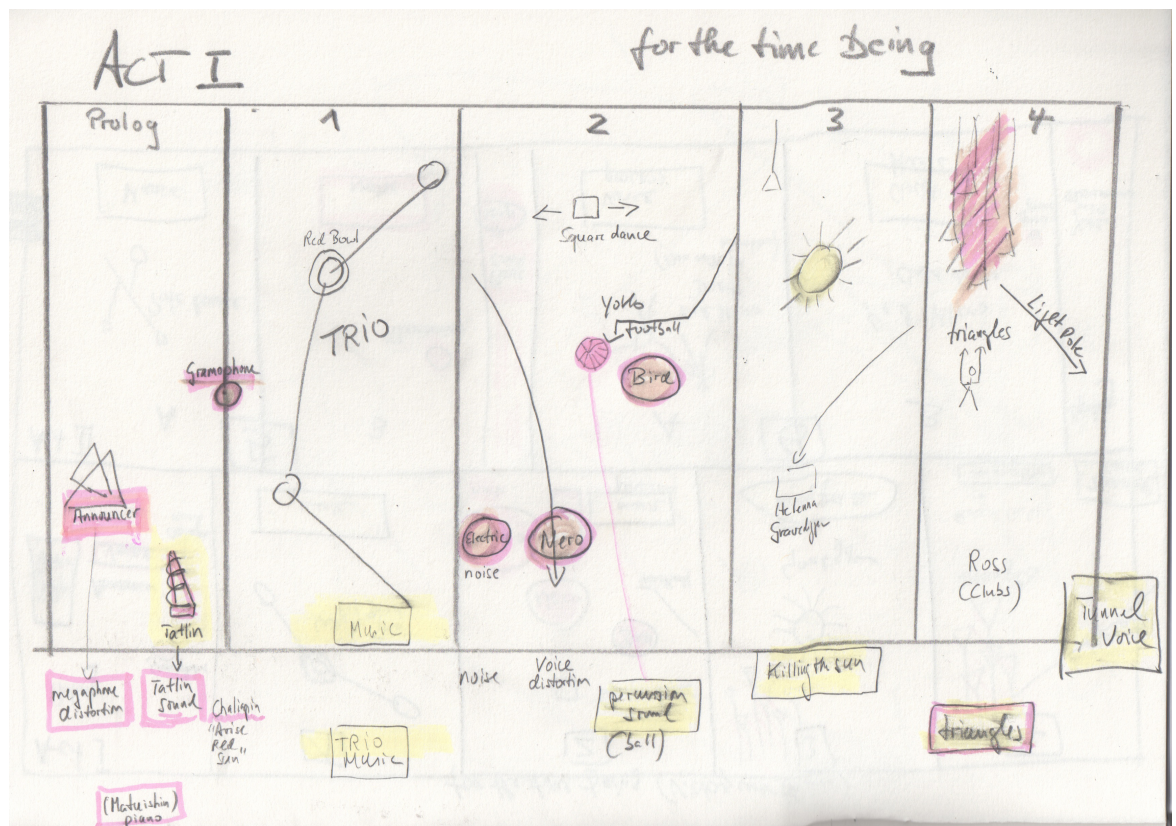
As electro-acoustic wearable instruments, integrating interactive circuitry, the TatlinTower (head)dress and Futurian ChestPlate explore the dancers' connections to the physical materiality of their bodily extensions and expanded instrument-body in the digital performance space. In direct contrast, the GraveDigger, whilst still focused on the same



key objective – to enable the dancer in motion to influence her sound world – is devoid of technologies in its physical makeup as such. Rather, the concept for this particular prototype, which scrutinises the forces exerted on the dancer between the visceral and the virtual in such environments, is its integration into a particular technological feedback system (explained below), for the emergence of movement and associated sounding. As is the case in such interactive systems, the virtual world feeds back to the dancer while the dance is able to move digital animated objects and digital sound, ‘evolving’ the projected graphic behaviour. The chestplate for the Futurian character is a more complex electro-acoustic instrument than the TatlinTower (head)dress and can be played in different ways. It can also auto-generate its sounding out. The Futurian character was developed out of the duet scenario described earlier on in this chapter, and is meant to perform in close proximity to and interrelationship with the dancer wearing the RedMicro Dress.

### **5.6.1. TatlinTower (head)dress – Prologue and Act I, Scene I**

The TatlinTower (head)dress prototype, realised in collaboration with musician John Richards, was conceived as a wearable vibrating electro-acoustic instrument to be mounted on the head of the dancer (fig. 63). In this sense, it extends the body of the dancer through a process of being touched touching – vibrations moving through the body, subtly massaging from the inside-out, in a form of vibrational augmentation as discussed in Chapter 4 (see section 4.6.). The design for the (head)dress follows the double helix formation of Tatlin’s previously mentioned iconic unrealised tower and is constructed in spring metal. The main body of the instrument design integrates a metal coil attached to a small motor/vibrator at its apex to rotate the coil, 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, and a black box speaker-amplifier. A piezo (contact mike) sits within the main construction of the (head)dress; to pick up and amplify the vibrations of the rotating spring which beats the tower, translating the mechanical activity into electrical signals – volts that can then be sent via the small circuit and jack to jack connection mounted at the base of the (head)dress, to the black box speaker, worn on the stomach area of the dancer, for amplification and portability of her minimal sound through the performance space. Richards created the micro-circuitry, advised on materials for achieving the desired vibrational qualities and designed the quiet disruptive sound for this audiophonic prototype.



Figures 61-62. *for the time being* [Victory over the Sun] – dramaturgical sketches highlighting the positioning and choreographic sequencing of the four prototypes: TatlinTower; GraveDigger; RedMicro Dress and Futurian ChestPlate, 2014. © Johannes Birringer.

DAP-Lab's performance of *for the time being* opens with two prologues, one performed by dancer Ren stage left, wearing the TatlinTower (head)dress and sending out its signals. Then across from her tower, downstage right, Khlebnikov's address to the futurians, from the original 1913 *Victory over the Sun* opening prologue (below), is recited by performer Ross Jennings who wears a dark blue worker's overall and performs a repetitive transverse movement along a small triangle grid outlined on the stage floor. I quote an edited version of the prologue, highlighting points of noise distortion, as it featured in *for the time being*, in order to demonstrate two points; firstly, the visual relationship on stage between Ren wearing the Tatlin radio tower (and its subtle repetitive signal sounds) and the worker-announcer on the other side of the stage, and secondly, their sonic relationship. Their kinaesonic prologues also constitute a duet; the TatlinTower dancer operates the radio softly with her white gloved fingers, as the Announcer indeed almost literally performs the function of a 'loud speaker' (performing with a megaphone) shouting out the bizarre address to the futurians, obliterating all else:<sup>16</sup>

People! Those who are born but have not yet died.

Hurry up into contemplation

Contemplation will lead you,  
Contemplationness is strongleader,

[*begin electronic distortion*]

Assemblage of gloomy leaders:  
From tormenters and horrorers to solidgaietyers  
and foreign laughers and light-heartedgaietyers:  
will pass in front of intent seers  
and contemplators and lookers:  
past-timers, be-ers, singers, live-ers, go-ers, callers,  
great-ers destiny argumenters  
and little ones.

[*complete distortion noise*]

(*audible again*)

Never  
will pass by  
like a quiet dream.

(Prologue, *Victory Over the Sun*)

After a few seconds, Jennings' shouting and the semantic meaning of the *zaum* poetry become unintelligible, as his voice is picked up by a condenser microphone downstage right, sampled and immediately distorted digitally into crackling, reverberating noise. The noise only subsides at the end of the announcement, and then in the silence that falls, he says the line about the 'quiet dream' after which the small sound of the TatlinTower faintly returns.

In the opening prologue to the performance, Ren sits static downstage left, legs outstretched (fig. 63), the TatlinTower carefully mounted on her head – the digital sun rises onscreen behind her. As the audience enters to take their seats, Ren's barely perceptible hand gestures in white gloves 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 connected 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 I, Act I, the complex constraining presence and vibrational touch of the wearable instrument extending her body can be visibly sensed in her restricted movements. After Jennings utters 'like a quiet dream', she rises slowly and skillfully to standing, her centre of gravity held low as she explores 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 (figs. 64-65).

The Russian painter and textile designer 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' in early twentieth century Russian fashion, as clothing that was fit for purpose, a particular work task or social action rather than as 'artistic product' (Stepanova 1987: 173). I adopt and adapt Stepanova, arguing for closer connections between design-in-motion and aesthetic transformations in performance. Wearable design is both in action (process) and artistic product, as it stimulates interactive gestures that become part of a larger choreographic and choreosonic 'transverse' (Kruchenykh in Steiner 2009: 34) – a travelling-across as it is implied by the Traveller Through All Centuries in Scene I of the original *Victory over the Sun* opera.

Ren wears a white productivist suit with the TatlinTower (head)dress prototype (figs. 63-65) for her performance. The aim is, in addition to the physical constraining effects placed

on her movements and habitus by the vibrating apparatus, that a psychological dimension to the wearing might also be activated by her utilitarian suit.



Figure 63. Helenna Ren in TatlinTower seated onstage, Prologue, Scene I in *for the time being [Victory over the Sun]*, Lilian Baylis Studio, Sadler's Wells, 2014. Photo © Hans Staartjes.

In terms of DAP-Lab's libretto, Ren needs to represent the coming of a 'new' world and increased productivity achieved through mass social movement in this scene. Moreover, she is ironically tasked with the efficient transmission of information to the people of the new society. Her task-oriented workwear, she confided, helps her to focus on her mission together with the interface requirements of her wearable. As a result, Ren's movements are part functional and precise, part creative, as she manipulates her sensor to alter the speed of rotation of her spring, holds her box speaker away from her abdomen, moving it from side to side to allow the sound to travel directionally from left to right, or turns the knob to alter her volume. Concurrently emerging with the sound, from her slow deliberate interactions with the wearable instrument, is the choreographic aesthetic of her skillful dynamic movement through space, in negotiation with and through her objects.





Figure 64. Helenna Ren in white productivist suit skillfully performing her TatlinTower instrument – the black box amplifier extended outward in Act I, Scene I, *for the time being [Victory over the Sun]*, Lilian Baylis Studio, Sadler's Wells, 2014. Photo © Hans Staartjes.



Figure 65. Helenna Ren performing radio transmissions in TatlinTower, a wearable electroacoustic instrument, Angeliki Margeti in background, *for the time being [Victory over the Sun]*, Lilian Baylis Studio, Sadler's Wells, London, 2014. Photo © Antonio Pagano.

In cultural dress, the multi-sensory aesthetics of garments, weight, sound, colour and so on serve to connect and transform the wearers' bodies. As Professor of Art History Cynthia Becker states in relation to Moroccan Berber dress:

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. (2007: 72)

I extend these impacts relating to the psychological dimension of touch and sensation to my practice-based research, proposing that wearable design can serve not purely as a part of the functional movement of a dancer but can moreover become a part of the movement of her body as a whole.

As Ren 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 through the space. 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 all-encompassing sound. Her movement expands the world; it heightens the experience, I believe, in the sense addressed by Becker above, and in the materialist framework of *for the time being* it is perhaps most pertinent to associate the spiraling movement-sound with the virtual infinity Malevich envisioned for his suprematist composition – an infinity that grasps spiritual freedom.

My observations of Ren during rehearsals, in performance and on documentary film reveal to me that the wearable draws attention to its material tactility, which necessitates a certain negotiation for the dancer to discover movement; shifting weight as she propels herself, yet prevented from tilting her head, as she contracts and releases the sensor in her hand – stopping, starting, stopping then re-starting the sound. Ren's movements are calm, composed and decisive throughout her performance with the wearable. Moreover, she incorporates moments of stillness and barely perceptible or audible movement: 'stillness is a form of movement', she confided on more than one occasion – transitioning slowly between states of motion and audibility as she explores her extended head and manipulates the sensor. Additionally, she taps the metal of the TatlinTower with her fingers to release more sounds acoustically. Ren's attention shifts in performance from her (head)dress to its black box appendage that had lain suspended against her stomach. She holds the box outward and moves it – first from left then to right – her head following in the same

direction – connecting the two distinct parts of her instrument. Then from holding the box away from her, she draws the appendage back in and presses it against her stomach. As she continues her passage – her right leg bends, then her left leg bends – she commences a skillful and measured folding and lowering to come to her knees; still swaying left to right. Then she rises part way up again, her legs apart and knees bent – low down, her body kept vertical and weight centrally held before her focus shifts once more to the black box, holding it away from the body, sounding out, drawing it back in.

Ren confided repeatedly during our shared processes that she did not like this wearable, that it was difficult to work with and the subtle vibrations, conducted via her skull, caused mild headache. On further interrogation of the wearing experience, in a more scrutinising exploration of the tower with dancer Vanessa Michielon, the latter also noted the vibrational qualities of the wearing experience in her more extensively articulated feedback. However, in complete contrast to Ren who had not enjoyed the vibrational sensations of the wearable instrument, Michielon explained how these same vibrations, rather than causing discomfort or disruption to her, could be harnessed choreographically as they coursed through her body from her head to her stomach – extended by the black box.

Michielon referred to the speaker box that emitted her sound as her new organ, a prosthesis belonging to her and her emergent performance. Her interest in the vibrations was diametrically opposed to Ren's localised and uncomfortable perception; she wanted to allow the vibrational sensation of wearing to permeate her entirety – take the most protracted route through her body so that its somatic touch might circulate for longer inside of her, thus impacting her movements more powerfully. On the impacts of the black box and TatlinTower (head)dress, and her associated physical and mental processing, 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. (Michielon 2014: email)

According to Michielon, wearing these objects on her body heightened her sense of perception 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 acknowledged, related to the weight of this particular wearable and how it altered her body-balance and proprioceptive sense. Moreover, Michielon expands further below 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 suggests 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. (Michielon 2014: email)

On 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. Yet, as I understood on a very practical level from Ren, this slowness for her came both from her movement skill as a performer and moreover from a position of discomfort and difficulty associated with balancing and navigating this encumbering wearable instrument rather than any induced psychoactive state. I include more expansive and enlightening feedback from Ren in my overall conclusion to the thesis (see pp. 218-220).

I have already commented in Chapter 1 on how prostheses and bodily extensions might simultaneously liberate and inhibit the capability of a body to reach – upward, downward, backward, sideways and so on – or more importantly cause it to reach differently. In the above example, the bodies of both Michielon and Ren were slowed down rather than accelerated, and the dynamics of their movement shifted by the extension of their wearable instrument. Concurrently, their reach sonically was altered, amplified and extended in space by the technologies and their interactive engagement. Moreover, movement

outcomes arising from the constraining effects of the TatlinTower prototype highlighted that whilst perceived and experienced differently by Ren and Michielon, such techniques of limitation had offered palpable movement suggestions to both performers. I suggest from the evidence and feedback I have gathered, that this is a form of liberation from a dance habitus and conduit to the emergence of a re-fashioned movement expression. Advancing this notion a stage further, wearable design concepts that afford access to virtual spaces via human computer interactions hypothetically offer an even greater extension of reach to the dancer. Such liberating possibilities however can also ironically impede the dynamics and rhythmical aspects of *real-space-movement* due to complexities of navigation and demands posed by the interface systems. The prototype introduced in my next section – GraveDigger, explores precisely these ideas and the co-existence of opposing forces in a design that aims to embed the body-garment into the technological system.

### 5.6.2. GraveDigger – Act I, Scene III

According to Malevich and Matiushin, the original libretto for *Victory over the Sun* was ‘devoid of any developing plot. Its central idea was 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 DAP-Lab’s dance opera version, the GraveDigger character (fig. 67) translates the historic plot into the creation of a *solntselov* (sun-trapper) and an iconic ‘Killing of the Sun’ scene. Design concepts utilise elements of humour with futurist devices of metaphorical (visual and material) languages to enact the capturing and killing 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 retro protective eyewear with UV shield (circa late 1960s) and straw hat add to the comical textures of this prototype.

During my initial explorations of Russian Cubo-Futurism and in connection with my studies on *Victory over the Sun*, as mentioned earlier, I had discovered Lissitzky’s portfolio of lithographs for a new mechanical version of the opera. This portfolio contains a series of strange object-human forms proposing machine-driven characters with titles such as: ‘The Announcer’, ‘The Globetrotter’, ‘The New Man’, ‘The Trouble Maker’,

‘Man with Bad Intentions’, and in particular for the prototype ‘Gravediggers’ (fig. 66).

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. What was important, however, was the question of how to combine state-of-the-art technologies with these historical textures to generate a costume concept, integrating real-time interactional elements to be used by dancers in narrative performance.

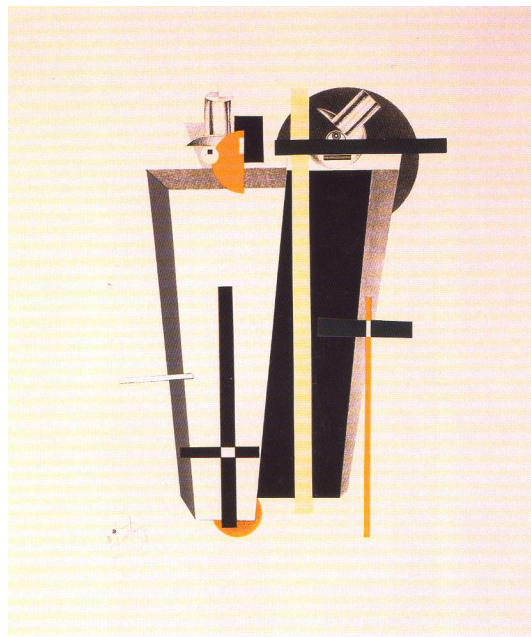


Figure 66. Gravediggers, *Victory over the Sun*, El Lissitzky, 1923. Photo © J. Milner, *El Lissitzky: Design*.

With regard to the historical perspectives, Lissitzky’s artwork achieved its 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 works clean, energetic and new in the context of the time. The aesthetic design of the GraveDigger costume intentionally 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 Motion Builder, Blender, and other OpenSource 3D software. The scene is programmed by media artist and 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. 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. Instead, the form of the costumed-body partners as active agent with the technological Kinect system.

This method involves certain complexities, since to activate/de-activate the system for real-time audio-visual performance with the digital sun, through modes of wearing and movement, the costumed-body needed to relate to the particular characteristics of the system. Specifically, the shapes and surface textures presented to the 3D camera-vision are required to work within its parameters for inter-actions to occur. McKirdy, technological collaborator for this prototype, very helpfully comments on the vision system, reflective fabrics, as well as his discussions with performance artist Stelarc on the nature of Kinect sensor interfaces (in the quotation below – an excerpt from our lengthy email correspondences preceding the final realisation of design):

Reflective materials tend not to 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. (McKirdy 2012: email)

The camera basically needs to 'see' the human skeleton – arms, hands and legs to be precise – to begin mapping the body and generating data for effect, and certain materials confuse its vision such as those with over shiny or retro-reflective surfaces like the raincoat. With this knowledge in mind, I began to imagine a garment that might deliberately attempt to confuse a technological system before beginning to allow the body to work with it. The outcome was to be my GraveDigger prototype.

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 body (recognisable to the Kinect camera) inside its form. Ren enters the space stage left, and constricted in her movements by her garment silhouette she shuffles diagonally across the space, using tiny steps, towards her place of interaction (a small square marked downstage right). As she traverses the stage, she turns her back to the audience at points, a technique she uses to fully display the artwork airbrushed onto her costume. As Ren reaches her destination, she turns her body once more to face the audience and steps into the small square marked on the floor. She has entered the realm of the camera-eye, but is concealed from its vision, the system has been fooled and as such

remains immobilised. Ren holds her arms firmly inside the coffin shape she wears; her skeleton is stowed away so to speak (fig. 68).

Just as the costumes of Modernist theatre aimed to erase the actor's body onstage (Monks 2010: 64-65), the sarcophagus form of the GraveDigger aimed to obscure the body from the view of the camera-eye. The similarities end here however since this costume was not concerned with erasing the body due to its limited expressive potentials as was the case in the early twentieth century. Rather my aim was concerned with momentarily concealing the true potentials of a body to interact expressively with a system only to then reveal them. The moment Ren releases her arms, allowing them to each emerge from her coffin-body, one at a time, the system becomes activated and data is generated and mapped from her movements by the system (figs. 68-71).

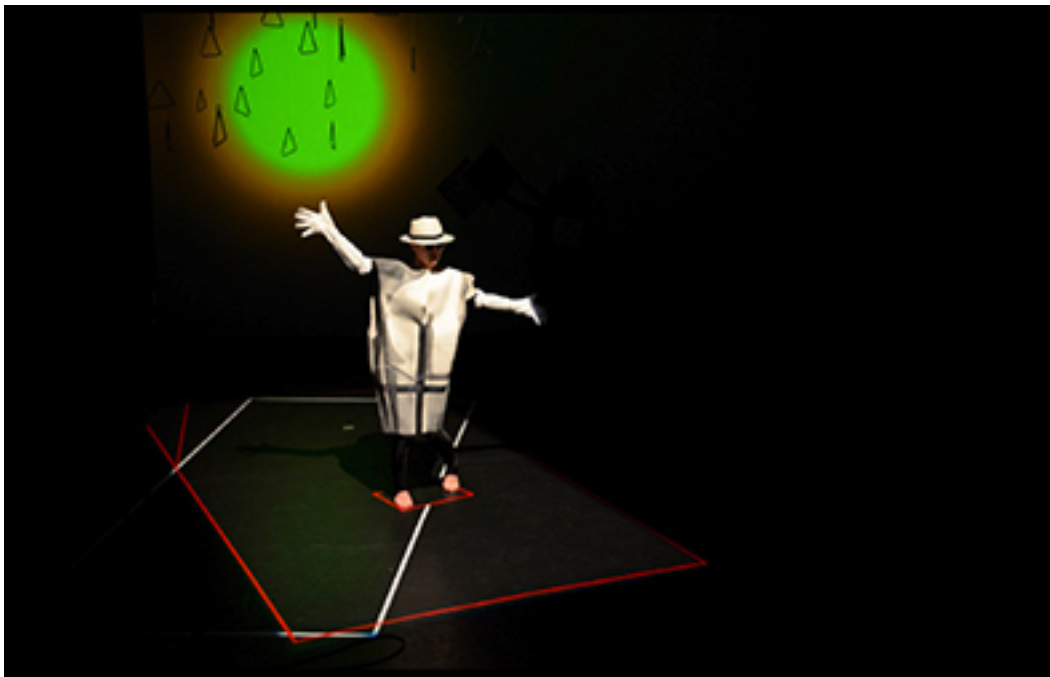


Figure 67. Scenographic Space – Helenna Ren as GraveDigger enacts the role of sun-trapper in the ‘Killing of the Sun’ scene, *for the time being [Victory over the Sun]*, Lilian Baylis Studio, Sadler’s Wells, London, 2014. Photo © Antonio Pagano.

In terms of her gestural impact on sound and the type of sound that was emitted, Doyle who once again programmed the sound and parameters in relation to McKirdy’s virtual sun explains:

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 [McKirdy]. 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). (2014: email)

This was, therefore, a dull monotonous sounding produced by Ren's gestures that built in intensity, throbbing and pulsing at a more rapid rate as her battle with the sun was won. McKirdy also set certain parameters to enable Ren, in her 'hit-woman' capacity, hired for the assassination of the sun, to first manipulate and capture the onscreen fiery golden globe through her knowledgeable hand gestures and interactions (she worked through touch and muscle memory of her movements in the garment, her back toward the sun) and then bury it deep beneath the earth (at which point it is extinguished from the screen behind her). The sun is eclipsed and the sky goes black, the stage falls dark (fig. 72).

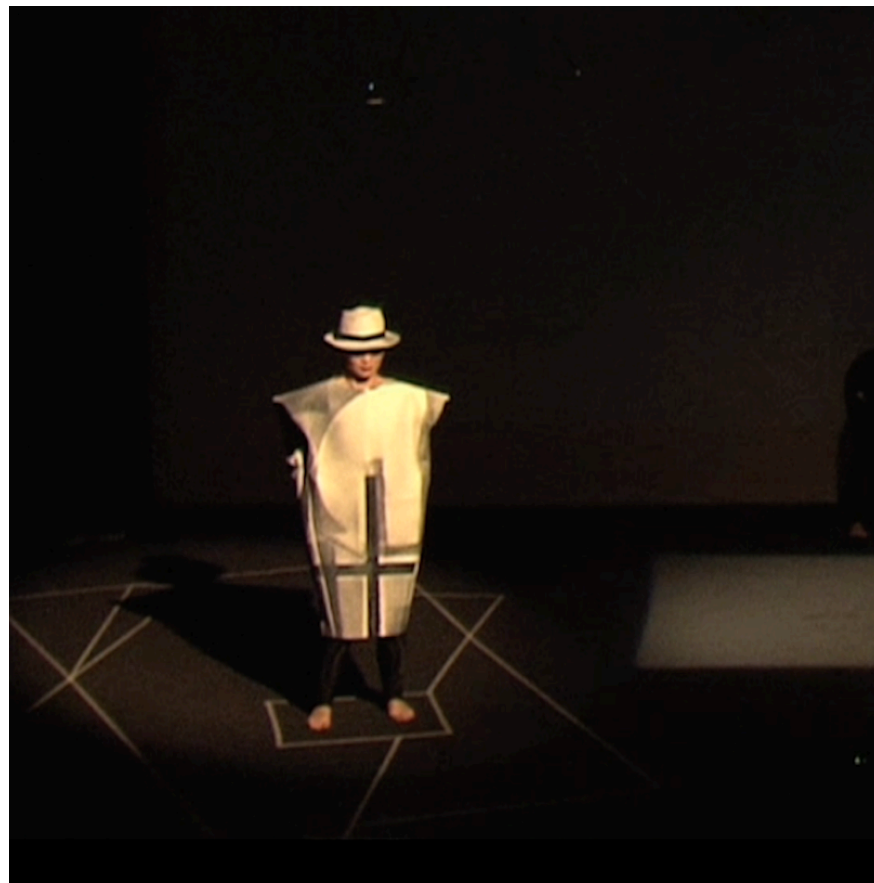
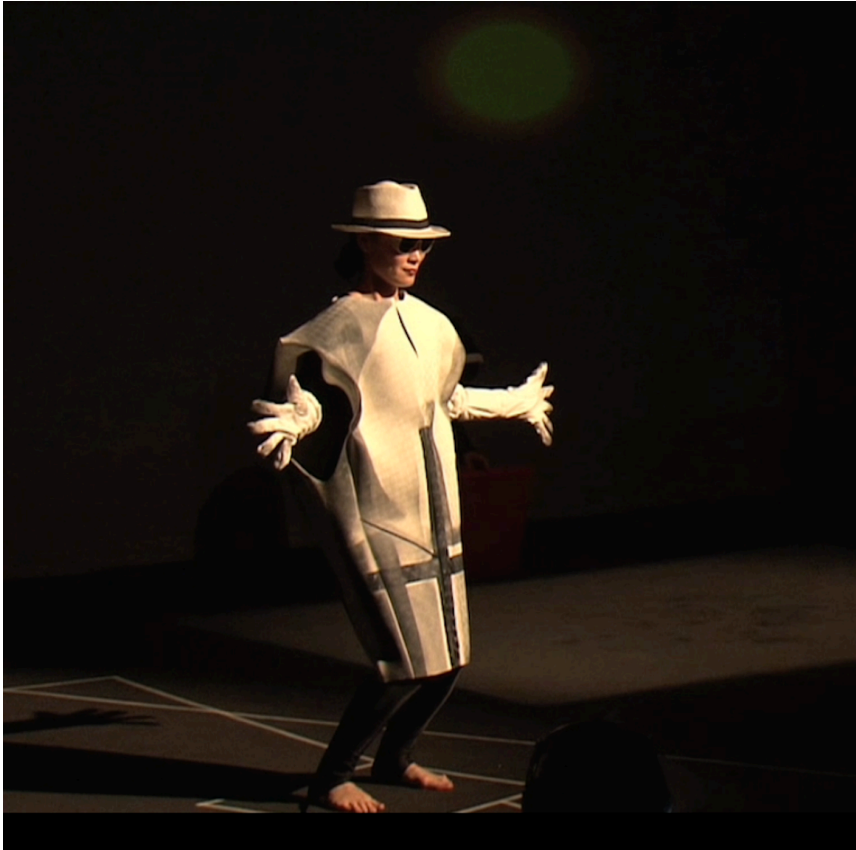


Figure 68. Helenna Ren inside her square of interaction, holds her arms firmly inside her sarcophagus; her skeleton stowed away at the beginning of the 'Killing of the Sun' scene in *for the time being [Victory over the Sun]*, Lilian Baylis Studio, Sadler's Wells, London, 2014. Video still © Johannes Birringer.



Figures 69-70. Helenna Ren releases her arms from inside her sarcophagus, the Kinect system recognises her and the virtual sun rises on screen. She then begins her battle through interactive gestures to capture and kill, *for the time being [Victory over the Sun]*, Lilian Baylis Studio, Sadler's Wells, London, 2014. Video stills © Johannes Birringer.





Figure 71. Helenna Ren moves her arms in interactive gestures to capture and kill the sun during this scene, *for the time being [Victory over the Sun]*, Lilian Baylis Studio, Sadler's Wells, London, 2014. Video still © Johannes Birringer.

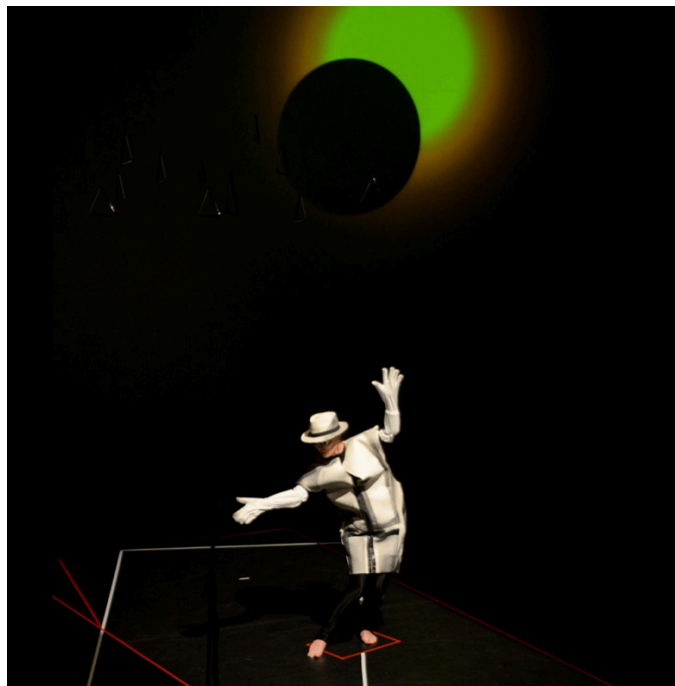


Figure 72. Helenna Ren completes her role as *solntselov* (sun-trapper) and eclipses the sun – the sky begins to turn black in *for the time being [Victory over the Sun]*, Lilian Baylis Studio, Sadler's Wells, London, 2014. Photo © Antonio Pagano.



### 5.6.3. Futurian ChestPlate – Act II, Scene VI

The last in the series of sounding wearables<sup>17</sup> to be prototyped for DAP-Lab's *for the time being*, the Futurian ChestPlate was conceptualised as a wearable musical instrument to feature in Act II. Constructed in collaboration with musician Richards, the instrument is equipped with three small interconnected microcircuits, with the main sound generator built around a fourth noise circuit based on Richard's 'Bed of Nails' schematic for resistance and flow (fig. 73).

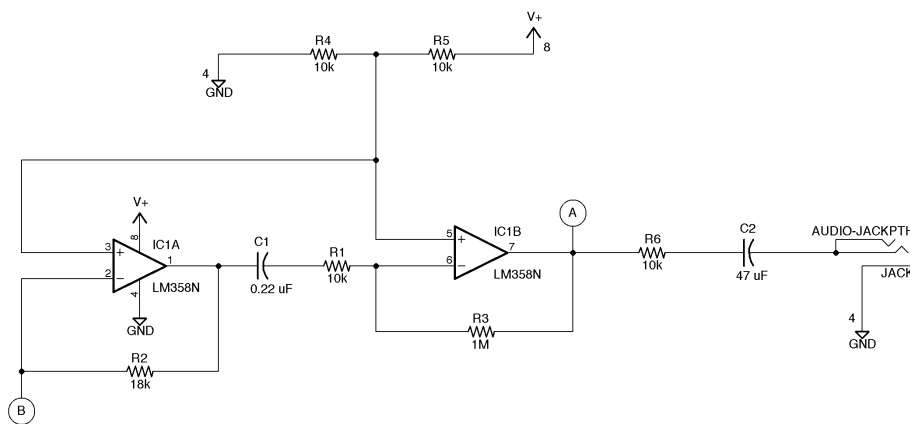


Figure 73. 'Bed of Nails' Schematic © John Richards.

The visual aesthetic form of the main circuit was loosely inspired by the 1919 *Toft* linear graphics of Russian artists Rodchenko and Stepanova, and was constructed using copper metal and wire/strings allowing the wearer to play the wearable instrument to generate sound (fig. 74). The overall concept for the prototype was influenced by the intricate interactive electronic sculptures of Peter Vogel, which I saw at the ZKM exhibition on *Sound Art* in 2012, where components and circuits were made clearly visible.<sup>18</sup> Yet, it was not purely the visual aesthetics of Vogel's circuits that interested me, but also the interactive dimension of his pieces. Works such as *Duo* (2006) and *Minimal Music Sculpture* (1988), for instance, with their integrated speakers, photocells and other small electronic components, in addition to being visually fascinating were designed to operate as participatory installations where the sound emitted from the integrated speakers can be influenced by the movement of bodies in front of the circuit-sculpture. This in turn generates a score for the electronic music. It is his notion of the *Gesamtkunstwerk* or total

artwork incorporating a synthesis of bodies, technologies, materials and movement for the design of the instrument, where sounding becomes inter-relational, which provoked further my thoughts for the duet in Act II, Scene VI, and the construction of the Futurian ChestPlate.



Figure 74. Close-up of Angeliki Margeti in Futurian ChestPlate playing her oscillating electro-acoustic instrument – completing the electronic circuit through touch, 2014. Photo © Hans Staartjes.

Moreover, on re-visiting Malevich's characters for the original opera, to further stimulate the design aesthetics for the prototype, I was drawn to his 'Member of the Chorus' (fig. 75). The visual idiosyncrasies of Malevich's 'singing' character wearing a large flat shield-like structure over the chest inspired me to create a chestplate instrument. The intentionality for this second electro-acoustic instrument was to explore the notion of movement-sounding or choreosonic performance through wearable partnering. The two areas of investigation were: 1) How sound interference or noise, resulting from improvised movement interventions between two bodies in wearables might simultaneously orchestrate the dance which in turn synthesises and modulates the sound; 2) How sound distortion and pitch bending might result from movement interventions and the shifting dynamics of proximity and distance between two dancers, as they move towards and away from one another.



Figure 75. Member of the Chorus, *Victory over the Sun*, Kazimir Malevich, 1913. Photo © R. Bartlett, R. and S. Dadswell, *Victory over the Sun: The World's First Futurist Opera*.

During the dance quintet of Act II, Scene VI involving Margeti, Michielon and performers Yoko Ishiguro and Rosella Galindo, all partners move relationally but the central duet emerges from the intimate dynamics of Margeti's and Michielon's conjoined improvised performances. The Futurian character enters into a proximal relationship with the RedMicro Dress to commence their dance. Michielon in red executes a repeated series of revolutionary poses, arms held straight and elbows rotating as she explains in her earlier quote (above), while Margeti as Futurian approaches in her blue, black and cream garment – a science fiction instrument adorning her chest (fig. 76), its two small speakers attached to her lower back. The light and proximity sensors integrated into the circuitry and construction of the chestplate detect the presence of her partner – RedMicro Dress – and mobilise sounding. As bodies draw up close, closer, before retracting again, the sounding emitted from the two integrated speakers is actuated, intensified and distorted by the circuitry interactions. The Futurian's noise is picked up by the dynamic microphone worn by Michielon in the RedMicro Dress and transmitted to collaborating musician Oliver Doyle who works with it – further distorting and amplifying the sonic textures to create a whole new noise experience. Thus, the intimate entwinement of the body instrument is advanced in Act II through dynamic methods of co-creation for compositional purposes. The choreographic here is the choreosonic (figs. 76-78).



Figures 76-77. Dancers Vanessa Michielon in RedMicro Dress and Angeliki Margeti in Futurian ChestPlate (with interactive circuitry, incorporating proximity and light sensors) performing a duet in *for the time being [Victory over the Sun]*, Lilian Baylis Studio, Sadler's Wells, London, 2014. Video stills © DAP-Lab.

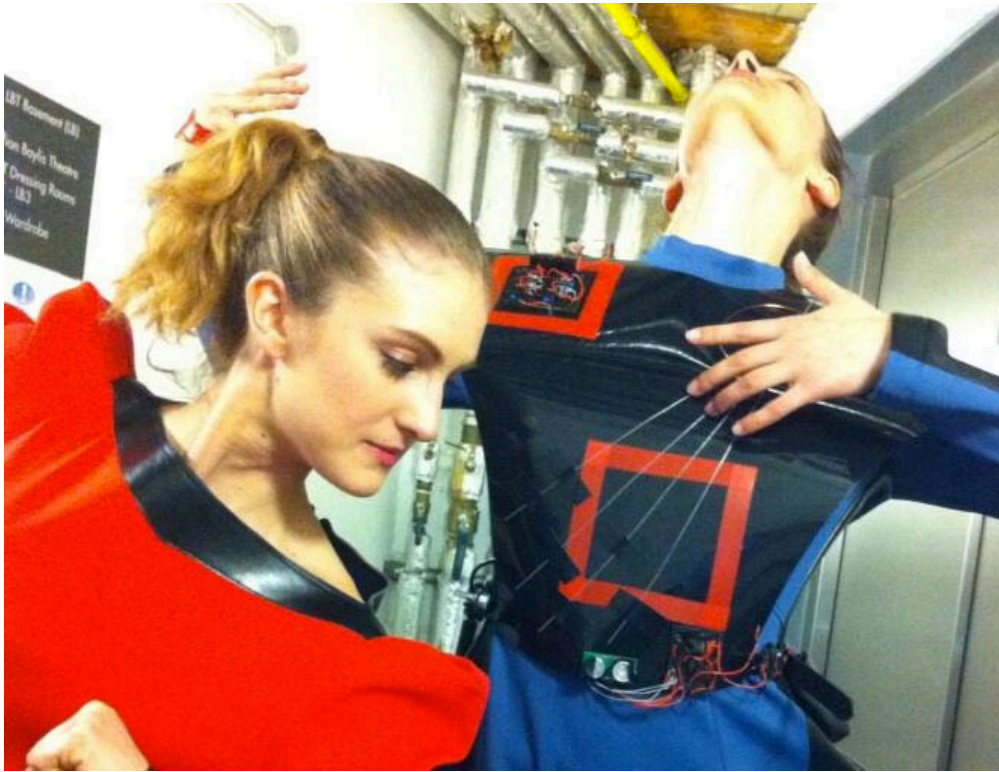


Figure 78. Futurian ChestPlate: A Futurist noise wearable, worn by Angeliki Margeti with Vanessa Michielon in RedMicro Dress in foreground, 2014. Backstage Photo © John Richards.

## 5.7. Conclusion

How can one then think through the choreographic sound and sonic choreography elicited in such wearable scenes as I have described them for the prototypes in *for the time being*? What are the criteria for the placement of sounds (in the score) and how does the sound unfold aesthetically, relationally and meaningfully? One conclusion that I draw is that the mutual enfolding of movement choreography and sound generation requires more careful attention to the scope and insistence of the aural, and in the case of DAP-Lab's adaptation of the futurist opera, attention to the music drama and its narrative threads. Dancers initiating a noise process through wearable performance are meant to disrupt aural experience, in addition to processes of performance-making. The characters I have adopted evolve on stage as sounding movement characters in costume. To some extent they are visual abstractions – their movement gestures perceived as an important part of the suprematist visual aesthetic of the performance – and I have explained in considerable detail the art historical dimensions that undergird the wearable prototypes in DAP-Lab's

retrograde version of *Victory over the Sun*. In addition to the visual dimension, the movement gestures will also be associated by the dancer and audience alike with the sound they elicit and provoke in the interactions with the technological feedback system – thus the particular design aesthetic of the bodies in motion is correlated to a particular noise aesthetic along with the imagistic synergies with Russian Futurism and Suprematism (Malevich, Lissitzky).

The noise aesthetic is nowhere clearer than in the vibrational ‘radio’ coil sonics of TatlinTower (head)dress and the heavy metal guitar associations of Futurian ChestPlate, the latter’s visual electronic circuits a subtle but distinct allusion to Rodchenko and Stepanova’s abstract *Tofts* graphics. Operatic voices are only heard three times in the entire performance: twice distorted, and on one occasion coming from an old gramophone record played by Caroline Wilkins’ Motley Eye bird-character. The recorded voice also becomes warped as the needle eventually gets stuck in the groove. If noise and crackling distortion are perceived as a form of interference, then this is a very pertinent index of my design aesthetic which I have elaborated in this chapter through frequent references to the dancer’s somatic and technical experience of the dresses and their particular encumbrances.

A second conclusion to be drawn from the new prototypes therefore relates to the nature of interruption and conductive improvisation in the partnering aspects of *for the time being*. The *design-in-motion* prototypes featured in this chapter were built to enable dialogical partnering between dancers and costumes, and between dancers and technical systems, affecting both the sound and the movement choreography mutually. The metaphoric allusion to electrical conductivity was deliberate, and the ChestPlate prototype utilised conductive touch literally as I have explained. The GraveDigger prototype was my example for dialogic *intra-activity* between human movement and technical Kinect system,<sup>19</sup> and the dancer’s sensing of the eclipse of the digital sun marked the mutual attribution in this scene. The camera sensed certain gestures; the gestures worked their way into the parameters of the vision system and simultaneously actuated sound processes.

Rather than characterising the wearable as choreosonic, I applied the term in this chapter to a particular type of choreography that movement-sounding mobilised through dancer-garment interactions and *dialogic partnering*. This presented a significant shift in my research thinking and production. The examples of the TatlinTower (head)dress, RedMicro and Futurian ChestPlate prototypes represent the new level in my design practice

highlighting how wearable design in multimedia theatre not only involves integrative and collaborative methods of performance-making but offers new stimuli for choreographic partnering that advances the notion of the wearable as instrument and interface for disruptive sonic expression. The electronic noise aesthetic I developed in *for the time being* can be perceived as a contemporary correlative to the Russian futurist invention of the non-rational *zaum* language used by librettists Kruchenykh and Khlebnikov.

The four new prototypes introduced in Chapter 5 were inspired by the historic *Victory over the Sun* libretto and Russian avant-garde art from the same era. They are here positioned as experimental instruments, compositional and choreographic tools, and thus to a large extent effective – as stimulus and constraint – in the generation of sonic *and* movement material for the ensemble work in DAP-Lab's dance opera. Finally, the use of garments and wearables – costumes within responsive media systems of intra-active performance – herewith draws vital attention to the sensory aspects of 'body-computer' interactions. Both the proprioceptive, somatic-sensorial and the relational, outwardly tuned awareness of the wearable interface, in my experience, affords new relationships and compositional possibilities to emerge through the specific ways it augments the performer's body. In *for the time being*, I explored costumes incorporating technologies for their potentials to extend the present body visually, sonically and sensorily, and to facilitate attunement between multiple partners (dancers) and entities (wearables).



## Notes

<sup>1</sup> *Victory over the Sun*, Act II, Scene 5 (Kruchenykh, Malevich, and Matiushin 2009: 85). References to the libretto are to DAP-Lab's adaptation of the original 1913 *Victory over the Sun*, compiled by Patrician Railing in Russian and in Eugeny Steiner's English translation. Another translation we consulted was the 1971 translation by Ewa Bartos and Victoria Nes Kirby.

<sup>2</sup> Bartlett and Dadswell (2012) contains scores, set and costume designs from *Victory over the Sun* (1913), together with an annotated translation of the libretto by Bartlett, and a facsimile of the Russian original. The book provided a rich source of information for my research and design.

<sup>3</sup> According to artist Johannes Itten and his theory of colour explained in his book *The Elements of Color* (1970), the seventh colour contrast he outlines – 'contrast of extension' – notes that a proportionally minority colour (in my case red), will behave defensively and thus appear more vibrant in the overall composition. Additionally, when a hue appears against a monochrome backdrop the eye spontaneously generates its complementary colour. Such 'simultaneous contrast' concerning 'complementary contrast' produces a greater visual excitement where colours 'incite each other to maximum vividness' (Itten 1970: 49).

<sup>4</sup> Interaktionslabor, an international media laboratory held annually on the site of the former coal mine in Göttelborn, Germany was founded in 2003 by co-director at DAP-Lab Johannes Birringer: <http://interaktionslabor.de>

<sup>5</sup> See Christian Rizzo (2000) in Chapter 1.

<sup>6</sup> I spoke of the animating auratic power of fashion in Chapter 1. 'Animate Entities: Objects in Performance' was a two-day festival held at the University of Toronto, March 18-19, 2016. Here, artists, curators and scholars positioned the 'performative lives of objects' core to their work: <http://animateentities.wixsite.com/ae2016>.

<sup>7</sup> The transformed substantivised use of 'choreographic' applied here to the relations between design and movement choices in composition of the works I analyse is not as evasive as it reads, on occasion, in Joy (2014). Joy seeks to encourage a kind of vague, messy travelling with dancing as sensual address and embodied movement of thought, as tangibly felt 'lessons from the landscape' of dance (Joy 2014: 25).

<sup>8</sup> Film footage was available to view of Vsevolod Meyerhold's biomechanics as part of the exhibition: *Russian Avant-garde Theatre: War Revolution and Design 1913-1933* (2014) Curated by Kate Bailey, Victoria and Albert Museum, London (18 October 2014-15 March 2015).

<sup>9</sup> 'Kinaesonic', as I mentiond in Chapter 2, is a term used by musicians Mark and Julie Wilson Bokowiec in their work with the Bodycoder.

<sup>10</sup> The types of flutes Watanabe played during the rehearsals are: (1) ryuteki: for Gagaku (royal court music); (2) nohkan: for noh theatre or kabuki theatre; and (3) shinobue: for festival music (matsuri), folk music or kabuki theatre. All are made of bamboo and have a thin and delicate sound (Watanabe 2013).

<sup>11</sup> A large and growing area of interest in performance practice, the term 'postdramatic' refers to contemporary experimental theatre (multimedia theatre, performance art, dance) and new theatre aesthetics that have emerged in Europe and North America since the 1970's. The notion of the



postdramatic was first hypothesised by German theatre researcher Hans-Thies Lehmann in his seminal text on the subject: Lehmann [1999] (2006). This was a theatre responding to the changing media conditions of the twentieth century, in particular, as explained by Jüres-Munby in her introduction to Lehmann's work: '...the historical shift out of a textual culture and into a "mediatized" image and sound culture' (2006: 1).

<sup>12</sup> As Principal Lecturer at DeMontfort University (2009-2013), I made annual visits to St. Petersburg State University of Technology and Design, where I developed good relations with staff and students. During these visits, I was able to learn about Russian art and culture first-hand, and my interest and knowledge expanded.

<sup>13</sup> Technically a construction rather than reconstruction since *Tatlin's Tower* (1919-1920) was never actually built but remained a vision for the Communist Monument to the Third International.

<sup>14</sup> Many of the works for this particular exhibition were borrowed primarily from the A. A. Bakhrushin State Central Theatre Museum, Moscow and St. Petersburg State Museum of Theatre and Music.

<sup>15</sup> Ballets Russes were an experimental ballet company established by its director Serge Diaghilev in 1909. Five choreographers contributed to the various works: Mikhail Fokine, Vaslav Nijinsky, Leonide Massine, Bronislava Nijinsky and George Balanchine. Costumes and sets were produced by artists such as Léon Bakst, Pablo Picasso, Henri Matisse, Georges Braques, Andre Masson, Giorgio de Chirico, and Pavel Tchelitchew. The exhibition at the Victoria and Albert Museum interested me for the collaborative dimension and sound content in this research project, as opposed to the quality of the costumes.

<sup>16</sup> In the *Building the Revolution* exhibition I discovered a fascinating drawing on paper by Gustav Klutis titled *Design for Loudspeaker* (1922) which shows a tripod-like architectural drawing with two cone shaped loudspeakers pointing in different directions. This drawing inspired both the Prologue scene as well as the later scenes of 'Motley Eye', a bird character (performed by Caroline Wilkins) with cone shaped beak who plays old Russian songs on the gramophone and steals the microphone from 'NeroCaligula' (performed by Yiorgos Bakalos).

<sup>17</sup> It should be mentioned that *for the time being* featured eight performers on stage (Yiorgos Bakalos, Manaskarn Insang, Yoko Ishiguro, Ross Jennings, Angeliki Margeti, Vanessa Michielon, Helenna Ren, Caroline Wilkins), and that I was creating additional prototypes as well as modifying found objects and accessories to style all the performers, but for the purpose of this thesis and its central argument I concentrate only on the capsule collection of the sounding garments.

<sup>18</sup> Peter Vogel's sculptures were exhibited as part of a massive historical and contemporary overview, *Sound Art. Sound as a Medium of Art* (17 March 2012 - 6 January 2013), at the ZKM, Karlsruhe, featuring a range of works from Futurism to Fluxus through to Twitter sonifications. A strong focus was placed on contemporary practices, with works from 90 artists providing inspiring insights into not only the sound cosmos of contemporary art but also current architectural-sonic design, and interactive constellations where the visitor himself becomes the generator of sounds: <http://soundart.zkm.de/en>.

<sup>19</sup> Karen Barad (2003: 815) has proposed the term 'intra-activity' for intra-acting agencies (human, non-human, objects, etc) that bring 'objects' and mattering into emergence rather than assuming that objects have a prior existence. In the case of GraveDigger, it is the 'killing' of the digital sun as eclipse which emerges through the intra-action.

## Conclusion

This thesis presents findings from theoretical and practice-based research derived from two large case studies, *UKIYO [Moveable Worlds]* and *for the time being [Victory over the Sun]*. These productions consisted of a series of design prototypes that aimed to investigate and demonstrate the impact of wearable design incorporating sounding characteristics on the performance-making process, and thus on an extended sense of the choreographic actualised through the fashioned garment. I specifically set out to examine the discernible impact of dress, envisioned as *wearable performance design*, on practices of movement choreography and sound composition within interactive performance frameworks. Moreover, my intention has been to interrogate the position of dress in contemporary dance performance, and the agency of fashion as costumier and multi-sensorial impetus for the dancer in the emergence of movement.

As I briefly mentioned in my introduction, fashion enjoys a close and well-established relationship with performance art, and has a long trajectory of its designers creating costume for dance, some of whom I have highlighted in Chapters 1 and 2. During the 1990s, the hybrid field of fashion and performance became especially intertwined and a new kind of conceptual designer evolved. Fashion shows such as those of the late Alexander McQueen mutated into performance (Evans 2003: 4) whilst the likes of John Galliano began to use more theatrical techniques to stage their fashion narratives (Evans: 32). While I have chosen not to focus in greater detail on this phenomenon in this thesis, it is important to acknowledge the enduring impact this era had on me and to the relations between fashion and performance. Crucially, I observed garments were no longer simply showcased by supermodels (a phenomenon of the preceding decade), rather, a certain criticality accompanied them down the catwalk. This same notion of fashion's criticality and questioning evoked through garments and their staging sits at the core of this project. However, the concern has been located not with the spectacular impacts of fashion for the catwalk audience but rather to:

- 1) The sensory augmentation and transformation of the performing body through the affects of wearable performance design extending the body expressively.

2) The integration of ‘wearable’ technologies into costume design concepts that touch and stimulate the body gesture using sensorial design techniques (sound/visual aesthetics and tactile qualities [of design]) to impact performer presence and experience.

3) The expansion of the performing body through wearable design to create fused and intertwined sounding instrument-bodies for particular performance contexts.

According to Elizabeth Wilson, dress and adornment are symbolic, communicative and aesthetic in the roles they play and ‘dress is always unspeakably meaningful’ (1985: 3). For Caroline Evans, the clothes in McQueen’s Spring/Summer 2001 collection ‘almost fetishised materials: feathers, brocade, shells, a wooden bodice, an outfit made from a jigsaw puzzle of a castle...’ (95) which she identified communicated a certain dysfunctional and psychotic look in the models. Here, both fashion theorists (Wilson’s *Adorned in Dreams* was a seminal text in the field of fashion theory in the 1980s) are arguing essentially that fashion designers have the ability to explicate ideas visually via the designs they create. In Chapter 1, I discussed McQueen’s glass slide dress from the same McQueen collection Evans is referring to, and how when worn by Björk it transformed into a percussion object – the glass slides rattling as she moved, becoming amplified and animated (section 1.3.3.). This example, incorporating a sonic dimension, aimed to highlight the metamorphic power and mutability of fashion to transform a body (Björk’s in this instance which simultaneously became percussive through her movements in the dress) and be transformed. This is a notion of mutuality of exchange and influence I adhere to and illuminate through my own practice and research findings in this thesis.

As a method of choreographic intervention, fashion by its very nature is well placed. As a medium, it constantly strives for change and the establishment of new paradigms. It does not stand still. Significantly, placing the dress and more crucially myself as a fashion designer at the core of the choreographic process, as described in Chapter 3, has enabled me to establish more intimate and meaningful relations between dancer and costume throughout the devising stages of the dance. This is a positioning other researchers might choose to take to gain deeper insights into the intertwinement between costume, dancer and the emergence of movement. The inquiry I have undertaken has sought specifically to extend the aesthetic value of the materiality of costume/garment to embrace a sensorial dimension (tactile and aural) as stimulus for the dancer. Furthermore, the costumes I have created frequently aimed to invoke an element of dysfunctionality, particularly in terms of

the way technologies were used, and the types of subversive sounds (noise music) that were generated. The productions described in this thesis demonstrate how a performance methodology focused on *wearability*, and integrated processes foregrounding closer interlinks between the tactile body-worn stimulus of garments and choreographic process, can reveal new, provocative approaches to the implementation of costume in performance. Here, noise also becomes a metaphor for fashion's disruptive potential to alter disciplinary conventions. Furthermore, I suggest this notion is not limited to real-time interactive and improvisational performance. Rather, it can be applied to a broader spectrum of movement choreography and sound composition in contemporary performance. Additionally, I propose that scope exists to apply such techniques of wearable performance design for compositional purposes to a range of immersive theatre, music, fine arts and media arts contexts.

With this thesis on *design-in-motion* I have reached a point at which I can look back at seven years of intensive creative and research processes where new avenues for my understanding of both my own design practice and the performative dimensions of garments and fashion have unfolded. Moreover, embracing fashion in such a vigorously interdisciplinary sense – as compositional tool (movement and sound) in dance contexts – I believe has expanded the already close relations fashion has with performance.

My research practice has not reached a conclusion, but rather is at a stage where new possibilities emerge, for example in my thinking about conductivity: this encompasses visions for future work in capacitive sensing using conductive materials and e-textiles as part of the movement-fashioning process.<sup>1</sup> Work that could be undertaken by other researchers in the field of energy transference – the coupling between bodies (and bodies and environments) – through conductivity of garments has the potential to be investigated further in future studies. At the same time as I contemplate such possibilities, I reflect back on the outset of this research which already stemmed from a larger body of practice concerned with emergence (*Emergent Dress* project)<sup>2</sup> and the mutability of shapes and materials in motion. This mutability, as a kind of propagation, became the central tenet for this thesis, namely conjoining fashion design with theatrical character as movement sounding out – amplified, sonified, conductive, transceiving, actuating and interactional.

The thesis has laid out the experimental and conceptual procedures of creating two multimedia dance performances, completed and presented during the course of the doctoral research. The main aim was to interrogate the choreographic space of real-time

interactive audio-visual performance and installation through experimentation with specially designed wearables – a series of choreosonic designs, propagating sound or noise, introduced at the start of a performance-making and choreographic process. Moreover, some of these wearables also transmitted data able to actuate graphic/motion image projections (e.g. LeavesWoman [*UKIYO*] and GraveDigger [*for the time being*]). The performative dynamics of the work focused on the ‘choreosonic’, a hybrid concept I define as the conjoining of movement (choreo) and sound (sonic) through the wearable character. The particular design aesthetics of the garments I constructed, with their visuo-sonic resonances and transcultural references (Japanese cultural traditions, ukiyo-e drawings, anime and manga in *UKIYO*; Russian Futurism and Suprematism in *for the time being*), emphasised material contextuality, aiming to formulate an unconventional use, and encumbering architectonics, of costume-as-character (indebted to some extent to the sculptural figurality of Schlemmer’s Bauhaus dances). Or more precisely: movement-sounding character.

Within the contemporary era of digital performance and wide-spread cultural obsession with networks, social media and communications technologies, this research makes a contribution, in design practice and scholarship, to the performance and media genre from an interdisciplinary perspective. Chapter 1 of this thesis interrogated the broad but interconnected artistic and theoretical contexts for my research engaging fashion, costume and interaction design, performance art and the sonic arts alike. My own design approach and the methodology for the *design-in-motion* projects, an approach that could also be adopted by others, described in detail throughout the second half of this thesis, are laid out in Chapters 2 and 3. In terms of its structure, then, the thesis follows a logical pathway from an overview of the artistic and research contexts (and specific historical precedents of instrument and wearable design-performance) to my design principles and the applied methods in the dance-theatre productions of *UIKYO* and *for the time being*.

The methodology for the project comprised interlacing artistic, theoretical, practical, empirical and discursive aspects throughout this thesis, and the aims of the research posited two main components. The first focused on identifying and investigating design strategies for the creation of wearable performance design that can augment a body, and be instrumental in the composition and choreographic process of performances and installations – impacting movement flow and the acoustic/aural dimensions of the work. The second was concerned with testing and analysing how the agential capacities of the material designs in turn effect change and transformation within the theatrical

environments wherein they are staged, and understanding the potential affects choreosonic wearables have on the performer's movement technique and kinaesthetic awareness – extending the body's reach and expressivity. The work thus necessarily involved: 1) The interrogation of an audiophonic design practice for the creation of choreosonic performance wearables; 2) The examination of the technological and wearable design concepts from an affective and effective perspective – as interface, mediator and transceiver of information flow in human computer interactions.

The approach to wearable performance articulated through the conceptual and artistic aspects of this research was focused on questions of performance at a sound-generating material level of the garments in movement. This is the level where the dancers would respond to or 'interpret' the costume to embody, amplify, manipulate and attenuate behaviors of the costume-phenomena, i.e. the material sound or technological instrument sonics built into the costume. Moreover, how they would wear, extend and perform the costume, and how they would 'instrumentalise' the costume's sounding capacities to interact with the stage environment, processual structures and in some cases the visual digital projections. Yet narrative also influences the way a performer moves or behaves, and this instrumentalised movement also manifested through the relational aspects of the characters in the overall dramaturgical structures or narrative developments of the pieces. Since completing the large productions, my experiments with conductivity and further research undertaken in the field of audiophonic wearable performance design question more deeply the interlinks between dancer and the sensory 'auratic power'<sup>3</sup> of garments in the absence of a narrative or theatrical frame. My NailFeathers Dress (2016), which opts for a more fashionable design aesthetic than the ones drawn from historical text or cultural era, explores the notion of sounding-movement design from an essentially abstract point of view – an idea I intend to pursue further in my future studies in conjunction with capacitor sensing (fig. 79). Constructed using a multitude of nails interwoven into the main mesh fabric of the dress, the idea of the NailFeathers garment was to amplify purely the sound of the wearer's movements stimulated by the dress and nothing more.



Figure 79: NailFeathers Dress worn by Elisabeth Sutherland in rehearsal, *metakimospheres no.3*, Artaud Performance Centre, London, 2016. Video still © Michèle Danjoux.

In brief, this was achieved through integrating a series of piezos – contact mikes – into the garment, to pick up the vibrational qualities of the nails – animated by the dancer – and then making these audible via a wearable amplifier-speaker carried like a camera on the dancer's body.<sup>4</sup> Elisabeth Sutherland, who wore this garment, told me how inspired she was to use her body literally as an instrument, unencumbered by narrative or any additional factors, to generate sound through her individual steps and whole body movements. Her body expanded through wearable design to create a fused and intertwined sounding instrument-body, generating compositional elements of pure instrumental music kinetically in performance – wearer sensations and interactions the only motivations to movement-sounding.

Over the course of the practice-based research and development for the project, it became clear that the performers responded in individual ways to the challenges of the wearable structure. I have tried to evoke the ‘felt’ presence of technologies and other multi-sensorial affects of costume on the performing body through my accounts of the characters and the dancers’ feedback. Through the emergent choreographies of real-time interaction and the amplification of physical presence through costume, I found clear evidence of new, particularised forms of dance specific to the *character of the wearable*: the dancer adopted or discovered movement expressions not based on familiar technical vocabularies (ballet, modern dance, tanztheater) but inspired by the intricacies of the material and sonic design. The designs I have created – explained contextually and performatively in Chapter 4 and Chapter 5 – sought to be both visually highly distinctive yet also distinctively audible when activated through wearing by the dancer in motion.

I would however maintain that the overarching emphasis of the *design-in-motion* research was directed at what I call the *sonic touch*, namely the contained, intimate, proximate movement expression of the dancer articulating her wearable dress as a transceiver instrument. The method used for discovering the sonic touch fundamentally stipulates a practice of designing that attaches electro-acoustic instruments onto the dancer’s body and costume, testing emergent behaviours of materials, movement, sound in the design process while conceptualising them as relational and active. A significant marker of transfer between this method and artistic movement practices concerned with emergent/improvisatory processes is, as I claim, the importance of initial design form (provided in stages, added on in the process). Each prototype is a kind of machine of its own kinetic poiesis. The poetry of its sonic touch, in other words, is generated through the embodiment of the costume’s constraint as potentiality for a particular outcome.

The capacity for achieving different sonic characters in the design development was illuminated in my descriptive and analytical sections (in Chapters 4 and 5) on the associated dramaturgy of *UKIYO* and *for the time being*. I have drawn attention to how, in both projects, the design process dealt with various fabric materials and their potentials (e.g. their resistance, elasticity, density, weight, etc.), how particular historical, cultural or narrative resonances were established, how electro-acoustic or electronic components were incorporated into the garments or accessories, and how the resultant choreosonics contributed to the movement narrative and overall dramaturgy of the productions.

The analysis has shown how the choreosonic wearables can foster a multivalent



understanding of the costumes' agential capacities, their live generative performativities. As I demonstrated, for example, with the prologue and opening scene of *for the time being*, the TatlinTower (head)dress – worn, activated and 'played' by Helenna Ren – dominates the semiotic and symbolic dimensions of the DAP-Lab ensemble's adaptation of *Victory over the Sun*. The design of this character instantly evokes a symbol of the revolution and the role of the radio tower as a transmitter. Abstract language (*zaum*), mathematics, poetry and futuristic designs complement each other in the development of the particular aesthetic materiality of the production. All fashioned prototypes for the nine character-costumes analysed in this thesis were featured in the poetic landscapes of *UKIYO* and *for the time being*, and perhaps it is not too ambitious to argue that the particular dance form of these productions is grounded in the subjects and role enactments of the design performance. The roles fashioned were visual-kinaesthetic, sonic and tactile, affecting perceptions of the choreography through the sonic gestures.

Through this doctoral research, I have arrived at a thorough understanding of the intricacies of choreographic improvisation with wearables. My *design-in-motion* process methodology for emergent performing-garments proved effective for the ensemble members of both productions, from their point of inception to their realisation. *UKIYO* and *for the time being* were presented six times to the public, in different venues, and film and radio versions of the works have been viewed or heard by thousands on the internet and through the BBC.<sup>5</sup> I have described how the wearables were coming into scenic action, and analysed the creation and development of the concepts for the electro-acoustic, electronic and conductive instruments. These instruments enabled me to work intimately with the dancers, encouraging them to discover a new palette of sonicity and noise in the sonic movement expressions that became possible through the costume characters. The wearables were the potential and motivating 'sky' – in the sense in which choreographer Deborah Hay encourages dancers to 'figure a sea, using the sky' (Maar 2016: 5)<sup>6</sup> – within a highly dynamic environment where the specific choreosonics produced by the garments in movement effected the colours and poetic temperatures of the entire work and stood out at the same time.

Responses from the dancers, and specifically the detailed feedback from Vanessa Michielon in Chapter 5, demonstrate that garments have touched them affectively – having a physical and psychological effect on their movement expression and how it emerged. The most revealing comments, however, come from Ren at the end of my process, and I wish to evoke them in this conclusion. Before, Ren had not been so analytically

forthcoming; she confided as a performer she prefers not to operate in academic research mode. Katsura Isobe had voiced a similar resistance during *UKIYO*. This suggests either that some dancers find it uncomfortable to articulate what they feel and process somatically within their bodies, or that designers have not always found the right channels to solicit responses to the garments. Ren preferred to work without engaging pointed questions about her experiences of wearable design, which she said I knew well anyway having worked many years with her (since 2005). She tended to speak through her body and respond intuitively to the wearable extensions. And I had indeed grown to understand her well through my observations and our conversations in the dressing room. The dancer first and foremost needs to be receptive to the garment or wearable design, re-focussing attention towards its presence on the body, she told me, adding that she must allow it to move her. In turn, she will move it. There must be an understanding on the dancer's part of the wearable and what it aspires to achieve, an openness to the tactile stimuli on offer, which requires a certain body consciousness.

On probing Ren further on the valuable insights she provided, she re-affirmed the ability for the design to touch her in ways that will animate her:

I think as dancers we need to have an awareness of the costume design before we put it on, for instance, the shape, colour, texture, weight and so on... As every little detail and aspect can stimulate movement - physically, mentally, sensorially, and especially when technology is involved. For me personally, there has been a strong relationship between your designs and my movements in wearable design performance, as each effects and influences the other closely, powerfully, from the point of view of both the physical body and perception of mind. (Ren 2016: email)

The craft of a dancer in such contexts is thus to process and respond kinetically to the materiality of the garments and their touch knowingly. Ren wore several wearables for this research project across the two productions, and this is what she stated on the co-creative process between body and garment in wearable performance:

I have performed several of the garments, and they also performed me. Characters such as: HammerWoman, with the hammer in my right hand, bend sensor on my right arm, focusing my movement mainly on my right arm; SpeakerWoman, the two large round speakers I carried becoming my extended hands, the cables on my back my extended spine; TatlinTower, the metal hat on my head, I can still feel the vibrational noise each time I think about it, and my movement had to be so very careful to keep my body balance, and often slower; GraveDigger, this garment controlled me not to move freely, plus I was further restricted by the Kinect camera's square of interaction I had to perform inside. My movement could not reach out too far, otherwise we lost the visual sensor connection between the real

and the virtual. Here it was important to understand not just the costume but the technology that it formed a part of too. (2016: email)

Beyond anything, I believe that Ren's comments show the *con-sensual* side of wearable performance design, whereby unless the performer understands and consents to the sensory provocations on offer to her, the impacts cannot be felt, at least not in a way that can influence choreography. Wearable performance design, thus, according to Ren requires a mental shift in order to activate physical movement. Furthermore, in terms of developing a choreography or devising movement, Ren concluded:

I often studied the garment statically, as well as exploring it dynamically – questioning how can I move freely whilst at the same time showing the garments in different shapes with my body – from the front, side, back... and how can I not move? I learnt stillness (that is also a movement in dance) and sometimes my movements were slowed down which seemed more powerful. In performance, I embodied the garment and become one, like a human sculpture in an abstract shape whilst at the same time allowing or bringing the audience close to view not just a dancer but also the costume and how it is performed by the dancer – becoming something new. (2016: email)

This statement, that the garment enabled the dancer to 'become' at one with it, is a powerful reflection of the design ethos that instilled the work I brought to our ensemble. In summary, *design-in-motion* expands commonly accepted notions of fashion design and costume design insofar as it makes a sustained contribution to performance and media art practices, as well as choreographic and compositional production processes (what Rebstock and Roesner [2012] have referred to as 'composed theatre') by introducing a distinct concept of choreosonic wearables and a radically nonconventional *design-in-motion* methodology that begins choreographic research and movement improvisation with the emergent material constructs of costumes (rather than complementing movement invention at the end of rehearsal and stage design processes).

The wearables in my work are not at all understood to be 'wearable technology' in the sense in which fashion or computer science industries may dream of future cyborgs and augmented human beings (the so-called posthumans). By the same token, they are not deemed 'non-wearable' (Bolton 2015: 19), as in the conceptual provocations of Alexander McQueen designed purely for the fashion runway. Rather, the dance performances and installations I have created, along with my ensemble, reflect a historical, critical and reflective sensibility where the wearables are, above all, poetic statements. As such they impute generative performative behaviour, each pouring out affecting a subjective, often quite intimate process of noise making that does not comply to any ready-made ideologies

of interactive technology (the ‘garments of paradise’ Susan Elizabeth Ryan (2014) writes about) but seeks to crawl underneath: my wearable instruments often tend to be perplexing encumbrances, sly inhibitors and misfits, instruments gesturing towards uninstrumentation. Whilst work has been done in this project to gain insights from the dancers, and whilst these insights have been very meaningful to my research and understanding, I realise scope remains for interrogative investigation. The somatic and experiential side of the choreosonic performance could well deserve further study and a more structured systematic empirical observation, perhaps also linked to currently emerging neuro-scientific research into bodily motion perception, cognition and empathy.

A larger and future ambition to extend this research, but not the topic for this thesis would be to expand into how affective wearing might relate to wearable performance design’s potential to offer a form of ‘affective re-training’ for the dancer – a disentanglement from old practices and habitus. Additionally, this could involve a study of the flow of ‘affective transmission’ from performer to performer, and moreover, performer to audience member in future work. These types of studies would require more formal methods of data collection and analysis techniques than have been used in this project. But for the scope of this thesis, my main concern was to understand and encourage the dancers’ improvisation with the wearable structure, and invent sounding possibilities with them and the engineers that helped me to devise the sound-making apparatuses. My apparatuses, I would suggest, are not garments of paradise as much as they are choreosonic poems with halted, fluttering rhythms like the onomatopoeia of Kruchenykh’s *zaum*, grr grr grr, prnnn, drr drr, rd rd ooh ooh ooh, k n k n lk m, ba ba ba ba, the motherland perishes/because of dragonflies/the locomotive/sketches lilies.<sup>7</sup>

## Notes

<sup>1</sup> This experimentation has already been under way in tandem with the METABODY (<http://www.metabody.eu>) project but exceeds the scope of this thesis. METABODY was initiated in Madrid (July 2013) by a collaborative network of arts organisations, research labs and performance companies engaged in a radical rethinking of perception and movement away from the mechanistic-rationalistic tradition, and thus also the dominant Western tradition of visibility or ocularcentrism combined with formal and systemic ‘built’ environments and protocols that take certain embodiments for granted, towards a (digital) embodiment that places emergent differentials of bodies and affects to the forefront of its concerns. METABODY encompassed eleven primary

partners including the Asociación Transdisciplinar REVERSO, DAP-Lab, STEIM, InfoMusLab, Stocos, Hyperbody TU Delft, Palindrome, Trans-Media-Akademie Hellerau, and others. Regarding my investigations of conductivity, between the 10<sup>th</sup> and 12<sup>th</sup> October 2014, Studio for Electro-Instrumental Music in Amsterdam (STEIM), invited me to a three-day research-creation laboratory on e-textiles, movement and sound, bringing together experts in the divergent fields with the view to creating synergies and short performances through the convergence of these disciplines. Working teams consisted of textile experts, interaction designers, sound artists, choreographers, dancers and performers. The short but intensive residency was organised by Marije Baalman, an electronics engineer then based at STEIM, and it was during this residency that I conceived of and created the ConductiveCoat prototype, opening up directions for future research. I reflect on these in ‘Design-in-motion: Conductive Choreography’ (see Chapter 2, endnote 4).

<sup>2</sup> <http://people.brunel.ac.uk/dap/emergent.html>.

<sup>3</sup> Expanding on my earlier reflections on auratic fashion design, I here borrow Caroline Evans’ term ‘auratic power’ (2015: 194) as I again consider the agency of sounding garments. Evans uses it to describe an enduring potentiality that remains in the ‘showpieces’ – hard bodices made in metal, glass, leather, shells, plywood etc. – of designer Alexander McQueen even when viewed off the body in an exhibition context.

<sup>4</sup> Neal Spowage assisted in the electronic construction of this prototype design.

<sup>5</sup> Films of TatlinTower (head)dress and RedMicro Dress, both with Vanessa Michielon performing the wearables, were featured during a symposium broadcast to which I was invited for the BBC World Series ‘Click’ Program on Wearable Technologies, London, February 25, 2014, in the BBC's Radio Theatre both in front of a local audience and to listeners on the air.

<sup>6</sup> For an extended reflection on her choreographic practice, empowering the performer’s perception, and her trust in the feedback of bodily intelligence, see Hay 2016.

<sup>7</sup> Adapted from the original libretto (*Victory over the Sun*), for Act II, Scene 5, ‘Tenth Country’, as performed in DAP-Lab’s *for the time being*.

## References

- Agon* by New York City Ballet (1957) Directed by George Balanchine [New York City Centre 55<sup>th</sup> Street Theatre. 1 December].
- Agoradanse (2009) *Passage de kondition pluriel* (video online). Available at: [www.youtube.com/watch?v=apmPKrvxbEk](http://www.youtube.com/watch?v=apmPKrvxbEk) [Accessed September 14, 2017].
- Afterscorpio (2017) *Hironobu Oikawa Archive*. Available at: <https://sites.google.com/site/afterscorpio/oikawa-texts> [Accessed September 14, 2017].
- Alexander McQueen: Savage Beauty* (2015) Curated by Claire Wilcox, Victoria and Albert Museum, London (14 March - 2 August 2015).
- Allgemeine Elektrizitäts-Gesellschaft, AEG (2014) *The Next Black – A film about the future of Clothing* [video online]. Available at: <https://www.youtube.com/watch?v=XCsGLWrfE4Y> [Accessed July 15, 2016].
- Animate Entities: Objects in Performance: <http://animateentities.wixsite.com/ae2016>.
- AnOther (2017) *MOVEment: About MOVEment*. Available at: <http://www.anothermag.com/fashion-beauty/7275/about-movement> [Accessed August 5, 2017].
- Arnold, Rebecca (2001) *Fashion, Desire and Anxiety: Image and Morality in the 20<sup>th</sup> Century*, London: I.B. Tauris.
- Artaud, Antonin ([1964] 2010) *The Theatre and its Double*, trans. Victor Corti, London: Oneworld Classics Ltd.
- Atomos* by Random Dance (2013) Directed by Wayne McGregor [Sadler's Wells Theatre, London. 9 October].
- Aware: Art Fashion Identity* (2011) Curated by Kathleen Soriano and Edith Devaney, Royal Academy, London (2 December 2010 - 30 January 2011).
- Bach, Rudolf (1933) *Das Mary Wigman Werk*, Dresden: Carl Reissner Verlag.
- Banes, Sally (1983) *Democracy's Body: Judson Dance Theater, 1962-64*, Ann Arbor: UMI Research Press.
- Banes, Sally (1993) *Democracy's Body: Judson Dance Theatre, 1962-1964*, Durham: Duke University Press.
- BAMPFA (2009) *Ellen Fullman on the Long String Instrument*. Available at: <https://www.youtube.com/watch?v=Uq9AFRMWLTU> [Accessed September 15, 2017].
- Barad, Karen (2003) 'Posthumanist performativity; towards an understanding of how matter comes to matter', *Signs* 28 (3), 801-831.

Barbieri, Donatella (2006) 'An Exploration of the Application of the Laboratoire d'Étude du Mouvement (LEM) pedagogy to the Teaching and Practice of Costume Design for Performance', Costume Symposium 2006 Academic Research Papers, Arts Institute, University of Bournemouth. Available at: [http://ualresearchonline.arts.ac.uk/1754/1/Costume\\_Symposium\\_2006.pdf](http://ualresearchonline.arts.ac.uk/1754/1/Costume_Symposium_2006.pdf) [Accessed May 17, 2015].

Barbieri, Donatella (2012) 'Encounters in the Archive: Reflections on Costume', *V&A Online Journal*, 4. Available at: <http://www.vam.ac.uk/content/journals/research-journal/issue-no.-4-summer-2012/encounters-in-the-archive-reflections-on-costume/> [Accessed August 5, 2017].

Barbieri, Donatella (2015) 'PQ Workshops': *Wearing Space: physical exploration through movement and objects*. Available at: [pq.cz/en/program/spacelab-2015/workshops/costume-design](http://pq.cz/en/program/spacelab-2015/workshops/costume-design) [Accessed September 18, 2015].

Barbieri, Donatella (2016a) 'Costume Before and beyond the Production: The Spacelab Costume Workshop at Prague Quadrennial' *Studies in Costume & Performance* 1 (1), 199-206.

Barbieri, Donatella and Sofia Pantouvaki (2016b) 'Towards a philosophy of costume', *Studies in Costume & Performance* 1 (1), 3-7.

Barrett, Estelle and Bolt, Barbara (eds.) (2007) *Practice as Research: Approaches to Creative Arts Enquiry*, London: I. B. Tauris.

Barthes, Roland ([1967] 1983) *The Fashion System*, trans. Matthew Ward and Richard Howard, Berkeley: University of California Press.

Bartlett, Rosamund and Dadswell, Sarah (eds.) (2012) *Victory over the Sun: The World's First Futurist Opera*, Exeter: University of Exeter Press.

Batson, Glenna (2009) 'Somatic Studies and Dance', *The International Association for Dance Medicine and Science*, 2. Available at: <https://www.iadms.org/page/248> [Accessed September 23, 2016].

Baugh, Christopher (2013) *Theatre, Performance and Technology: The Development and Transformation of Scenography*, 2<sup>nd</sup> edition, New York: Palgrave Macmillan.

*Bauhaus: Art as Life* (2012) Curated by Catherine Ince and Lydia Yee, Barbican Art Gallery, London (3 May 2012 - 12 August 2012).

Becker, Cynthia (2007) 'Awakening the Senses: The Aesthetics of Moroccan Berber Dress'. In: Clay Johnson, Donald and Bradley Foster, Helen (eds.) *Dress Sense: Emotional and Sensory Experiences of the Body and Clothes*, Oxford: Berg, pp. 72-83.

Ben-Tal, Oded and Wilkins, Caroline (2010) 'The embodiment of music/sound within an intermedia performance space', ARTECH 2010, 5th International Conference on Digital Arts, 22 and 23 April 2010, School of Architecture, Universidade do Minho, Guimaraes, Portugal, pp. 19-24.

Biacchi, Sonia (2013) *Sonia Biacchi*. Available at: <https://www.facebook.com/media/set/?set=a.617136004982438.1073742037.223418931020816&type=1> [Accessed March 4, 2014].

Bicât, Tina (2012) *Costume and Design for Devised and Physical Theatre*, Marlborough: The Crowood Press.

Biggs, Simon (2009) 'New Media: The "First Word" in Art?' In: Smith, Hazel and Dean, Roger T. (eds.), *Practice-led Research, Research-led Practice in the Creative Arts*, Edinburgh: Edinburgh University Press, pp. 66-83.

*Biped* (1999) Directed by Merce Cunningham [Zellerbach Hall, University of California. 23 April].

Birringer, Johannes and Danjoux, Michèle (2005) 'The Telematic Dress: Evolving garments and distributed design in streaming media and fashion performance', in

Leishman, Brian (ed.), *Globalization of the Fashion Industry: future vision and the challenges for education and business: conference proceedings 2005, International Foundation of Fashion Technology Institutes. Annual Conference (7<sup>th</sup>: 2005: Tokyo, Japan)*, Tokyo: Bunka Women's University, pp. 156-162.

Birringer, Johannes and Danjoux, Michèle (2006) *The Emergent Dress: Transformation and Intimacy in Streaming Media and Fashion Performance*. Available at: <http://people.brunel.ac.uk/dap/emergent.html> [Accessed September 14, 2017].

Birringer, Johannes (2008a) 'After Choreography', *Performance Research* 13 (1), 118-123.

Birringer, Johannes (2008b) *Performance, Technology, and Science*, New York: PAJ Publications.

Birringer, Johannes and Danjoux, Michèle (2009a) 'Wearable Performance', *Digital Creativity* 20 (1-2), 95-113.

Birringer, Johannes and Danjoux, Michèle (2009b) 'Wearable technology for the performing arts'. In: McCann, Jane and Bryson, David (eds.), *Smart Clothes and Wearable Technology*, Cambridge: Woodhead Publishing Ltd., pp. 388-419.

Birringer, Johannes (2010a) 'Moveable Worlds/Digital Scenographies', *International Journal of Performance Arts and Digital Media* 6 (1), 89-107.

Birringer, Johannes (2010b) Conversation with the author, 10 February.

Birringer, Johannes and Danjoux, Michèle (2013) 'The Sound of Movement Wearables', *Leonardo* 46 (3), 232-40.

Birringer, Johannes (2014) 'The Theatre and its Screen Double', *Theatre Journal* 66 (2), 207-25.

Blom, Lynne Anne and Chaplin, L. Tarin (1989) *The Intimate Act of Choreography*, London: Dance Books.

Blume, Torsten (2014) 'An Undertaking Contrary to Nature for Purposes of Order', *Bauhaus* 6, 6-13.

Böhmig, Michaela (2012) 'The Russian Cubo-Futurist Opera Victory over the Sun: Aleksei Kruchenykh's Alogical Creation'. In: Bartlett, Rosamund and Dadswell, Sarah



(eds.), *The World's First Futurist Opera: Victory over the Sun*, Exeter: The University of Exeter Press, pp. 109-25.

*Boléro* (2013) Directed by Sidi Larbi Cherkaoui, Damien Jalet and Marina Abramovic [Opéra national de Paris – Palais Garnier, Paris. Premiere: 2 May].

Bolton, Andrew (2015) 'In Search of the Sublime'. In: Wilcox, Claire (ed.) *Alexander McQueen*, London: V&A Publishing, pp. 15-21.

Bolton, Christopher, Csicsery-Ronay Jr., Istvan and Tatsumi, Takayuki (eds.) (2007) *Robot Ghosts and Wired Dreams: Japanese Science Fiction from Origins to Anime*, Minneapolis: University of Minneapolis Press.

Bouquillard, Jocelyn and Marquet, Christophe (2007) *Hokusai: First Manga Master*, trans. Liz Nash, New York: Abrams.

Borchardt-Hume, Achim (ed.) (2014) *Malevich*, London: Tate Publishing.

Bradby, David (ed.) (2006) *Theatre of Movement and Gesture: Jacques Lecoq*, Abingdon: Routledge.

Braddock Clarke, Sarah E. and O'Mahoney, Marie (2005) *Techno Textiles 2*, London: Thames & Hudson.

Braddock Clarke, Sarah E. and Harris, Jane (eds.) (2012) *Digital Visions for Fashion and Textiles: Made in Code*, London: Thames and Hudson.

Brand, Jan and Teunissen, José (eds.) (2006) *The Power of Fashion: About Design and Meaning*, Arnhem: ArtEZPress.

Bremser, Martha and Saunders, Launa (eds.) ([1999] 2011) *Fifty Contemporary Choreographers*, 2<sup>nd</sup> edition, London: Routledge.

Briginshaw, A. Valerie & Burt, Ramsay (2009) *Writing Dance Together*, Basingstoke: Palgrave Macmillan.

Brophy, Philip (2005) *100 Anime*, London: British Film Institute.

Brown, Barclay (1982) 'The Noise Instruments of Luigi Russolo', *Perspectives of New Music* 20, 31-48.

Brown, Carol and Ramsgard Thomsen, Mette (2008) 'Dancing-Drawing Fields of Presence in SeaUnSea'. In: Hannah, Dorita and Harsløf, Olav (eds.) *Performance Design*, Copenhagen: Museum Tusculanum Press, pp. 228-246.

Brownell, Blaine (2006) *Transmaterial: A catalog of materials that redefine our physical environment*, New York: Princeton Architectural Press.

Bruzzi, Stella (1997) *Undressing Cinema: Clothing and Identity in the Movies*, London: Routledge.

*Building the Revolution: Soviet Art and Architecture 1915-1935* (2011) Curated by Mary-Anne Stevens and Maria Tsantsanoglou, Royal Academy of Art, London (29 October 2011 - 22 January 2012).

Bugg, Jessica (2016) 'Dancing dress: Experiencing and perceiving dress in movement', *Scene 2* (1-2), 97-111.

Burt, Ramsay (2006) *Judson Dance Theater: Performative Traces*, London: Routledge.

Burt, Ramsay (2009) 'What the Dancing Body Can Do: Spinoza and the Ethics of Experimental Theatre Dance'. In: Briginshaw, Valerie A. and Burt, Ramsay, *Writing Dance Together*, Basingstoke: Palgrave Macmillan, pp. 204-16.

Burt, Ramsay (2012) Private email correspondence, 14 November.

Calza, Gian Carlo (2007) *Ukiyo-e*, London: Phaidon.

Camurri, Antonio and Volpe, Gualtiero (eds.) (2004) *Gesture-Based Communication in Human-Computer Interaction*, Berlin: Springer.

*Carbon Life* (2012) Directed by Wayne McGregor [The Royal Opera House, London. 5 April].

Carmody Groake (2017) *Bauhaus Art as Life at the Barbican Art Gallery*. Available at: [http://www.carmodygroarke.com/Bauhaus\\_Art\\_As\\_Life\\_at\\_the\\_Barbican/index.html](http://www.carmodygroarke.com/Bauhaus_Art_As_Life_at_the_Barbican/index.html) [Accessed August 25, 2017].

Carpenter, Betsy (2012) *Dance Works III: Merce Cunningham/Rei Kawakubo*, Curatorial Statement, Walker Art Center. Available at: <http://www.walkerart.org/calendar/2012/dance-works-iii-merce-cunningham-rei-kawakubo> [Accessed May 19, 2017].

Chapple, Freda and Kattenbelt, Chiel, (eds.) (2006) *Intermediality in Theatre and Performance*, Amsterdam: Rodopi.

Cherkaoui Sidi Larbi (2010) *Choreography*. Available at: <http://www.milongatour.co.uk/sidi-larbi-cherkaoui.php> [Accessed July 25, 2017].

Chessa, Luciano (2012) *Luigi Russolo: Futurist Noise, Visual Arts, and the Occult*, Berkeley: University of California Press.

Chunky Move (2009) *Mortal Engine* [video online]. Available at: [https://www.youtube.com/watch?v=pS1WALmBqUw&has\\_verified=1](https://www.youtube.com/watch?v=pS1WALmBqUw&has_verified=1) [Accessed September 17, 2017].

*Club to Catwalk* (2013) Curated by Claire Wilcox, Victoria and Albert Museum, London (10 July 2013 - 16 February 2014).

Cohen, Louis, Manion, Lawrence and Morrison, Keith (2011) *Research Methods in Education*, Abingdon: Routledge.

*Cold War Modern: Design 1945-70* (2008) Curated by Jane Pavitt, Victoria and Albert Museum, London (25 September 2008 - 11 January 2009).

Collins, Jasmine (2015) 'MOVEMENT', *Another Magazine*. Available at: <https://fms505collinsjblog.wordpress.com/2015/11/11/movement/> [Accessed August 5, 2017].

Collins, Nicolas ([2006] 2009) *Handmade Electronic Music: The Art of Hardware Hacking*, 2<sup>nd</sup> edition, London: Routledge.

*Come, Been and Gone* by Michael Clark Company (2009) Directed by Michael Clark [Edinburgh International Festival. 29 August].

Compton, Susan P. (1978) *The World Backwards: Russian futurist books 1912-16*, London: The British Museum.

Connor, Steve (2004) 'Sound and the Self'. In: Smith, Mark M. (ed.) *Hearing History: Reader*, Athens, GA.: The University of Georgia Press, pp. 54-66.

Connor, Steve (2005) 'Ears Have Walls: On Hearing Art'. Lecture given in the series *Bodily Knowledges: Challenging Ocularcentricity* at Tate Modern, 21 February 2003. Published in *FO A RM*, 4, 8-57. Available at <http://www.stevenconnor.com/earshavewalls/> [Accessed September 22, 2015].

Crotty, Michael (1998) *The Foundations of Social Research*, London: Sage Publications.

CUTE Centre: <http://cutecenter.nus.edu.sg>.

Cutler, E.P. and Tomasello, Julien (2015) *Art + Fashion: Collaborations and Connections Between Icons*, San Francisco: Chronicle Books.

Dailymotion (2017) *Steina, Violin Power, 1978* [video online]. Available at: [http://www.dailymotion.com/video/x7rb4w\\_steina-violin-power-1978\\_creation](http://www.dailymotion.com/video/x7rb4w_steina-violin-power-1978_creation) [Accessed August 14, 2017].

Damasio, Antonio R. (1994) *Descartes' Error: Emotion, Reason and the Human Brain*, London: Macmillan.

Dance & Technology Zone (1998) *hand drawn spaces*. Available at: <http://www.art.net/resources/dtz/archive/DanceTech98/0588.html> [Accessed September 20, 2017].

Danjoux, Michèle (2007) 'The Emergent Dress: fashion, performance and materiality', in

Elizabeth Rouse (ed.), *Extreme Fashion: pushing the boundaries of design, technology and business: conference proceedings 2007, International Foundation of Fashion Technology Institutes. Annual Conference (9<sup>th</sup>: 2007: Toronto, Ont.)*, London: Centre for Learning and Teaching in Art and Design, pp. 214-233.

Danjoux, Michèle (2010) 'Sensual Wearables/The Sound of Character', paper presented to DRHA (Digital Resources for the Humanities and the Arts) 2010, Sensual Technologies: Collaborative Practices of Interdisciplinarity, Brunel University, London, 5 - 8 September.

Danjoux, Michèle (2011) 'Intimate and Dynamic Design Processes', paper presented to Artaud Forum 1: The World from Within & Without, in Memorium of Kazuo Ohno, Artaud Performance Centre, Brunel University, London, 4 - 5 April 2011.

Danjoux, Michèle (2013a) 'The Sound of Movement Wearables', paper presented to Critical Costume: Towards a Vocabulary of Scenographic Bodies, A Symposium and Exhibition, Edge Hill University, 17 - 18 January 2013.

Danjoux, Michèle (2013b) *The Sound of Movement Wearables*, an exhibition of audiophonic design prototypes, Critical Costume: Towards a Vocabulary of Scenographic Bodies. A Symposium and Exhibition, Edge Hill University, 17 - 18 January 2013.

Danjoux, Michèle (2013c) 'Design in Motion', paper presented to Embodied Cognition: Practice-based Research in Doctoral Programmes, The HEA Discipline Workshop and Seminar Series, 2012-2013, The University of Winchester, 30 April 2013.

Danjoux, Michèle (2013d) 'Wearables in Performance: The Choreographic Potentials of Bodies and Design in Motion', paper presented to The Body in Twentieth and Twenty-First Century Performance, De Montfort University, 5 June 2013.

Danjoux, Michèle (2014a) 'Interactive Technologies, Costume Design and Choreography'. In: Behringer, Klaus and Birringer, Johannes (eds.), *Manifest der Interaktionskunst*, Saarbrücken: PoCul Verlag, pp. 37 - 48.

Danjoux, Michèle (2014b) 'Choreography and Sounding Wearables', Special Issue on 'Critical Costume', *Scene 2* (1-2), 197-220.

Danjoux, Michèle (2014c) 'TatlinTower and RedMicro Dress', presentation and demonstration of wearable prototypes to BBC World Series 'Click' Program on Wearable Technologies, BBC Radio Theatre, London, 25 February 2014.

Danjoux, Michèle (2014d) 'Re-Fashioning the Performing Body: The transformational potentials of fashion in contemporary dance performance', paper presented to Shapeshifting Conference: Transformative Paradigms of Fashion & Textile Design, AUT University, Auckland, New Zealand, 14 - 16 April 2014.

Danjoux, Michèle (2015) 'Wearables and Choreosonic Performance', paper presented to Symposium Fashion Responsive, Geneva University of Art & Design (HEAD), Geneva, Switzerland, 24 March 2015.

DAP-Lab [Design and Performance Lab]: <http://people.brunel.ac.uk/dap/>.

Davies, Eden (2001) *Beyond Dance: Laban's Legacy of Movement Analysis*, New York: Routledge.

Davies, Eden (2006) *Beyond Dance: Laban's Legacy of Movement Analysis*, rev. edition, Oxford: Taylor & Francis.

Dean, Roger. T. (ed.) (2009) *Oxford Handbook of Computer Music*, Oxford: Oxford University Press.

Dean, Sally. E. (2014) *sally e. dean – the artist*. Available at: <http://www.sallyedean.com/about/sally-e-dean/> [Accessed May 15, 2017].

Dean, Sally. E. (2015) 'Amerta Movement & Somatic Costume: Gateways into Environment'. In: Whatley, Sarah, Garrett-Brown, Natalie and Alexander, Kirsty (eds.), *Attending to Movement: Somatic Perspectives on Living in this World*, Axminster: Triarchy Press, pp. 155-180.

Dean, Sally. E. (2016) 'Where is the body in the costume design process?' *Studies in Costume & Performance* 1 (1), 97-111.

*Diaghilev and the Golden Age of the Ballets Russes, 1909-1929* (2011) Curated by Jane Pritchard and Geoffrey Marsh, Victoria and Albert Museum [V&A], London (25 September - 9 January 2011).

Doruff, Sher (2009) 'The Tendency to "Trans-": The Political Aesthetics of the Biogrammatic Zone'. In: Chatzichristodoulou, Maria, Jeffries, Janice and Zerihan, Rachel (eds.), *Interfaces and Performance*, London: Ashgate, pp. 121-40.

Doyle, Oliver (2014) Private email correspondence, 3 March.

Duncan, Isadora (1995). In: Helen Thomas *Dance, Modernity and Culture: Explorations in the sociology of dance*, London: Routledge p. 64.

*Dysfashional* (2007) Curated by Luca Marchetti and Emanuele Quinz, La Rotonda 1, Luxembourg, (May - June 2007).

Dyson, Frances (2009) *Sounding New Media: Immersion and Embodiment in the Arts and Culture*, Berkeley: University of California Press.

Emotional Technology Platform: <http://www.xoxemotionaltech.com>.

Entwistle, Jeanne (2000) *The Fashioned Body: Fashion, Dress and Modern Social Theory*, Cambridge: Polity Press.

*Eonnagata* by Sylvie Guillem, Russell Maliphant and Robert Lapage in collaboration with Alexander McQueen (2009) [Premiere: Sadler's Wells, London. 26 February].

Evans, Caroline (2003) *Fashion at the Edge: Spectacle, Modernity and Deathliness*, New Haven: Yale University Press.

Evans, Caroline (2015) 'Modelling McQueen: Hard Grace'. In: Wilcox, Claire (ed.) *Alexander McQueen*, London: V&A Publishing, pp. 189-201.

Fashioning Technology: A DIY Intro to Smart Crafting: <http://www.fashioningtechnology.com>.

Finlayson, Sandy (2011) email correspondence, June 13.

Flick, Uwe (ed.) (2007) *Designing Qualitative Research*, Los Angeles: Sage Publications.

Fogtmann, Maiken Hillerup, Fritsch, Jonas, and Kortbek, Karen Johanne (2008) 'Kinesthetic interaction: revealing the bodily potential in interaction design'. In: *Proceedings of OZCHI08 – the CHISIG Annual Conference on Human-Computer Interaction 2008*, pp. 89-96.

Forsythe, William (2009) *Synchronous Objects*. Available at: <http://synchronousobjects.osu.edu> [Accessed September 30, 2016].

Forsythe, William (2014) *Motion Bank*. Available at: <http://motionbank.org/en> [Accessed September 30, 2016].

Forsythe, William (2017) *Synchronous Objects for One Flat Thing*. Available at: <https://synchronousobjects.osu.edu> [Accessed September 15, 2017].

*for the time being [Victory over the Sun]* by DAP-Lab (2012) Directed by Johannes Birringer and Michèle Danjoux [Watermans International Digital Arts Festival, London. 26-27 May].

*for the time being [Victory over the Sun]* by DAP-Lab (2014) Directed by Johannes Birringer and Michèle Danjoux [Lilian Baylis Studio, Sadler's Wells, London. 3-4 April].

Fraleigh, Sondra (1987) *Dance and the Lived Body: A Descriptive Aesthetics*, Pittsburgh: University of Pittsburgh Press.

Fraleigh, Sondra (1999) *Dancing into Darkness: Butoh, Zen and Japan*, Pittsburgh: University of Pittsburgh Press.

Fraleigh, Sondra (2004) *Dancing Identity: Metaphysics in Motion*, Pittsburgh: University of Pittsburgh Press.

Fraleigh, Sondra and Nakamura, Tamah (2006) *Hijikata Tatsumi and Ohno Kazuo*, New York: Routledge.

Fraleigh, Sondra (2009) *Land to Water Yoga: Shin Somatics Moving Way*, New York: iUniverse, Inc.

Fraleigh, Sondra (2010) *Butoh: Metamorphic Dance and Global Alchemy*, Urbana: University of Illinois Press.

Fraleigh, Sondra (ed.) (2015) *Moving Consciously: Transformations through Dance, Yoga, and Touch*, Harrogate, Combined Academic Publishers Ltd.

Fraser, Mariam and Greco, Monica (eds.) (2004) *The Body: A Reader*, London: Routledge.

Fullman, Ellen (2009) *Ellen Fullman on the Long String Instrument* [video online]. Available at: <https://www.youtube.com/watch?v=Uq9AFRMWLTU> [Accessed August 12, 2017].

Fullman, Ellen (2012) 'A Compositional Approach Derived from Material and Ephemeral Elements', *Leonardo Music Journal* 22, 3–10.

Fullman, Ellen (2012) *Street Walker* [video online]. Available at: <https://vimeo.com/channels/1017437/45207205> [Accessed August 14, 2017].

*Future Beauty: 30 Years of Japanese Fashion*, the Barbican, London (15 October 2010 - 6 February 2011).

Garelick, Rhonda K. (2007) *Electric Salome: Loïe Fuller's Performance of Modernism*, Princeton: Princeton University Press.

*Ghostcatching* (1999) Directed by Bill. T Jones [Cooper Union, New York. January].

Goffman, Erving (1963) *Behavior in Public Places: Notes on the Social Organization of Gatherings*, London: Free Press.

Goldberg, RoseLee (2000) *Laurie Anderson*, New York: Harry N. Abrams, Inc.

Goumarre, Laurent (2007) 'His t-shirt read "dance or die"'. In: *Dysfashional: Disturbance in Fashion*, Exhibition Catalogue, Luxembourg: ActarD Inc., pp. 15-23.

Graham, Beryl (2010) 'Tools, Methods, Practice, Process... and Curation'. In: Gere, Charlie and Gardiner, Hazel (eds.), *Art Practice in a Digital Culture. Digital Research in the Arts and Humanities*, London: Ashgate, pp. 165-74.

Granata, Francesca (2017) *Experimental Fashion: Performance Art, Carnival and the Grotesque Body*, London: I.B. Tauris.

*Gravity Fatigue* (2015) Directed by Hussein Chalayan [Sadler's Wells Theatre, London. 28 October].

Greco, Emiro and Scholten, Pieter, C. (2017) *Double Skin/Double Mind The Method*. Available at: <http://www.ickamsterdam.com/en/academy/education/ick/double-skin-double-mind-the-method-20> [Accessed September 10, 2017].

Green, Paul D. and Porcello, Thomas (eds.) (2005) *Wired for Sound: Engineering and Technologies in Sonic Cultures*, Middletown, CT: Wesleyan University Press.

Grosz, Elizabeth (1994) *Volatile Bodies: Toward a Corporeal Feminism*, Bloomington: Indiana University Press.

*Hand-drawn Spaces* (1998) Directed by Merce Cunningham [Riverbed at Siggraph. 20 July].

Hann, Rachel and Bech, Sidsel (eds.) (2014) 'Critical Costume', *Scene 2* (1-2), 3-8.

Hannah, Dorita and Harsløf, Olav (eds.) (2008) *Performance Design*. Copenhagen: Museum Tusculanum Press.

Hansen, Mark (2006) *Bodies in Code. Interfaces with Digital Media*, New York: Routledge.

Harris, Jane (2004) *Potential Beauty*. Available online: <http://johncurtingallery.curtin.edu.au/exhibitions/archive/2004.cfm> [Accessed August 14, 2017].

Haseman, Bradley (2007) 'Rupture and Recognition: Identifying the Performative Research Paradigm'. In: Barrett, Estelle and Bolt, Barbara (eds.) *Practice as Research: Approaches to Creative Arts Enquiry*, London: I.B. Tauris, pp. 147-57.

Hay, Deborah (2016) *Using the Sky: a dance*, London: Routledge.

Hegarty, Paul (2007) *Noise/Music: A History*, New York: Bloomsbury.

Henriques, Julian F. (2011) *Sonic Bodies: Reggae Sound Systems, Performance Techniques and Ways of Knowing*, New York: Continuum.

Hexagram (2017) *Scientific Orientations*. Available at: <http://hexagram.ca/index.php/eng/> [Accessed September 14, 2017].

Hill, Colleen (2013) 'Ballet Shoes: Function, Fashion, and Fetish'. In: Steele, Valerie (ed.) *Dance and Fashion*, New Haven: Yale University Press, pp. 143-65.

Hindson, Catherine (2013) 'Dancing on Top of the World: A Serpentine through Late Nineteenth-Century Entertainment, Fashion and Film'. In: Uhlirova, Marketa (ed.), *Birds of Paradise: Costume as Cinematic Spectacle*, Koenig Books: London, pp. 65-77.

Horosko, Marian (2002), *Martha Graham: The Evolution of Her Dance Theory and Training*, rev. ed., Gainesville: University Press of Florida.

*how long does the subject linger on the edge of the volume...* (2005) Directed by Trisha Brown [Arizona State University. 14 April].

Human Harp (2017) *HumanHarp*. Available at: <http://humanharp.org> [Accessed April 8, 2017].

*Hussein Chalayan: From Fashion and Back* (2009) Curated by Donna Loveday, The Design Museum, London (21 January - 17 May 2009).

Huxley, Michael (2015) *The Dancer's World, 1920-1945: Modern Dancers and their Practices Reconsidered*, Basingstoke: Palgrave Macmillan.

IFFTI: The 7<sup>th</sup> International Foundation of Fashion Technology Institutes Annual Conference: *The Globalization of Fashion: Future Challenges for Education and Business*, 31 October - 5 November 2005, Bunka Women's University, Tokyo, Japan.

IFFTI: The 9<sup>th</sup> International Foundation of Fashion Technology Institutes (IFFTI) Annual Conference: *Extreme Fashion*, 12-15 April 2007, Ryerson University, Toronto, Canada.

Ihde, Don (1983) *Existential Technics*, Albany: State University of New York Press.

Ihde, Don (1990) *Technology and the Life World: From Garden to Earth*, Bloomington: Indiana University Press.

Ihde, Don (1991) *Instrumental Realism: The Interface Between Philosophy of Science and Philosophy of Technology*, Bloomington: Indiana University Press.

Ihde, Don (2002) *Bodies in Technology*, Minneapolis: University of Minnesota Press.

Ihde, Don and Selinger, Evan (eds.) (2003) *Chasing Technoscience: Matrix for Materiality*, Bloomington: Indiana University Press.

Ihde, Don (2009) *Postphenomenology and Technoscience*, Albany: State University of New York Press.

Ihde, Don (2010) *Embodied Technics*, Copenhagen: Automatic Press/VIP.

Ihde, Don (2013) *How Does Technology Transform Our Perception? – A conversation with Don Ihde* [video online]. Available at: <https://vimeo.com/67744883> [Accessed February 5, 2017].

Ihde, Don (2016) *Husserl's Missing Technologies*, New York: Fordham University Press.

Iles, Anthony and Iles, Mattin (eds.) (2009) *Noise and Capitalism*, Donostia-S. Sebastián: Arteleku Audiolab.



Ince, Catherine and Nii, Rie (eds.) (2010) *Future Beauty: 30 Years of Japanese Fashion*, London: Merrell/Barbican Centre.

Ingold, Tim (2007) 'Against Soundscape'. In: Carlyle, Angus (ed.) *Autumn Leaves: Sound and the Environment in Artistic Practice*, Paris: Double Entendre, pp. 10-13.

Interaktionslabor (2013) <http://interaktionslabor.de/lab13/index.htm>.

Interface: live. electronic. music. video. dance. improvisation:  
<http://www.arts.rpi.edu/~bahnc2/interface/>.

Isobe, Katsura (2010a) Private email correspondence, 12 October.

Isobe, Katsura (2010b) *Floating Worlds*. Available at:  
[http://ukiyoperformance.blogspot.co.uk/2010\\_05\\_01\\_archive.html](http://ukiyoperformance.blogspot.co.uk/2010_05_01_archive.html) [Accessed September 30, 2016].

Isobe, Katsura (2009-2015) *About Katsura*. Available at:  
<http://katsuraisobe.net/About.html> [Accessed April 18, 2016].

Isobe, Katsura (2016) Private email correspondence, 28 May.

Itten, Johannes ([1970] 1992) *The Elements of Colour*, London: Chapman & Hall.

Jackson, George (2012) 'Judson Church: Dance'. *Dance Heritage Coalition Publications*. Available at: [http://www.danceheritage.org/treasures/judsonchurch\\_essay\\_jackson.pdf](http://www.danceheritage.org/treasures/judsonchurch_essay_jackson.pdf) [Accessed July 30, 2017].

Jalet, Damien (2015) 'Interview'. In: Morby, Alice, 'Hussein Chalayan debuts first dance production at London's Sadler's Wells', *Dezeen*, October 30. Available at:  
<https://www.dezeen.com/2015/10/30/hussein-chalayan-gravity-fatigue-first-dance-production-london-sadlers-wells/> [Accessed June 01, 2017].

Jola, Corinne, Ehrenberg, Shantel and Reynolds, Dee (2012) 'The experience of watching dance: phenomenological-neuroscience duets', *Phenomenology and the Cognitive Sciences* 11 (1), 17-37.

Jowitt, Deborah (2011) 'Introduction'. In: Bremser, Martha and Saunders, Laura (eds.) *Fifty Contemporary Choreographers*, 2<sup>nd</sup> edition, London: Routledge, pp. 1-18.

Joy, Jenn (2014) *The Choreographic*, Cambridge, MA: MIT Press.

Juniper, Andrew (2003) *Wabi Sabi: Design Principles of Wabi Sabi*, Tokyo: Tuttle Publishing.

Junko, Muto (2005) 'Enjoying Actor Prints: Imagining the Voices of Actors and Music', in Calza, Gian Carlo (ed.), *Ukiyo-e*, London: Phaidon Press, pp. 10-15.

Jupsie4 (2014) *Mary Wigman, Hexentanz* (video online). Available at:  
<https://www.youtube.com/watch?v=AtLSSuFIJ5c> [Accessed September 14, 2017].

Jürs-Munby, Karen (2006) 'Introduction'. In: Lehmann, Hans-Thies, *Postdramatic Theatre*, trans. Karen Jürs-Munby, London: Routledge.

- Kahn, Douglas (1999) *Noise, Water, Meat: A History of Sound in the Arts*, Cambridge, MA.: MIT Press.
- Kane, Brian (2014) *Sound Unseen: Acousmatic Sound in Theory and Practice*, New York: Oxford University Press.
- Katan-Schmid, Einav (2016) *Embodied Philosophy in Dance: Gaga and Ohad Naharin's Movement Research*, London: Palgrave Macmillan.
- Kelly, Caleb (2009) *Cracked Media: The Sound of Malfunction*, Cambridge, MA.: MIT Press.
- Kershaw, Baz and Nicholson, Helen (2011) *Research Methods in Theatre and Performance*, Edinburgh: Edinburgh University Press.
- Kim-Cohen, Seth (2009) *In the Blink of an Ear: Towards a Non-Cochlear Sonic Art*, London: Continuum.
- KINETICA Art Fair, London (February 08-12, 2012).
- kondition pluriel: <http://konditionpluriel.org>.
- Kozel, Susan (2007) *Closer: Performance, Technologies, Phenomenology*, Cambridge, MA.: MIT Press.
- Kozel, Susan (2012) 'Embodying the Sonic Invisible: Sketching a Corporeal Ontology of Musician Interaction'. In: Peters, Deniz, Eckel Gerhard, and Dorschel, Andreas (eds.) *Bodily Expression in Electronic Music: Perspectives on Reclaiming Performativity*, New York: Routledge, pp. 61-70.
- Kozel, Susan (2013) *Practice Based Research in the Arts*. Lecture for the Practice Based Research in the Arts Course at Stanford University. [video online]. Available at: <https://www.youtube.com/watch?v=mv7Vp3NPKw4> [Accessed June 4, 2015].
- Kracht, Christian (2008) *Ich werde hier sein im Sonnenschein und im Schatten*, Cologne: Kiepenheuer & Witsch.
- Krauss, Rosalind (1979) 'Sculpture in the Expanded Field', *October* 8, 30-44.
- Kruchenykh, Aleksei, Malevich, Kazimir and Matiushin Mikhail (2009) *A Victory Over the Sun Album, vol. 1*, compiled by Patricia Railing; trans. Evgeny Steiner, Forest Row: Artist Bookworks.
- Kruchenykh, Aleksei (1913) 'Programme Notes'. In: Kruchenykh et al., *A Victory Over the Sun Album, vol. 1*, compiled by Patricia Railing, trans. Evgeny Steiner (2009), Forest Row: Artist Bookworks, pp. 33-40.
- Laban, Rudolf (1966) *Choreutics*: Annotated and edited by Lisa Ullman, London: Macdonald and Evans.
- LaBelle, Brandon (2006) *Background Noise: Perspectives on Sound Art*, New York: Continuum.

LaBelle, Brandon (2010) *Acoustic Territories: Sound Culture and Everyday Life*, New York: Continuum.

LaMarre, Thomas (2009) *The Anime Machine: A Media Theory of Animation*, Minneapolis: University of Minneapolis Press.

Langdridge, Darren (2007) *Phenomenological Psychology: Theory, Research and Method*, Harlow: Pearson Education Ltd.

Lazarus, Heide (2006) 'Mit dem Körper sprechen: Mary Wigman und der Tanz als Kunstwerk', *Journal Ethnologie*: Available at: [http://www.journal-ethnologie.de/Deutsch/Schwerpunktthemen/Schwerpunktthemen\\_2006/Hautzeichen\\_-\\_Koerperbilder/Mit\\_dem\\_Koerper\\_sprechen/index.phtml](http://www.journal-ethnologie.de/Deutsch/Schwerpunktthemen/Schwerpunktthemen_2006/Hautzeichen_-_Koerperbilder/Mit_dem_Koerper_sprechen/index.phtml) [Accessed May 20, 2013].

L'École Internationale de Théâtre Jacques Lecoq (2017) 'Laboratory of Movement Study'. Available at: [http://www.ecole-jacqueselecoq.com/en/lem\\_en-000003.html](http://www.ecole-jacqueselecoq.com/en/lem_en-000003.html) [Accessed July 31, 2017].

Lecoq, Jacques (1987) *Le Théâtre du Geste: Mimes et Acteurs*, Paris: Dessain et Tolra.

Lee, Miri (2015) Private email correspondence, 3 March.

Lehmann, Hans-Thies ([1999] 2006) *Postdramatic Theatre*, trans. Karen Jürs-Munby, London: Routledge.

Levine, Gabriel (2016) *Animate Entities: Objects in Performance*, Festival-Conference-Exhibition, University of Toronto. 18-19 March. Available at: <http://animateentities.wixsite.com/ae2016/documentation> [Accessed June 10, 2016].

*Loops* (1971) Directed by Merce Cunningham [Museum of Modern Art, New York. 3 December].

Loschek, Ingrid (2009) *When Clothes Become Fashion: Design and Innovation Systems*, Oxford: Berg.

Lucca, Ciro (2013) *Laurie Anderson Home of the Brave (1986)* [video online]. Available at: <https://www.youtube.com/watch?v=mua8Pr6uRso> [Accessed September 20, 2017].

Lynton, Norbert (2009) *Tatlin's Tower: Monument to Revolution*, New Haven: Yale University Press.

Maar, Kirsten (2016) 'Figure a Sea – Using the Sky: Interview with Deborah Hay', *Magazin im August*, 4-7. Available at: <http://magazinimaugust.de/2016/08/06/cullberg-ballet-figure-a-sea-using-the-sky/> [Accessed February 27, 2017].

MA Costume Design for Performance, London College of Fashion: <http://www.arts.ac.uk/fashion/courses/postgraduate/ma-costume-design-for-performance/>.

Mainstone, Di (2017a) *Di Mainstone*. Available at: <http://dimainstone.com/about/> [Accessed April 8, 2017].

Mainstone, Di (2017b) *Di Mainstone*. Available at: <http://dimainstone.com/project/serendipitchord/> [Accessed April 8, 2017].

Mainstone, Di (2017c) *Human Harp*. Available at: <http://humanharp.org> [Accessed April, 8, 2017].

*Maison Martin Margiela* (2010) Curated by Kaat Debo and Bob Verhelst, Somerset House, London (3 June - 5 September 2010).

*Malevich* (2014) Curated by Achim Borchardt-Hume, Tate Modern, London (16 July - 26 October).

Manning, Erin (2009) *Relationscapes: Movement, Art, Philosophy*, Cambridge, MA.: MIT Press.

Marchetti, Luca and Quinz, Emanuele (eds.) (2007) *Dysfashional: Disturbance in Fashion*, Exhibition Catalogue, Luxembourg: ActarD Inc.

Marra, Melissa (2013) 'Movement, Style, and Something More: Martha Graham and Modern Dance'. In: Steele, Valerie (ed.) *Dance and Fashion*, New Haven: Yale University Press, pp. 227-53.

Massumi, Brian (2002) *Parables of the Virtual: Movement, Affect, Sensation*, Durham: Duke University Press.

Massumi, Brian (2015) *Politics of Affect*, Cambridge: Polity Press.

Maubrey, Benoît (2010) 'The History of Electronic Clothing', *Amber 07*, Istanbul: BIS, pp. 130-36.

Maubrey, Benoît (2017) *Benoît Maubrey: Electroacoustic Sculptures*. Available at: <https://www.benoitmaubrey.com> [Accessed August 14, 2017].

McCann, Jane and Bryson, David (eds.) (2009) *Smart Clothes and Wearable Technology*, Cambridge: Woodhead.

McGregor, Wayne (2012a) 'A choreographer's creative process in real time', *TEDGlobal*. Available at: [https://www.ted.com/talks/wayne\\_mcgregor\\_a\\_choreographer\\_s\\_creative\\_process\\_in\\_real\\_time#t-99831](https://www.ted.com/talks/wayne_mcgregor_a_choreographer_s_creative_process_in_real_time#t-99831) [Accessed April 16, 2016].

McGregor, Wayne (2012b) 'Lexicon for Dancing'. In: Tonucci, Giulia, *Lexicon for Dancing: An interview to Wayne McGregor on Carbon Life*. Available at: <http://www.digicult.it/news/lexicon-for-dancing-an-interview-to-wayne-mcgregor-on-carbon-life/> [Accessed September 6, 2015].

McGregor, Wayne (2008) *Choreographic Language Agent*. Available at: <http://waynemcgregor.com/research/choreographic-language-agent> [Accessed September 10, 2017].

McKechne, Shirley and Stevens, Catherine (2009) 'Knowledge Unspoken: Contemporary Dance and the Cycle of Practice-led Research, Basic and Applied Research, and Research-led Practice'. In: Smith, Hazel and Dean, Roger T. (eds.) *Practice-led Research, Research-led Practice in the Creative Arts*, Edinburgh: Edinburgh University Press, pp. 84-103.

McLuhan, Marshall (1964) *Understanding Media: The Extension of Man*, London: McGraw-Hill.

McLuhan, Marshall ([1967] 1996) *The Medium is the Massage: An Inventory of Effects*, with illustrations by Quentin Fiore, Berkeley: Gingko Press Inc.

McKirdy, Cameron (2012) Private email correspondence, 9 May.

Merce Cunningham Trust (2017). Available at: <https://www.mercecunningham.org> [Accessed August 20, 2017].

Merleau-Ponty, Maurice ([1962] 2005) *Phenomenology of Perception*, 2<sup>nd</sup> edition, trans. Colin Smith, Abingdon: Routledge.

Merleau-Ponty, Maurice (1968) *The Visible and the Invisible*, Evanston, IL: Northwestern University Press.

METABODY: <http://www.metabody.eu>

Metzinger, Thomas (2004) *Being No One: The Self-Model Theory of Subjectivity*, Cambridge, MA: MIT Press.

Michielon, Vanessa (2013) 'Interview', interviewed by Michèle Danjoux, 11 August.

Michielon, Vanessa (2014) Private email correspondence, 22 February.

Miller, Janice (2011) *Fashion and Music*, Oxford: Berg.

Milner, John (2007) *A Slap in the Face! Futurists in Russia*, London: Philip Watson Publishers.

Milner, John (2009a) *El Lissitzky: Design*, Woodbridge: The Antique Collectors' Club.

Milner, John (2009b) *Alexander Rodchenko: Design*, Woodbridge: The Antique Collectors' Club.

Miranda, Eduardo R. and Wanderley, Marcelo M. (2006) *New Digital Musical Instruments: Control and Interaction Beyond the Keyboard*, Middleton, WI: A-R Editions.

Molzahn, Laura (2014) 'come, been and gone at MCA Chicago', *Chicago Tribune*, October 26. Available at: <http://www.chicagotribune.com/entertainment/theater/ct-bowie-is-michael-clark-dance-review-20141026-column.html> [Accessed November 23, 2014].

Monks, Aoife (2010) *The Actor in Costume*, Basingstoke: Palgrave Macmillan.

Montgomery, Will (2012) *Machines for Living*. Available at: <http://steim.org/wp/wp-content/uploads/2012/01/STIEM-wire.pdf>, pp. 29-30 [Accessed October 25, 2014].

Moore, Timothy (2002) 'Japanese Kyōgen in the Ancient Comedy Classroom', *The Classical Journal* 98 (2), 189-98.

Morby, Alice (2015) 'Hussein Chalayan debuts first dance production at London's Sadler's Wells', *dezeen*, October 30. Available at: <https://www.dezeen.com/2015/10/30/hussein-chalayan-gravity-fatigue-first-dance-production-london-sadlers-wells/> [Accessed June 01, 2017].

Moriarty, Michael (2008) *René Descartes: Meditations on First Philosophy with Selections from the Objections and Replies*, trans. Michael Moriarty, Oxford: Oxford University Press.

Moritz, Sara (2012) *Laetitia Sonami (FR/US): Lady's Glove*. Available at: [https://www.youtube.com/watch?v=C8GqbS2w\\_Lg](https://www.youtube.com/watch?v=C8GqbS2w_Lg) [Accessed August 14, 2017].  
*Mortal Engine* by Chunky Move (2008) Directed by Gideon Obarzanek [Sydney Festival, Australia. January].

*Move: Choreographing You – Art and Dance since the 1960s* (2011) Curated by Stephanie Rosenthal, Hayward Gallery, Southbank Centre, London (13 October 2010 - 9 January 2011). Available at: <https://www.southbankcentre.co.uk/venues/hayward-gallery/past-exhibitions/move-choreographing-you> [Accessed July 27, 2017].

Munster, Anna (2006) *Materializing New Media: Embodiment in Information Aesthetics*, Hanover: Dartmouth College Press.

Murray, Louis (1980) *Inside Dance*, New York: St. Martin's Press.

Nelson, Robin (2013) *Practice as Research in the Arts: Principles, protocols, Pedagogies, Resistances*, New York: Palgrave Macmillan.

Nöe, Alva (2006) *Action in Perception*, Cambridge, MA: MIT Press.

Norman, Sally Jane (2001) 'Corps/espaces interactifs'. In: Rousier, Claire (ed), *Oskar Schlemmer: l'homme et la figure d'art*, Paris: Centre national de la danse, pp. 152-64.

Norman, Sally Jane (2015) 'Oskar Schlemmer's Programmatic Gesture Research'. In: Salazar, Nicolas and Popat, Sita (eds.) *Digital Movement: Essays in Motion Technology and Performance*, Basingstoke: Palgrave Macmillan, pp. 21-34.

Novak, Cynthia (1993) 'Ballet, Gender & Cultural Power'. In: Thomas, Helen (ed.) *Dance, Gender and Culture*, London: Macmillan Press, pp. 34-48.

Ohno, Kazuo and Ohno, Yoshito (2004) *Kazuo Ohno's World from without and within*, Middletown: Wesleyan University Press.

*One Flat Thing* (2000) Directed by William Forsythe [Bockenheimer Depot, Frankfurt, Germany. January].

Oxford Dictionaries (2017) *Affect or effect?* Available at: <http://blog.oxforddictionaries.com/2011/03/affect-versus-effect/> [Accessed August 20, 2017].

Oxford Dictionaries (2017) *Ecosystem*. Available at: <https://en.oxforddictionaries.com/definition/ecosystem> [Accessed September 14, 2017].  
 Oxford Dictionaries (2017) *Interdisciplinary*. Available at: <https://en.oxforddictionaries.com/definition/interdisciplinary> [Accessed September 14, 2017].

Parviainen, Jaana (2012) 'Seeing Sound, Hearing Movement: Multimodal Expression and Haptic Illusions in the Virtual Sonic Environment'. In: Peters, Deniz, Eckel Gerhard, and Dorschel, Andreas (eds.) *Bodily Expression in Electronic Music: Perspectives on Reclaiming Performativity*, New York: Routledge, pp. 71-81.

- Pavitt, Jane (2008) *Fear and Fashion in the Cold War*, London: V&A Publishing.
- Peters, Deniz, Eckel, Gerhard, Dorschel, Andreas (eds.) (2012) *Bodily Expression in Electronic Music: Perspectives on Reclaiming Performativity*, New York: Routledge.
- Peters, Deniz (2012) 'Introduction'. In: Peters, Deniz, Eckel, Gerhard, Dorschel, Andreas (eds.) (2012) *Bodily Expression in Electronic Music: Perspectives on Reclaiming Performativity*, New York: Routledge, pp. 1-14.
- Polanyi, Michael (1957) *The Study of Man*, Chicago: University of Chicago Press.
- Polydorou, Doros (2011) *Immersion and Interaction: Creating Virtual 3d Worlds for Stage Performances*, PhD thesis, Brunel University.
- Prague Quadrennial of Performance Design and Space/PQ: <http://www.pq.cz/en/>.
- Prickett, Stacey and Thomas, Helen (eds.) [Forthcoming]. *Routledge Companion to Dance Studies*, London: Routledge.
- Quinn, Bradley (2002) *Techno Fashion*, Oxford: Berg Publishers.
- Quinn, Bradley (2003) *The Fashion of Architecture*, Oxford: Berg Publishers.
- Quinn, Bradley (2012) *Fashion Futures*, London: Merrell.
- Quinn, Bradley (2005) 'Afterwords: Autumn/Winter 2000'. In: *Hussein Chalayan*, Exhibition Catalogue. Groningen: NAI Publishers, p. 80.
- Rainer, Cosima, Rollig, Stella, Daniels, Dieter, Ammer, Manuela (eds.) (2009) *See This Sound: Versprechungen von Bild und Ton*, Cologne: Verlag Walther König.
- Rebstock, Matthias, and Roesner, David (2012) *Composed Theatre. Aesthetics, Practices, Processes*, Bristol: Intellect.
- Ren, Helenna (2016) Private email correspondence, 11 December.
- Reus, Jonathan (2014a) *Satellite Skin - iii*. Available at: <http://instrumentinventors.org/work/satellite-skin/> [Accessed June 11, 2017].
- Reus, Jonathan (2014b) Private email correspondence, 15 October.
- Reus, Jonathan (2014c) Private email correspondence, 21 October.
- Reynolds, Dee and Reason, Matthew (eds.) (2012) *Kinesthetic Empathy in Creative and Cultural Practices*, Bristol: Intellect.
- Richards, John (n.d.) *Bed of Nails Schematic* [image online]. Available at: [http://www.dirtyelectronics.org/docs/Bed\\_of\\_Nails.pdf](http://www.dirtyelectronics.org/docs/Bed_of_Nails.pdf) [Accessed June 11, 2017].
- Rizzo, Christian (1999) *100% Polyester, objet dansant n° (à définir)*. Available at: [http://www.lassociationfragile.com/christian-rizzo/choregraphe/spectacles\\_eng/christian-rizzo-choregraphe-spectacles.php?id=1](http://www.lassociationfragile.com/christian-rizzo/choregraphe/spectacles_eng/christian-rizzo-choregraphe-spectacles.php?id=1) [Accessed August 12, 2017].
- Rizzo, Christian (2002) *ET POURQUOI PAS: "BODYMAKERS", "FALBALA", "BAZAAR", ETC... ETC... ?* Available at:

<http://www.jgperiot.net/3%20AUTRES%20PROJETS/Falbala/falbala.htm> [Accessed August 20, 2015].

*Rodchenko & Popova: Defining Constructivism* (2009) Curated by Ben Borthwick, Christina Kiaer, and Margarita Tupitsyn, Tate Modern, London (12 February - 17 May).  
Rodgers, Tara (2010) *Pink Noises: Women and Electronic Music & Sound*, Durham: Duke University Press.

Rousier, Claire (ed.) (2001) *Oskar Schlemmer: l'homme et la figure d'art*, Paris: Centre national de la danse.

Rowell, Margit and Wye, Deborah (eds.) (2012) *The Russian Avant-garde Book 1910-1934*, New York: The Museum of Modern Art.

Royal Opera House (2012) *Carbon Life*. Available at: <http://www.roh.org.uk/productions/carbon-life-by-wayne-mcgregor> [Accessed September 6, 2015].

Rubidge, Sarah (2009) 'Performing Installations: Towards an understanding of choreography and performativity in interactive installations'. In: Butterworth, Joanne and Wildschut, Liesbeth (eds.) *Contemporary Choreography: A Critical Reader*, Basingstoke: Palgrave Macmillan, pp. 362-78.

*Russian Avant-garde Theatre: War, Revolution and Design 1913-1933* (2014) Curated by Kate Bailey, Victoria and Albert Museum [V&A], London (18 October 2014-15 March 2015).

*Russian Revolutionary Posters* (2013) Curated by Matthew Gale, Tate Modern, London (1 July 2013-24 August 2014).

Russolo, Luigi ([1913] 1986) *The Art of Noises*, trans. Barclay Brown, New York: Pendragon Press.

Ryan, Susan E. (2014) *Garments of Paradise*, Cambridge, MA: MIT Press.

Sadler's Wells (2015) *Hussein Chalayan – Gravity Fatigue*. Available at: <http://www.sadlerswells.com/whats-on/2015/hussein-chalayan-gravity-fatigue/> [Accessed August 5, 2017].

Sarabianov, Andrei, D. (2017) *Mikhail Vasilyevich Matyushin: Russian Painter, Composer and Theoretician* Available at: <https://www.britannica.com/biography/Mikhail-Vasilyevich-Matyushin#ref1117855> [Accessed September 20, 2017].

Schiphorst, Thecla (2013) *Thecla Schiphorst*. Available at: <http://www.sfu.ca/~tschipo/> [Accessed September 14, 2017].

Scott, Adolphe Clarence (1999) *The Kabuki Theatre of Japan*, New York: Dover Publications, Inc.

Sebaly, Abigail (2015) *Between Performance and the Present: Robert Rauschenberg's Belt for Merce Cunningham's Aeon*, Walker Art Center. Available at: <https://walkerart.org/collections/publications/art-expanded/between-performance-and-the-present/> [accessed August 6, 2017].



*Scenario* by Merce Cunningham in collaboration with and Rei Kawakubo (1997)  
Directed by Merce Cunningham [Premiere: Brooklyn Academy of Music, New York. 14 October].

*Self-Unfinished* (1998) Directed by Xavier Le Roy [Substanz Festival, Cottbus, Germany. 6 November].  
SenseLab: <http://senselab.ca/wp2/>.

SensorWiki.org: <http://www.sensorwiki.org/doku.php/isidm/introduction>.

Seymour, Sabine (2008) *Fashionable Technology: The Intersections of Design, Fashion, Science, and Technology*, Vienna: Springer.

Sheets-Johnstone, Maxine (2009) *The Corporeal Turn: An Interdisciplinary Reader*, Exeter: Imprint Academic.

Sheets-Johnstone, Maxine (2011) *The Primacy of Movement*, Amsterdam: John Benjamins Publishing Company.

*Shirtology* (1997) Directed by Jérôme Bel [Centro Cultural de Belem, Lisbon, Portugal. 22 February].

*SHOWstudio: Fashion Revolution* (2009) Curated by Claire Catterall, Somerset House, London (17 September 17 - 23 December 2009).

SHOWstudio (2017) *The Sound of Clothes: Anechoic*. Available at: [http://showstudio.com/project/the\\_sound\\_of\\_clothes\\_anechoic](http://showstudio.com/project/the_sound_of_clothes_anechoic) [Accessed September 14, 2017].

*Skin + Bones: Parallel Practices in Fashion and Architecture* (2008) Curated by Brooke Hodge, Somerset House, London (24 April - 10 August 2008).

Smith, Hazel and Dean, Roger T. (eds.) (2009) *Practice-led Research, Research-led Practice in the Creative Arts*, Edinburgh: Edinburgh University Press.

Sonami, Laetitia (2010) 'Laetitia Sonami'. In: Rodgers, Tara (ed.) *Pink Noises: Women and Electronic Music & Sound*, Durham: Duke University Press, pp. 226-34.

Sonami, Laetitia (2017) *Laetitia Sonami*. Available at: <http://sonami.net> [Accessed August 14, 2017].

*Soundart: Sound as a Medium of Art* (2012) Exhibition Catalogue, Karlsruhe: Zentrum für Kunst und Medien (ZKM).

*Sound Art. Sound as a Medium of Art* (2012) Curated by Peter Weibel, ZKM, Karlsruhe, Germany (17 March 2012 - 6 January 2013).

Spielmann, Yvonne (2004) *Steina: Violin Power, 1978, la fondation Daniel Langlois*. Available at: <http://www.fondation-langlois.org/html/e/page.php?NumPage=485> [Accessed August 14, 2017].

Spielmann, Yvonne (nd.) *Violin Power: Steina Vasulka (Creator)*. Available at: <http://www.see-this-sound.at/print/work/107> [Accessed August 14, 2017].

Spuybroek, Lars (2004) *NOX: Machining Architecture*, London: Thames & Hudson.

Steele, Valerie (2013) 'Dance and Fashion'. In: Steele, Valerie (ed.) *Dance and Fashion*, New Haven: Yale University Press, pp. 7-103.

Steele, Valerie (ed.) (2013) *Dance & Fashion*, New Haven: Yale University Press.

STEIM (2014) *About*. Available at: <http://steim.org/about/> [Accessed October 30, 2014].

Stepanova, Varvara (1987) 'Today's Fashion is the Worker's Overall'. In: Strizenova, Tattiana (ed.) *Costume Revolution: Textiles, clothing and costume of the Soviet Union in the Twenties*, London: Trefoil Publications, pp. 173-74.

Stern, Radu (2004) *Against Fashion: Clothing as Art, 1850-1930*, Cambridge, MA: MIT Press.

Stinson, Susan W. (2004) 'My Body/Myself: Lessons from Dance Education'. In: Bresler, Liora (ed.), *Knowing Bodies, Moving Minds: Towards Embodied Teaching and Learning*, Dordrecht: Springer, pp. 153-68.

Studio Wayne McGregor (2008) *Entity*. Available at: <http://waynemcgregor.com/productions/entity> [Accessed August 12, 2016].

Studio Wayne McGregor (2013) *Atomos*. Available at: <http://waynemcgregor.com/productions/atomos/> Accessed August 17, 2017].

Studio Wayne McGregor (2017) *Choreographic Language Agent* [video online]. Available at: <http://waynemcgregor.com/research/choreographic-language-agent/> [Accessed August 20, 2017].

Stuff-Em-Up the hill backwards (2015) *Laurie Anderson United States I-IV* [video online]. Available at: <https://stuffem.wordpress.com/2007/08/16/video-archive-laurie-anderson-united-states-i-iv/> [Accessed September 20, 2017].

Sullivan, Graeme (2005) *Art Practice as Research: Inquiry in the Visual Arts*, London: Sage Publications.

*Suna no Onna* (2007-08). Available at: <http://people.brunel.ac.uk/dap/suna.html> [Accessed September 20, 2017].

*Suna no Onna* by DAP-Lab (2008) Directed by Johannes Birringer and Michèle Danjoux [Laban Studio Theatre, London. 8 December].

Taiwo, Olu (2009) 'The Physical Journal: The Living Body that Writes and Rewrites Itself'. In: Broadhurst, Susan and Machon, Josephine (eds.) *Sensualities/Textualities and Technologies: Writings of the Body in 21st Century Performance*, Basingstoke: Palgrave Macmillan, pp. 103-16.

Tanaka, Atau (2009) 'Sensor-Based Musical Instruments and Interactive Music'. In: Dean, Roger T (ed.) *Oxford Handbook of Computer Music*, Oxford: Oxford Univ. Press, pp. 233-57.

Tao, Xiaoming (2005) *Wearable Electronics and Photonics*, Cambridge: Woodhead Publishers.

Tércio, Daniel (ed.) (2009) *Tedance: Perspectives on Technologically Expanded Dance/Perspectival sobre dança em expansão tecnológica*, Lisbon: Faculdade de Motricidade Humana.

Temirlan, Tima (2012) *Hussein Chalayan - Autumn / Winter 2000 Final*. Available at: <https://www.youtube.com/watch?v=UxOuOMcNvSU><https://www.youtube.com/watch?v=UxOuOMcNvSU> [Accessed October 25, 2014].

*The Fashion World of Jean Paul Gaultier From the Sidewalk to the Catwalk* (2014) Curated by Nathalie Bondil, the Barbican, London (9 April - 25 August 2014).

*The House of Viktor & Rolf*, the Barbican, London (June 18 - 21 September 2008).

*The Loss of Small Detail* by William Forsythe in collaboration with Issey Miyake and Tom Willems (1991) Directed by William Forsythe [Frankfurt, Germany. 21 December].

*The Next Black: A film about the Future of Clothing* (2014) Directed by David Dworsky and Victor Köhler, House of Radon.

The Whisper[s] *Research Group*. Available at: <http://whisper.iat.sfu.ca> [Accessed April 10, 2010].

Thomas, Helen (1995) *Dance, Modernity and Culture: Explorations in the sociology of dance*, London: Routledge.

Tilbury, Nancy (2011) *Studio Nancy Tilbury* [video online]. Available at: <https://fashionphreaking.wordpress.com/studio-nancy-tilbury/> [Accessed July 3, 2016].

Tilbury, Nancy (2014) 'Interview'. In: Wiederud, Hanna, *The Next Black – A film about the future of Clothing* [video online]. Available at: <https://www.youtube.com/watch?v=XCsGLWrfE4Y> [Accessed July 4, 2016].

Trimingham, Melissa (2011) *The Theatre of the Bauhaus: The Modern and Postmodern Stage of Oskar Schlemmer*, London: Routledge.

Trimingham, Melissa and Barbieri, Donatella (2016) 'War, revolution and design: exploring pedagogy, practice-based research and costume for performance through the Russian avant-garde theatre', *Studies in Theatre and Performance* 36 (3), 269-280.

*Tropicália - A Revolution in Brazilian Culture 1967–72* (2006) Curated by Carlos Basualdo, The Barbican London (3 February - 22 May 2006).

UbuWeb *The Art of Noise: Luigi Russolo* (1913). Available at: <http://www.ubu.com/papers/russolo.html> [Accessed June 11, 2017].

Uhlirova, Marketa (ed.) (2013) *Birds of Paradise: Costume as Cinematic Spectacle*, London: Koenig Books.

*UKIYO [Moveable Worlds]* by DAP-Lab (2010) Directed by Johannes Birringer and Michèle Danjoux [Kibla Media Arts Centre, Kibla, Slovenia. 18 June].

*UKIYO [Moveable Worlds]* by DAP-Lab (2010) Directed by Johannes Birringer and Michèle Danjoux [Lilian Baylis Studio, Sadler's Wells, London. 26 November].

*UKIYO [Moveable Worlds]* (2010). Directed by Johannes Birringer and Michèle Danjoux, Kibla Media Arts Centre and Sadler's Wells [video online]. Available at: [http://people.brunel.ac.uk/dap/Ukiyo\\_Sadlerswells\\_movie.html](http://people.brunel.ac.uk/dap/Ukiyo_Sadlerswells_movie.html) [Accessed July 11, 2015].

Universes in Universe (2017) *Stanley Ruiz: Barong Analog, 2005*. Available at: <https://universes.art/magazine/articles/2009/futuramanila/images/17-stanley-ruiz/> [Accessed September 21, 2017].

V2 Institute for the Unstable Media: <http://v2.nl>.

*Victory over the Sun* (1913) Directed by Aleksei Kruchenykh et al. [Luna Park, St. Petersburg].

Vogel, Peter (2009) *Duo*, interactive installation. Available at: <http://www.everydaylistening.com/articles/2009/5/28/beautiful-circuits-by-peter-vogel.html> [Accessed August 30, 2012].

Wanderley, Marcelo, M. (2001) *Gesture Control of Music*. Available at: <http://recherche.ircam.fr/equipes/analyse-synthese/wanderle/pub/kassel/> [Accessed September 15, 2017].

Watanabe, Emi (2013) Private email correspondence, October 15.

Watching Dance: *Kinesthetic Empathy*. Available at: [http://www.watchingdance.org/about\\_us/index.php](http://www.watchingdance.org/about_us/index.php) [Accessed December 12, 2016].

Wearable Futures: Hybrid Culture in the Design and Development of Soft Technology Conference (2005). Available at: <http://www.scansite.org/scan.php?pid=343> [Accessed January 10, 2017].

Wearable Technology Conference: <http://www.wearable-technologies.com/>.

Wetherell, Margaret (2012) *Affect and Emotion: A New Social Science Understanding*, London: Sage Publications Ltd.

Wetherell, Margaret (2015) 'Trends in the Turn to Affect: A Social Psychological Critique', *Body & Society* 21 (2), 139-66.

Whisper Costume (2007). Available at: <http://whispercostume.blogspot.co.uk> [Accessed June 11, 2017].

Wiederud, Hanna (2014) *The Next Black – A film about the future of Clothing* [video online]. Available at: <https://www.youtube.com/watch?v=XCsGLWrfE4Y> [Accessed July 24, 2016].

Wiens, Birgit (2010) 'Modular settings and 'Creative Light': The legacy of Adolphe Appia in the digital age', *International Journal of Performance Arts and Digital Media* 6 (1), 25-39.

Wilcox, Claire (ed.) (2003) *Radical Fashion*, London: V&A Publications.

Wigman, Mary (1925) 'Komposition'. Reprint in: *Tanzdrama* 9 (4), [np], 1989.

Wijnans, Stan (2009) *A Choreography of a Spatial Sonic Disembodiment*. Available at: [www.dmu.ac.uk/documents/technology-documents/research/mtirc/sssp0901wijnans.pdf](http://www.dmu.ac.uk/documents/technology-documents/research/mtirc/sssp0901wijnans.pdf) [Accessed September 14, 2017].

Wilde, Danielle (2003) *Ange*. Available at: <http://www.daniellewilde.com/embodying-interaction/ange/> [Accessed July 26, 2017].

Wilde, Danielle and Birkmayer, Sophie (2004) 'Dress and Ange: Coercing the address of highly personal body-centric issues', *Journal of Personal and Ubiquitous Computing* 8 (3-4), 264-273.

Wilde, Danielle (2008) 'hipDisk: using sound to encourage physical extension, exploring humour in interface design', *International Journal of Performance Arts and Digital Media* 4 (1), 7-26.

Wilde, Danielle (2011) *hipDisk – augmenting the moving body with sound*. Available at: <http://www.daniellewilde.com/swing-that-thing/hipdisk/> [Accessed July 26, 2017].

Wilkins, Caroline (2011) *The Instrument in Space: The Embodiment of Music in the Machine Age*, PhD thesis, Brunel University.

Wilkins, Caroline (2013) Private email correspondence, 25 April.

Wilson, Elizabeth (1985) *Adorned in Dreams: Fashion and Modernity*, London: Virago Press Ltd.

Wilson-Bokowiec, Julie and Bokowiec, Mark (2006) 'Kinaesonics: The intertwining relationship of body and sound', *Contemporary Music Review* 25 (1-2), 47-57.

Wilson-Bokowiec, Julie and Bokowiec, Mark (2008) 'Sense & Sensation: the Act of Mediation and its Effects', *Revue Intermédialités* 12 (2008), 129-42. Available at: <https://www.erudit.org/en/journals/im/2008-n12-im3626/039235ar/abstract/> [Accessed March 17, 2014].

Wilson-Bokowiec, Julie and Bokowiec, Mark (2017) *Bodycoder*. Available at: <http://www.bodycoder.com/> [Accessed August 14, 2017].

World Stage Design (2013) *Costume in Action*. Available at: <http://www.wsd2013.com/scenofest/costume-in-action/> [Accessed August 20, 2017].

XS Labs: <http://xslabs.net>.

Yin, Robert (2009) *Case Study Research: Design and Methods*, London: Sage Ltd.

Z. Pamela (2010) 'Pamela Z'. In Rodgers, Tara (ed.) *Pink Noises: Women and Electronic Music & Sound*, Durham: Duke University Press, pp. 216-25.

Z. Pamela (2017) *Pamela Z*. Available at: <http://www.pamelaz.com> [Accessed August 14, 2017]. Zielinski, Siegfried (2006) *Deep Time of the Media- Toward an Archaeology of Hearing and Seeing by Technical Means*, Cambridge, MA: MIT Press.

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Figures 69-70. Helenna Ren releases her arms from inside her sarcophagus, the Kinect system recognises her and the virtual sun rises on screen. She then begins her battle through interactive gestures to capture and kill, *for the time being [Victory over the Sun]*, Lilian Baylis Studio, Sadler's Wells, London, 2014. Video stills © Johannes Birringer.

Figure 71. Helenna Ren moves her arms in interactive gestures to capture and kill the sun during this scene, *for the time being [Victory over the Sun]*, Lilian Baylis Studio, Sadler's Wells, London, 2014. Video still © Johannes Birringer.

Figure 72. Helenna Ren completes her role as *solntselov* (sun-trapper) and eclipses the sun

– the sky begins to turn black in *for the time being [Victory over the Sun]*, Lilian Baylis Studio, Sadler’s Wells, London, 2014. Photo © Antonio Pagano.

Figure 73. ‘Bed of Nails’ Schematic © John Richards.

Figure 74. Close-up of Angeliki Margeti in Futurian ChestPlate playing her oscillating electro-acoustic instrument – completing the electronic circuit through touch, 2014. Photo © Hans Staartjes.

Figure 75. Member of the Chorus, *Victory over the Sun*, Kazimir Malevich, 1913. Photo © R. Bartlett, R. and S. Dadswell, *Victory over the Sun: The World’s First Futurist Opera*.

Figures 76-77. Dancers Vanessa Michielon in RedMicro Dress and Angeliki Margeti in Futurian ChestPlate (with interactive circuitry, incorporating proximity and light sensors) performing a duet in *for the time being [Victory over the Sun]*, Lilian Baylis Studio, Sadler’s Wells, London, 2014. Video stills © DAP-Lab.

Figure 78. Futurian ChestPlate: A Futurist noise wearable, worn by Angeliki Margeti with Vanessa Michielon in RedMicro Dress in foreground, 2014. Backstage photo © John Richards.

Figure 79: NailFeathers Dress worn by Elisabeth Sutherland in rehearsal, *metakimospheres no.3*, Artaud Performance Centre, London, 2016. Video still © Michèle Danjoux.

## Appendix 2

### *UKIYO: [Moveable Worlds] (2009-2011) - Questions to Dancers*

Dear Performer,

#### **Re: *UKIYO: [Moveable Worlds] (2009-2011)***

Please can you tell me about your performance in *UKIYO* in relation to the costume and body-worn technologies you engaged with. You need not limit your thoughts to the final production experience but rather also address the rehearsal and development processes with the interactive and wearable design.

Through your answers to the two sets of questions below, I hope to gain a better understanding of how the wearable designs impacted on the emergence of your performance for this performance installation.

#### **The Questions:**

##### **A) With a focus on your particular kinaesonic experience in the making and performing of *UKIYO*, please answer the following 4 questions:**

- 1) Did your movement style alter in any way as a result of wearing the wearable? If so, please tell me in what way.
- 2) How did the 'felt' sensations of wearing the costume/wearable impact on the emergence of your movement/movement character?

N.B. If you do not consider that it did then please communicate this as it is also important for me to know.

- 3) What type of character did the sounding wearable encourage you to become through your movement interactions?
- 4) How did your movement interactions with the costume contribute to the emergence of the overall choreography in your opinion?

+++++

**B) Now extending your focus to incorporate the environment and your relationship to the audience, please answer the next 3 questions:**

- 1) How did sensing your ability to generate and or transport sound in space effect/affect your sense of being in the space and once again your movements?
- 2) How do you consider the choreosonic wearable enhanced your ability to interface with the environment and visitors to the performance/installation?

N.B. If you did not notice or pay attention to the sounding aspects then please communicate this as again it is important for me to know.

- 3) How did the wearable/wearable features enable or encourage you to interact with the audience in this particular performance/installation?

+++++

Whilst responding to the questions above please consider aspects such as:

- The materiality of the costume, its weight, texture, form, fit etc., in relation to your moving body.
- The integrated technologies and what they required of you to engage and activate change in the environment.
- The interactions, gestures and movements the costume/wearable initiated for the generation/ activation/manipulation and/or transportation of sound in space.

Finally, please feel free to also comment on the significance if any of the design aesthetics to the way movement and character emerged for you.

Thank you  
Michèle

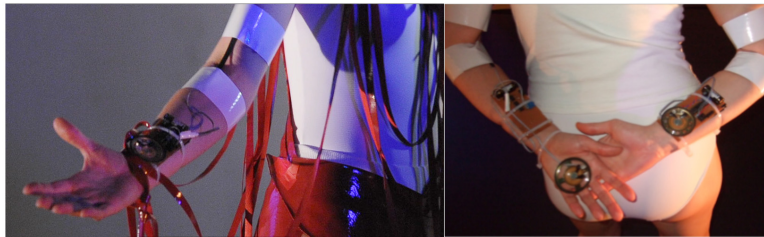
## Appendix 3

### *Bourdon (2011)*

#### Case Study 1: Bourdon / An Experiment in Gestural Performance with Wearable Sound



Image series of Sosana Marcelino with small wearable circuits on wrists incorporating motion sensors and integrated speakers, Interaktionslabor, 2011



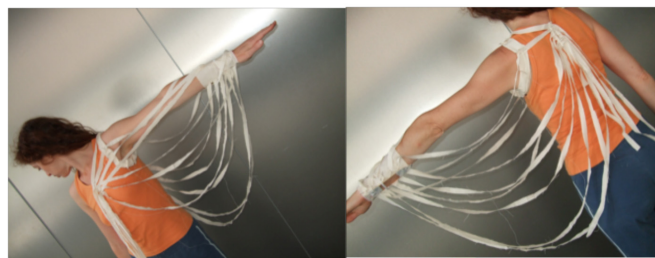
Close up of wearable circuit boards (with bend sensor at the elbow). Circuits built by musician John Richards, Interaktionslabor, 2011

The study aims to explore how physical movement and interaction can open up the performance space to the performer as she perceives sound in direct relation to her gesture. It seeks to understand more fully the sensory stimulation experienced by the dancer, Marcelino as she begins to generate choreosonic performance guided by her understanding and embodiment of the body-worn technologies. The design of the small circuits incorporating a series of electronics enables sounds to be activated / de-activated through gesture and movement of the wearer. Small tilt switches and orientation sensors turn the tiny devices on and off dependent on the movement and positioning of the performer's arms. Bend sensors enable a certain modulation of the generated sound. Bourdon involved a collaborative and interdisciplinary approach to the design of sounding wearables for performance between myself and musician John Richards. The dancer Sosana Marcelino tested / performed the design in motion, and provided feedback on her experiences or wearing sound in performance. All work was conducted during a two week residency at Interaktionslabor, Germany in August 2011.

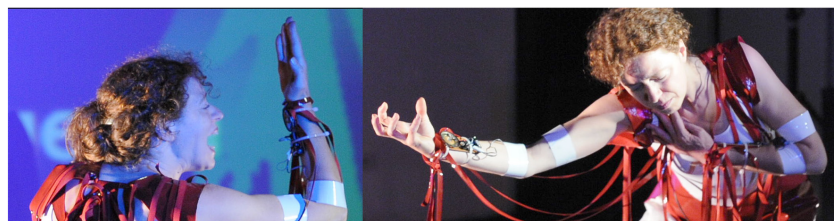
Case Study 1: Bourdon / An Experiment in Gestural Performance with Wearable Sound



Marcelino testing amplification and digital processing of small analogue sounds (emitted from the small wearable circuit boards) through interaction with microphone and Ableton Live processing software, Interaktionslabor, 2011



Design Development: Dynamic development of garment shape exploring the visual quality of lines in space that can be activated through movement and gesture of the dancer in choreosonic performance, Interaktionslabor, 2011



Marcelino in performance with the wearables (costume [red leather] and circuit boards), interaktionslabor, 2011

## Appendix 4

### *For the time being: [Victory over the Sun] (2012-2014) – Duet Study*

#### Case Study 2: RedMicro Dress, a Duet with Dynamic Microphone

The case study involves the construction of two costumes; RedMicro Dress (red neoprene and black leatherette) with integrated wearable wireless microphone, and a second costume (blue neoprene and black and cream leatherette) with custom built wearable circuit chest plate incorporating proximity sensors and other electronics (designed by John Richards). The primary idea is to utilise concepts of transmitters and receivers in the design of wearables and to apply these to dynamic moving bodies in performance. I wish to test here whether through the design of wearables that invite interaction and generate sound / sound variation through movement, proximity, distance and manipulation, whether the costumed-performers' bodies become transceivers with the potential to alter sound textures in the performance space. These explorations are for two movers, thus extending my earlier study of choreosonic wearables and performance beyond the single body. So saying this, the study maintains my concern with understanding better how each individual performer is affected by and relates to and embodies her costume, and how it contributes relationally to the movements she makes independently and in conjunction with the other.



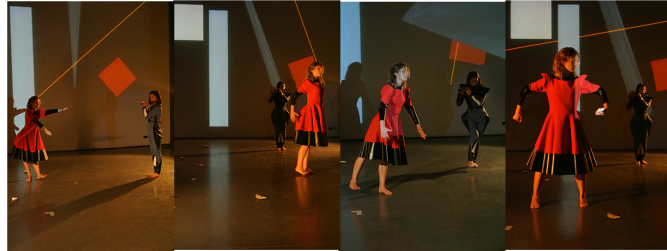
Preliminary studies: Duet with two dancers, Aggeliki Margeti and Helenna Ren exploring voice interaction with small wireless microphone worn on Margeti's left shoulder for pick up and amplification of Ren's voice and breath when the two bodies are in close proximity, DAP Lab workshop 2012



Initial testing of RedMicro Dress in interactive performance. Margeti explores the tactility and dynamics of the dress in relation to Ren's voice, breath and other small sounds (from portable wired speaker) amplified through proximity to the body-worn technology integrated into her dress. Watermans, London, May 2012



Second Phase of testing with new costume and new performers, Interaktionslabor, Germany, August 2013



Movement study and design prototyping advanced through a second phase of testing on dancer Vanessa Michielion with Emi Watanabe on flute, Interaktionslabor, Germany, August 2013



Integrated microphone



Michielion and Watanabe in close proximity, sound processing in Ableton Live by Elliott O'Brart, Interaktionslabor, 2013



Michielion exploring the dynamics of movement motivated by the concept and experiential wearing of the dress, Projected kinetic screen image by Cameron McKurdy, Interaktionslabor, 2013



## **Appendix 5**

### ***For the time being: [Victory over the Sun] (2012-2014) – Vanessa Michielon Study***

#### **Case Study**

##### **Sounding movement with wearables and the sensation of wearing with Vanessa Michielon February – March 2014**

#### **Summary:**

This study forms part of my larger project in the field of costumes/wearables for performance. It asks a dancer, Vanessa Michielon, trained in movement improvisation and performance-making with experiences in interactive dance and an academic background in multimedia, to explore the potential of technology-augmented costumes for the dancing body and to investigate some issues regarding the relationship between costume design, movement quality and choreography within interactive environments.

#### **Context:**

The larger research area is that of performance with wearable technologies, which lies at the intersection between several fields, such as choreography, costume design, sonic arts and interactive performance. It explores the notion that interactive technologies can be applied to costumes and wearable design for sensory augmentation and transformation of the body in real-time interactive audiovisual performance. Michielon states that for her when performing with interactive technologies dance improvisation plays a vital role both in the exploratory/rehearsal phase and in the final staging of the work. It is the improvisational aspects of working with wearables to devise movements for choreography that is important to this study as opposed to any rigidly choreographed and rehearsed repetitions of movements that might result from working with the wearables.

## **Objectives:**

The practice-based research will focus on real-time interaction between the dancer and different wearables from my collection of phase 2 experiments and will aim at the dancer:

- Verbalising bodily sensations emerging from the act of wearing sounding costumes;
- Understanding how physical movement style and techniques can be somehow influenced by wearing technologically augmented costumes that can offer restrictions or enable particular types of movement to emerge;
- Inventing and devising movements that can further be organised in a choreography inside a production.

## **Methodology:**

The experimentation will commence in early February 2014 and will consist of a series of improvisation and testing ‘wearing’ workshops, maximum four incorporating observation, dialogue between myself and Michielon and recording through notes, stills and video. The dancer will verbalise the sensations felt when wearing different costumes and in different contexts, from stillness to walking and then executing different kinds of movements using various improvisation techniques. A series of questions focusing on the sense impression of the dancer will be posed to assist with this process of verbalisation:

For example:

- **What are your sensory impressions of the garment/wearable?**
- **How does it impact on your bodily sensation and movements, your mode of being?**
- **Tell me a little of your emotional and physical response to the wearable/wearable instrument.**

- **What kinds of knowledge do you feel are being generated by your ‘sense impression’ (touch, vision, hearing)?**
- **In your impression, can the sounding of this type of wearable initiate a form of auditory dialogue in performance?**
- **How do you feel the sound? Is there a tactile perception of the sound?**
- **Do you hear the sound?**
- **How do you relate to this sound you are generating in motion?**

For the dancer, movement possibilities will be experienced and developed through the sensing, feeling and moving sounding body, with specific focus on the visual aesthetic dimension of the costumes and their particular presence and tactility. The kinaesthetic sensations arising from perception can then be explored for their potentials to be developed choreographically.

Specific focus will be placed on the experimentation with two prototypes:

1. **RedMicro Dress** - prototype integrating wearable microphone system, and will extend on from initial experiments into a duet conducted with Michielon whilst on residency at Interaktionslabor, Germany, August 2013. Michielon will interact with another performer on stage and a choreographic score will be developed. In this composition elements will be taken into account such as sound and its transmission through the wearable interactive system, proximity and distance between performers, relations with the sonic dimension, aesthetic reference to the futurist iconography and sensations provided by the angular cut constructivist inspired neoprene and leatherette costume.
2. **TatlinTower (head)dress** - a kinetic electroacoustic sound generating wearable instrument which consists of two connecting parts, a metal double helix construction for the head inspired by Tatlin's vision for his unrealised radio tower, and a black box amplifier / speaker. It integrates a spring, motor / vibrator, sensor (bend), piezo or contact mic into its design and poses questions of how to: generate sound through wearing and movement, amplify the small micro sounds, the

wearable sound, and work with the aesthetics of sound and of the technologies. This is achieved through head rotation and tilt sensors, hand gesture and bend sensors.

### **Questions:**

During the exploration, some research questions will be addressed by Michielon and Danjoux:

- How the shape, the weight and the material of the costume can suggest particular movement qualities and impact on a performance? How do they trigger certain kinds of movement ideas?
- What happens when technologies are worn on the body that have the potential to sound/create sounding? To what extent garment design and the aesthetics of costume can influence the movement expression of the dancer, also enabling her to generate and control multimedia objects on stage?
- How can we select movements that can be both relevant for the interactive environment and aesthetically convincing when arranged into a choreography?

### **TatlinTower (head)dress study, Monday 10<sup>th</sup> February 2014**

For Michielon, the black box hanging around the neck and housing speaker, amplifier and battery pack created movement from the stomach, the centre of her body, this is where the sound is emitted from, and she imagines the box as an organ. She notes that there is a detachment between the head wearing the TatlinTower (head)dress, with vibrating spring and the hands engaging with the sensor altering the speed of rotation of the spring and the box that amplifies the sound of the vibrating spring. This, acknowledges Michielon, enabled her to explore opposition with this wearable instrument. She considered how a signal might pass through her body via the longest route from head to stomach. She began to examine the weight of her skull noting that the vibrations on her face and head were not unpleasant but clearly palpable and created the sensation of her head growing bigger with each small movement.

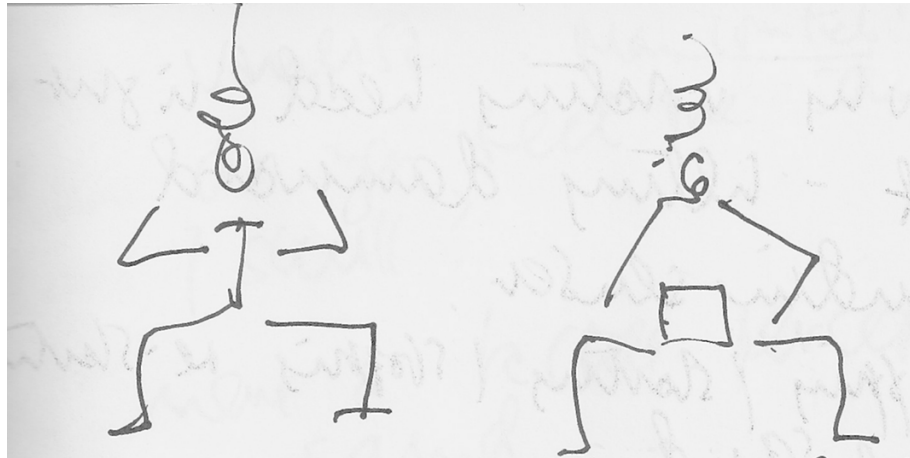


An electroacoustic wearable instrument: Vanessa Michielon exploring the sounding motion of the TatlinTower (head)dress and black box speaker / amplifier, manipulating sensor and examining the passage of sound through her body, Brunel University, 10 February 2014.

### **Observation of Movement: movement study with wearable instrument**

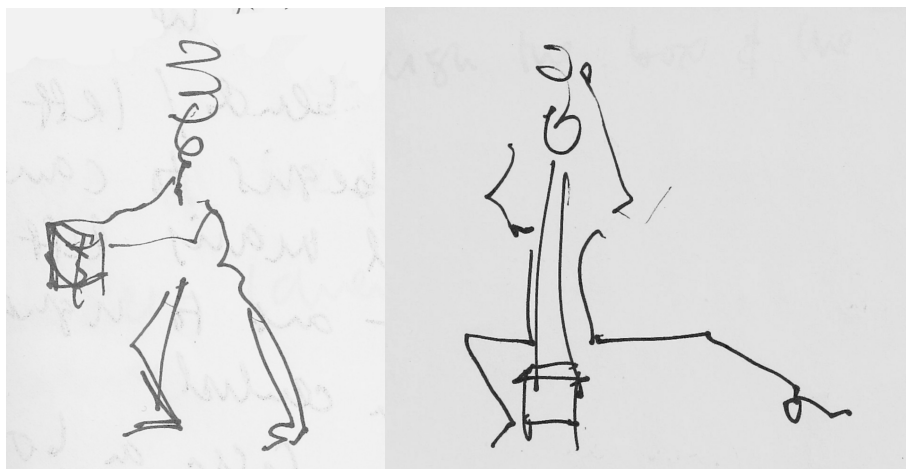
Standing upright begins slowly rotating head, right to left – tilting downwards – bending sensor that activated the spring for mechanical sound generation– stopping, starting, stopping then re-starting the sound. Tapping the metal of the TatlinTower (head)dress with her fingers releasing more sounds. Exploring the head, manipulating the sensor, beginning to move the black box that lies against her stomach suspended – left to right – head following in the same direction. Right leg bends, left leg bends – begins slowly and skillfully to come to knees – still moving left to right and back... Stands again and bends low down body kept central, weight centrally held – focus shifts again to box holding it away from the body.

This is a slow, deliberate, skillful performance from a strong, able and well-trained, disciplined body. Turning the body, the box following, twisting the body and then the head in opposite direction to the box. Weight displaced.



Slow, deliberate and skillful performance – manipulating sensor and bending low down with black box speaker/amplifier.

Finding the signal through the head. Fluidly - transitioning from one position to another, shifting the gaze – concentrating inwardly. Demonstrating an awareness and growing understanding of the wearable architecture, hearing the sound, guided by the sound a sound she calls her own sound that can be looped in its vibration. Movement shifts to rotation of left hip, knee, ankle, micro movements that subtly lead to rotation of entire leg, the rest of the body held static.



Displacement of weight: exploring the box, turning the head in opposition and fluidity – transitioning from one position to another and vibrating the tower with her hands.

## Appendix 6

### Published Papers

Birringer, Johannes and Danjoux, Michèle (2013) 'The Sound of Movement Wearables,' *Leonardo* 46 (3), 232-40.

Danjoux, Michèle (2014a) 'Interactive Technologies, Costume Design and Choreography'. In: Behringer, Klaus and Birringer, Johannes (eds.), *Manifest der Interaktionskunst*, Saarbrücken: PoCul Verlag, pp. 37 - 48.

Danjoux, Michèle (2014b) 'Choreography and Sounding Wearables', Special Issue on 'Critical Costume', *Scene* 2 (1-2), 197-220.

# The Sound of Movement Wearables: Performing *UKIYO*

Johannes Birringer  
and Michèle Danjoux

Choreographic principles of composition are largely directed at the creation of movement and the temporal organization of moving bodies in space. Some choreographers (e.g. Sidi Larbi Cherkaoui) think of this process as “temporary drawings” [1]; others (e.g. William Forsythe) work with complexity theories in mind and develop spatial methodologies for bodily extensions into environments that negotiate the intervals between presence (states of being) and transmutable movement in multiple ways. In tanztheater, the dancers’ presence resonates with darker undertones—emotional turmoils acted out through obsessively repeated gestures and acute physical/psychic self-revelation (see the work of Pina Bausch) [2]. In comparison, Japanese butoh dance contains its metaphysics in movement that slowly, sometimes imperceptibly, lives and breathes an interior world, the body metamorphosing between spirit, flesh and matter, animal and human forms, ineffable shapes.

Choreography always writes the presence of bodies in the theater in particular ways, but in contemporary digital or mixed-reality performance, such writing is now considered to be taking place in processual *biogrammatic* events or assemblages articulated through performative interfaces or “transductions,” as Sher Doruff calls them [3]. The performing bodies perform with or through media, with accessories and within compositional matrices—programmed environments—that can affect multiple sensory perceptions. What we propose in this essay are questions that primarily concern *sound wearability* and transformability of sound and sounding bodies in choreography, shifting attention to the design processes of creating particularized audiophonic, am-

plificatory and kinaesthetic costumes to be worn by dancers, actors and musicians. Design processes take over core dramaturgical propositions, but as movement and sound propositions they also constitute new aesthetic challenges for perceptual experiences in interactive and immersive installations.

We ask, firstly, how the functions and aesthetics of body-worn technologies enhance the bodies’ engagement with the environment as transmitters, receivers and enablers of sensory information; and, secondly, how one can develop new design processes in the context of different cultural dance vocabularies through 20th- and 21st-century technology and its impact on aural perception—and thus how wearability can enhance listeners’ *performance of the audible* or performativity of sound.

## THE WEARABILITY OF SOUND: AUDIBLE INTIMACIES

Intimate wearables (garments or accessories) challenge performers and audiences alike when the focus of a work’s aesthetic design is directed at creating particular sound characters that subtly redefine the idea of the “instrument” as well as dance’s temporal drawings—especially the latter’s gestural, narrative and erotic characteristics. The “instrument” here is both an object (a musical device created for the purpose of making musical sounds) and a body. The performers engage their instrument and invite the audience to observe, listen to and experience the sonorous body. The gestures play, in the sense of the Japanese *Mā*, with the intervals of time-space, drawing attention to that which is not “spoken,” to that which is intimate, fleeting and impermanent.

When devising the wearable-as-audible in performance, attention is shifted to the costume as a medium, to wearing as a performance technique that draws the digital back “across” into the visceral, into a collective behavioral environment where we listen and follow the smallest movement, the exhalation, the whisper of rustling fabric, the pleated sigh, the whirring of a tiny speaker worn on a wrist. In our work, dance fashions sound, but the asymmetries of our design also create an affect of surreal sensations (vision contrasting with hearing, touch), intimations of the grotesque in wounded, deconstructed garments or prosthetic lumps [4].

## ABSTRACT

Although interest in wearable/mobile technologies in today’s world of social networks, fashion and lifestyle industries is on the rise, the performing arts rarely integrate body-worn technologies into their dramaturgies. After some pioneering efforts in music and audio art, dance and theater practices have slowly begun to benefit from performance design investigating “sounding” garments that transduce the sensuality of movement gestures through the extension of wearable instrument-costumes. Describing their choreographic installation *UKIYO* (2009–) as an example of sound-motion-design research, the authors highlight integrated methods for creating particularized audiophonic, amplification and kinaesthetic garments to be worn by dancers, actors and musicians in interactive/responsive environments.

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See <www.mitpressjournals.org/toc/leon/46/3> for supplemental files associated with this issue.

Article Frontispiece. *UKIYO*, KIBLA Media Arts Center, 2010. Anne Laure Misme as WorkerWoman rotating wireless speaker, wears dysfunctional speaker bra, mini metal cage crinoline with tiny speakers, ostrich leather armlettes, rag wristbands, leggings, transmitter and contact mike. (© DAP-Lab)





Fig. 1. Katsura Isobe dancing the 3D creation scene in *UKIYO*, Sadler's Wells Theatre, London, 2010. (© DAP-Lab)

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. Experiencing distinct sounds requires conceptual leaps—a musical instrument becoming a crown, a hammer dropping to the floor and sucking up small magnets, an air pump inflating a screen that hovers above the crowd, a vinyl record becoming a camera eye. In previous work, the DAP-Lab ensemble paid much attention to the possibilities of linking movement interactively to screen projections of graphic images and experimenting with augmented (visual) environments [5]. Currently we think of screens as part of a sonic environment, membranes that echo the glyphic aspects of ensounded bodies. In our mixed-reality installations, we combine fashion design with sound design; inspired by designers Miyake, Yamamoto and Kawakubo and by Kabuki theater, we examine the multifaceted, dynamic and relational aspects of garments/accessories, technologies and sounding bodies [6]. The choreographic installation *UKIYO [Moveable Worlds]*, exhibited by our ensemble in 2009–2010, serves as an example of such sound-motion design research.

#### DESIGNING WEARABLES THROUGH CHOREOGRAPHY

*UKIYO*, based on the Japanese *ukiyo-e* tradition of drawings depicting the transient beauty of life, was created collaboratively with artists from Tokyo. We developed a mixed vocabulary based on improvisational techniques, expressive

articulations of European tanztheater, Nigerian percussive rhythms, and the slowed-down attenuation of time in *butoh*. Physical preparations for working with sensor-equipped garments also included the “Artaud Method,” explored in workshops with Hironobu Oikawa, whose *butoh* training encompasses the

Fig. 2. Katsura Isobe as RedMutant with partial corset, performing in *UKIYO*, KIBLA Media Arts Center, Maribor, Slovenia, 2010. (© DAP-Lab)



Chinese natural philosophy of the five elements (wood, fire, earth, metal, water) and their motions. The Qigong system we applied uses a mixture of training methods, combining dynamic, static, meditative and interactional patterns. *UKIYO*'s attention to sound generation arose from this cross-cultural process, with a philosophical, not merely technological, interest in developing a practice capable of integrating movement composition (physical movement and image animations) with methods for creating particularized audiophonic, amplificatory and sensorized garments. Our aesthetics of interactional design techniques implies that (1) the structure of the garment cannot be developed separately from the interaction potential and (2) the responsive systems developed for the choreographic installation allow performers to create "characters," generating sounds in real time that invite audiences into a private acoustic arena.

### SOUND CHARACTERS IN A KINAESONIC ENVIRONMENT

In rehearsing the different characters in *UKIYO*, all interactive patches were developed in parallel with the performers' skills and responses to garment design, in order to reach a good level of technical and expressive capability. Methodologically, our approach to sound generation proceeded from moving with the raw materials/partial states of the emergent costumes to feel/hear their (potential) characteristics and then fine-tuning the wearables to allow a combination of gesture/motion controllers and microphonic sensing/actuation. We used indirect mapping to process some but not all of the data in the combined PD, Max/MSP and Isadora patch environment to affect the mix of live and recorded sound. In the "creation" scene in Act II (Fig. 1), a dancer also controlled the projected 3D digital animation, her gestures "drawing" a landscape born from a desert but changing into rich vegetation with bursts of color. Through our choreographic, iterative and distributed approach to design, a more enhanced and hypersensual form of wearing extends into space and into 4D and 5D dimensions, including the projected virtual realms.

*UKIYO* expands such kinaesonics further by focusing on the membranes of wearable microphones and mini-speakers, the small fluttering of electrical energy pulses attached to the garments or the skin, amplifying sound originating from the performers or mediated through them. We also work with the sce-



Fig. 3. Interfacial design development: RedMutant prototype for Katsura Isobe's character in *UKIYO* [Moveable Worlds], 2009. (Photo © DAP-Lab)

nography of five criss-crossing *hanamichi* (runways), which open the space up for audience movement across them. Visitors are invited inside the space of action; they choose to be as close to the dancers and musicians as they desire. In the complex feedback environment we built (which includes networked linkup to a Second Life installation with avatars mirroring the real-space action), the performer interacts with a mediated environment of acoustic, visual, light and color projections constituted in continuous feedback loops, with signals generated through electro-physiological data (breath, pulse, voice and sensorimotor data interfaced with computer algorithms that process sound modulations). In neurophysiological feedback environments, such real-time improvisation concentrates less on semiotic processes of sense-making than on the immediate physical and emotional experience of movements inside or on the body [7]. We think of this work as having a transcendental dimension, linking the internal processes of the nervous system and intrinsic energies of the organism to the spatial environment and its extended virtual world, transmitting the movement to avatars in Second Life and reinforming the dancers' movements through avataric choreographies that are multifariously poetic, unrealistic, lossy and phantomic (inspired by 17th-century haiku and created by software).

While it is not possible in this short essay to analyze empirical evidence of how audiences "perform" the audible or process sensory impulses, we observed in several performances that scale and size of venue manifestly affect audience behavior; for example, in the smaller gallery space at KIBLA Media Arts Center (Maribor, Slovenia) (Fig. 2 and Color Plate A No. 1), the visitors mostly remained on the perimeter of the action, watching and listening intently, with only children crossing the *hanamichi*. In larger theatrical venues in London, audiences of between 100 and 150 milled across the entire space, intermingling with the performers at close range and following audible cues or engaging with the performers offering aural and olfactory stimuli or soliciting other audience members to touch wearable objects and be recorded by them, as in one scene when *The Engineer* (Yiorgos Bakalos) cuts a path through the throng with his boom mike.

### WEARABLE TECHNOLOGIES: VIBRATIONAL AUGMENTATION

As we seek to understand better the internal and external architectures and augmentation of the body through wearable technologies, it is not sufficient to focus merely on the notion of the visual "spectacle" of the body-wearable, with its





Fig. 4. Anne Laure Misme as WorkerWoman performing in *UKIYO*, KIBLA Media Arts Center, 2010. (© DAP-Lab)

memorable appearance. We must attend more fully to the emotional, vibrational sensations and inter/intra-psychological dimensions of wearing—that is, to the impact the wearables have beyond the visual on bodies, serving as extension of the senses, as “we assimilate them to our body by pouring ourselves into them” [8]. Thus we moved in our design process from the initial morphogenetic possibilities—explored through our digital photography of the choreography—to the listening body in the interface, incorporating all bouncing, reverberating sounds into the “pouring,” conjoining material and virtual oscillations into the immersive experience of imaginary space: the crackle of leaves; the dropping of salt onto the floor; the exhale of the bandoneon; the clicking of magnets against speakers; the sweeping of vinyl grooves with a finger next to a microphone; the glitches of claves seemingly beaten, the hands on the skin of the drum, the rustle of paillette sleeves (Figs 2 and 3).

The kind of mapping necessary to locate sounds in space and replicate the physiology of auditory processes, is, as Frances Dyson argues, immensely complicated [9]. The choreography of wearables becomes transmuted here. Sound waves are no longer discrete units, and this favors a “non-cochlear” [10] mode of listening, aimed not at eliminating the ear (its fluid functions as sensory organ) but at extending beyond it to a wider form of listening and sensory engagement in which other factors such as

internal sensation come into play. The dancers realign ears with the body, the bones, the pores of the skin: The whole body becomes an “acoustic sensorium” [11] and skillful transceiver of vibrational waves and sensation. This echoes the metaphysical concerns Antonin Artaud expressed in his search for the “complete, sonorous, streaming naked realization” of the theater of cruelty:

Snakes do not react to music because of the mental ideas it produces in them, but

because they are long, they lie coiled on the ground and their bodies are in contact with the ground along almost their entire length. And the musical vibrations communicated to the ground affect them as a very subtle, very long massage. Well I propose to treat the audience just like those charmed snakes and to bring them back to the subtlest ideas through their anatomies [12].

*UKIYO* deployed various models for working with “wearing sound”—sound activated by the sonically extended and amplified body-in-motion for a more expressive, augmented performance, in which immediate haptic and abstract aural qualities of the materials were intertwined for multi-sensory experience. Rather than building costumes, accessories and performances, sound characters were generated to explore what effect garments can have on micro-textures of sonic transformation and on how we hear images or make connections between sounds and image textures in time and space. Here we introduce three sound characters from *UKIYO*: WorkerWoman, InstrumentWoman and LeavesWoman, each exploring distinctive characteristics of sound and visual aesthetics.

### WORKERWOMAN (ACT I)

In the context of *UKIYO*, WorkerWoman is a factory worker and revolutionary figure, a provocative symbol of the past (the Russian Revolution and the industrial age). This character is noisy, strong and kinetic, and her powerful, compulsive-

Fig. 5. *UKIYO*, KIBLA Media Arts Center, 2010. Caroline Wilkins (left) as InstrumentWoman, with HammerWoman (front). (© DAP-Lab)



obsessive movements draw the audience closer into a mechanized world that does not stand still, inviting them to feel in their own bodies her muscular and physical sensations. Tools and technologies are appropriated in new and subversive ways, as compositional means, to effect transformational change (Article Frontispiece), utilizing the extended sound practices of *musique concrète* and “cracked media” to achieve “the sound of malfunction” [13]. The dancer (Anne-Laure Misme), kitted out with various sound-generating accoutrements (metal cage/mini crinoline [incorporating curved speaker grills], speakers, contact mike and vinyl disc), actively explores the technologies that extend her body physically and sonically.

Musician Sandy Finlayson notes that, for this work,

I recorded a series of samples directly from the already damaged 12" [Misme] was using, and looped segments. This created a noisy but still inherently musical sound, which may have been too delicate on its own, so this was complemented by the use of a clip-on radio microphone attached to her finger. When she dragged this over the vinyl, the sounds were amplified to the point of distortion [14].

Wireless portable speakers with unstable Bluetooth transmission become motivational worker tools, offering unpredictability of performance and flow. Two additional inverted dysfunctional speakers worn provocatively on the body (speaker breasts integrated into bra design) paradoxically emit no sound at all, whilst unexpected sounds are forced from the flexing vinyl in a manner unintended, as Misme's motion shifts methods of sound production from playback of recorded sound through sonic rhymes of air displacement to detecting and amplifying hidden vibrational sounds “existing below the line of audibility” [15] by use of the small contact mike. Pushing the vinyl across the white hanamichi strip, running her microphone finger over its grooves, Misme is further stimulated by her capabilities to manipulate the sonic landscape, generating a dark, booming crescendo of low-frequency sound and hum, intermingled with Finlayson's live electronics in a shared creative process of improvised performance.

In creating the WorkerWoman character, we had a loose concept for the distorted and dysfunctional sound, involving interferences and elements of analog and digital hacker culture to pull up new sounds and compositional strategies. We wanted WorkerWoman, like the *Barong Analog* wearables of Stanley

Ruiz, to combine live performance with experimental improv/noise [16]—noise that would be generated by performer and musician in a form of shared instrument alternating between the digital and the analog.

Acoustically, this character's noise-making performative role explores disturbance as a tool for audience engagement and excitement. Atonality or disintegration of harmonic structure is superimposed over the top of the soundtrack of a cracked bandoneon (played by Caroline Wilkins and processed/recomposed by musician and composer Oded Ben-Tal) producing sounds “filled with noise, as unintended and extra-musical sounds are pulled from the technology as it is pushed to the edge of breaking” [17]. Recorded sounds of metal-working lathe and damaged vinyl intermingle, as changing playback speeds and dramatic jump effects combine with heavy breathing and other noises of a highly physical performance (Fig. 4).

### INSTRUMENTWOMAN (ACT II)

Caroline Wilkins as InstrumentWoman is a Kyogen character of “mad words,” relating to instrumental sound theater traditions of Japanese Noh and Kabuki. Exploring the musician's physical body in relation to her extended bodily instru-

ment in space, InstrumentWoman enacts a series of transformations through a free-flowing form of improvisation, wherein the various sound-generating elements of her performance combine to produce musical sequences. Key sound sources are the bandoneon and the voice of the performer, combined with a wearable costume incorporating wired and wireless systems of amplification into its design. Following detailed observations of Wilkins playing her instrument in rehearsal, noting how her body had evolved with the bandoneon, we arrived at a design that suggests an inseparable connection between Wilkins and bandoneon. The garment she wears in Act II (gold-pleated silk dupion dress with neoprene and leather collar feature) evokes a further evolutionary state created from the material characteristics of the instrument, its structures, textures, colors and other design features, such as concertina capabilities. The dress utilizes sun-ray pleating that allows a radiating out of form into a kind of distinctive trapeze shape that denoted the instrument in flux. Dress and bandoneon thus breathe together and fuse—the playing of the instrument, as folding and unfolding of its physical and energetic features, resulted in a poetic metaphor for the unfolding of the golden persona of InstrumentWoman.

Fig. 6. Discarded neoprene and leather collar with square speakers emitting tiny voices, final scene in *UKIYO*, Sadler's Wells, 2010. (© DAP-Lab)





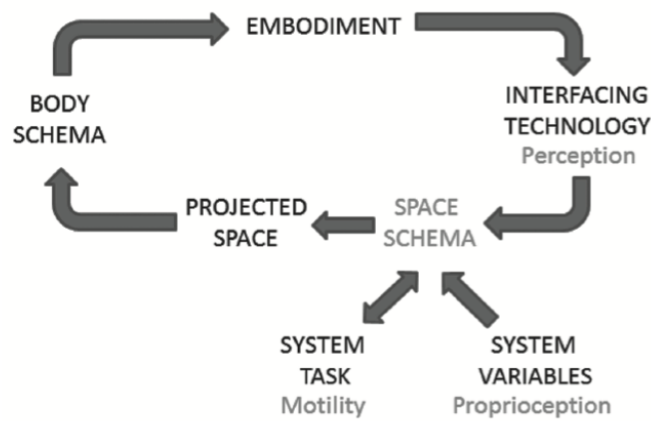


Fig. 7. The Space Schema connections for Creation Scene, 2011. (Diagram © Doros Polydorou)

As the performance progresses, attention shifts from drawing, sweeping fingers—knocking, tapping, pressing keys on either side of the resonant bandleon case, releasing a cacophony of percussive sounds—to the anatomical intimacy of the sound-shaping mouth, on to the structures of the golden-pleated trapeze dress—its collar feature extending into a spinal column adorned with two square-mounted speakers (to relay the voice and live electronics). Mouths within mouths open up, and for Wilkins,

the voice becomes an extension of instrumental sound, employing a wide range of techniques including speech, pitched and non-pitched sounds, Sprechstimme, etc., with the effect of spatial difference, of far and near, macro-/microscopic, created by a “dialogue” between the different loudspeaker sources [18].

Exploring the small voice of birdcall coming from the speakers mounted on the spine of her neck accessory (Fig. 5), Wilkins’s character begins to transform into a state of “Becoming Bird” through the combined sound-gestures. Becoming bird, in the *butoh* sense of metamorphosis, enables the performer to reconfigure her role alongside the silent dance of the Japanese performers who act as subconscious ghosts in Act II. She reaches into the spiritual dimensions of the *Qigong* performance of energies (mixing fire and water), combining Western technological notions of the virtual with the metaphysical consciousness of the universe found in *butoh*. Once again the scene involves intrinsic fusions between

performer, musician and costume design in the creation of sound character and narrative. The speakers are compact but also relatively heavy and must be counterbalanced on the collar, which is softly padded; the presence of these transducing technologies adds a sense of weight and burden to this character, almost choked at times by the pull on her collar, restricting flow, as she spits out onomatopoeic words. The audio cable that extends from the speakers to the amplifier is cut to a set length, just sufficient to allow Wilkins to advance three-quarters of the way along her *hanamichi*, and then the tethering wires begin to contain her movement, creating a sense of incarceration of this mad woman of mad words and gestures who cannot advance any further unless she is to remove her asphyxiating collar that begins to restrict and confine her so. The wearing and removing of the collar and negotiation with wires are indeed a pertinent part of the performance; the wires create their own sound and resultant choreography as they are dropped furiously to the floor in frustration, and the discarded vestigial collar provides an eerie object presence in itself, as it remains long after the performer has gone, with tiny voices, mere traces, still emitting from the transparent membranes of its two golden speakers (Fig. 6).

#### LEAVESWOMAN AND CREATION SCENE (ACT II)

LeavesWoman explores the dance of creation and the deeper metaphorical

dimensions of real and digital objects coupled with bodily experience and the simultaneous existence of corpo/virtual realities. Developed in collaboration with 3D designer Doros Polydorou and dancer Katsura Isobe, this prototype explores gestural creation of a 3D world, building on navigation strategies and techniques used in computer game worlds, “investigating the technological methodology as well as the instruments and the code required to create a gesture-activated and body-movement-controlled real time virtual 3D world” [19].

The concept for LeavesWoman first evolved in December 2009, when the DAP-Lab ensemble visited Japan to work with collaborators at Keio University. The stimulus came from the iconic ephemeral image of Ginkgo leaves falling to the ground to create a carpet of yellow. Outdoors transitioned to indoors, and Isobe, now in the studio, was enveloped in a sensual world of leaves. Clothed in the leaves, she slowly tuned to her body, touched by the texture and smell of the fresh leaves, alert to their sounds as movement initiators, her bare hands and feet slowly moving through crackling textures. Wearing one bend sensor and one pressure sensor, transmitter on her left arm, Isobe was equipped to explore and enjoy amplified sounds within sounds as she manipulated in real time the organic and rendered sounds of the recorded rustle of the leaves (worked on by Ben-Tal). She thus explored the subcutaneous levels of leafiness, in the same way that LaBelle describes the anatomy of a recording as “scrutinized, magnified, repeated, re-recorded and played back so as to hear all of its hidden and potential details, uncovering the inner dynamic nestled inside every instant or particle of sound” [20].

In the final work, Isobe is clothed in a Ginkgo dress—a simple tunic with carefully preserved leaves delicately worked into its net of fine silk tulle, incorporating the Eowave Eobody 2HF sensor interface. She immerses herself in this imaginary world she creates while simultaneously activating a new visual and sonic dimension for the audience members to enter through the data she generates using her sensors (see Fig. 1). Sound/image synchronicity and causal or semantic forms of relationships between image and sound dissipate, for Isobe no longer inhabits a world of scrutinized leaf sounds but instead a world of noise music—a dense, pitch-bending sonic collage of samples, stretched and compressed multi-layered frequencies, and deep and low-down drones vibrat-



Fig. 8. *UKIYO*, Sadler's Wells, 2010. Helenna Ren as HammerWoman wears lycra all-in-one body, necklace of tiny speakers and hinged polypropylene prosthetic arm with integrated bend sensor, eyelets and lacing feature, talon extended, hand clutching hammer. (© DAP-Lab)

ing the space. Rendered sounds create an extension of the sound environment of this virtual and evolving world. We sought with the audio samples/recordings for the Creation Scene to reflect each evolutionary section of a world forming—the cracking earth, growing trees, inhabitation and so on. Recorded sounds of church bells ringing somewhere in the distance hinted at a population rooted on the ground, but once they were stretched out over many minutes, all original meaning held within these sounds was gone, replaced by high-pitched, airy, abstract sonic textures of the sky. Data is sent via one of the sensors to a dedicated laptop running Max/MSP for the real-time manipulation of the sonic landscape, while the other sensor generates data for the visual realm. Antonio Damasio, in his writings on organisms (bodies and brains), discusses their internal interactions and external sensory stimuli, where interactions extend into the environment, stressing the importance of the conscious body in such contexts, the body that is aware of its own emotional state for flexible response based on a particular “history of interactions with the environment” [21]. This acute sense of bodily self-awareness and alertness can be observed in Isobe, who is trained to work with systems and

sensors (Fig. 7) and listens through all her sensory channels, perceiving through her entire body, her movements often animal-like, suspended somewhere between the rhythmic and the arrhythmic as she navigates real and virtual spaces.

Our 3D designer, Polydorou, states:

The embodied performer . . . extends his/her form with interfacing technology . . . and releases both consciously and unconsciously data signals which are being received by the system. These signals . . . can tell the system sets of information such as the location of the performer in the physical space, movement patterns and movement intensity. . . . By using a variety of sensorial instruments directly on the performer's body, acting as interface devices actuated by movement, movement quality/effort or touch, he or she can make a tree grow with a single raising of the hand [22].

Throughout the scene, crowded by the audience, which amplified the intensity Polydorou describes, Isobe's presence seemed diminished, while the effect of her gestures on the virtual world grew disproportionately with each seed that she planted. Other important characters in *UKIYO* investigating aural and visual aesthetics and how these can be shaped by drawing the audience into closer proximity and visceral experience of *sound*

*wearability* in performance were SpeakerWoman (Color Plate A No. 2) and HammerWoman (Fig. 8), both performed in Act I by dancer Helenna Ren.

## CONCLUSION

The project described here does not just evoke a design practice that utilizes interactive media technologies. It is essentially an exploration of design concepts becoming visible and audible, where technology is manipulated to emphasize the importance of the aesthetics/metaphysics of performance. We prioritize the relationship of the aesthetic to the technical in the creation of audible wearables, seeking to involve the audience in a narrative landscape inspired by the ukiyo-e tradition. The sensual material design of the garments links the tactile (the instrumental musical quality) to the acoustic perceptions we gain of the characters. At the same time, this aesthetic direction is completely integrated with the different cultural performance techniques and styles the performers brought to the dance or, as Olu Taiwo, another dancer in the ensemble, would put it, to the “physical journal” of the performance artists who participated in the creation of *UKIYO*'s mixed reality.

## References and Notes

Unedited references as provided by the authors.

1. "Dance is always a temporary drawing, it disappears when the movement ends. So the drawing can be written over, or rewritten at any time. Each performance has to be drawn again." Belgian-Moroccan choreographer Sidi Larbi Cherkaoui's comments have often been cited; see <[www.dansfestival.com/2010/bio-sidi-larbi-cherkaoui.html](http://www.dansfestival.com/2010/bio-sidi-larbi-cherkaoui.html)>. For a video excerpt, see <[www.youtube.com/watch?v=od\\_9QhMjJK0](http://www.youtube.com/watch?v=od_9QhMjJK0)>.
2. Videos of works by Forsythe and Bausch and of butoh dance are readily available online. For the expanded choreographic context, see J. Birringer, *Performance, Technology, and Science* (New York: PAJ Publications, 2008), pp. 214–232.
3. S. Doruff, "The Tendency to 'Trans-': The Political Aesthetics of the Biogrammatic Zone," in M. Chatzichristodoulou, J. Jeffries and R. Zerihan (eds.), *Interfaces and Performance* (London: Ashgate, 2009), pp. 121–140. Affective tonalities in our dance inspire the emerging forms of the choreography, and these tonalities are difficult to map. We adopt Doruff's term "biogrammatic" to refer to unstable forces in interaction.
4. A video of our *Suna no Onna* production (2007–2008) is at <<http://people.brunel.ac.uk/dap/suna.html>>.
5. Our ensemble initiated a new project on "Immersive Environments for Trans-sensory Interfaces" with Brazilian partners in 2011, particularly addressing empirical questions of audiences' aural perceptions and behaviors in such kinesthetic installations.
6. Forsythe has collaborated with Japanese fashion designers such as Miyake, Yamamoto and Kawakubo (video footage of this was featured at the Barbican exhibition "Future Beauty: 30 Years of Japanese Fashion" [2010]); the role of costume design in Japanese dance is also credited in S. Fraleigh's recent book, *Butoh: Metamorphic Dance and Global Alchemy* (Urbana: University of Illinois Press, 2010), pp. 56–61.
7. Birringer [2].
8. M. Polanyi, *The Study of Man* (Chicago: University of Chicago Press, 1957), p. 25.
9. F. Dyson, *Sounding New Media: Immersion and Embodiment in the Arts and Culture* (Berkeley: University of California Press, 2009), p. 139.
10. S. Kim-Cohen, *In the blink of an ear: Toward a non-cochlear sonic art* (New York: Continuum, 2009).
11. C. Rainer, S. Rolig, D. Daniels, M. Ammer (eds.), *See This Sound: Versprechungen von Bild und Ton* (Cologne: Verlag Walther König, 2009), p. 158.
12. A. Artaud, *The Theatre and Its Double*, trans. Victor Corti (London: One World Classics, 2010), pp. 37, 58.
13. C. Kelly, *Cracked Media: The sound of malfunction* (Cambridge, MA: MIT Press, 2009). *UKIYO's* narrative and historical reference systems are layered and combine images and physical gestures reflecting, for example, Russian engineer A.K. Gastev's motion and strike pressure experiments with workers wearing prostheses; sound references to Khlebnikov and *zaum*; with black and white film noir scenes inspired by C. Kracht's novel *Ich werde hier sein im Sonnenschein und im Schatten* (e.g. we filmed scenes where an African engineer explains the plasticity of oral/aural languages to the military; other film animations reference Hokusai and Japanese sci-fi manga and anime). For a film excerpt, see: <[http://people.brunel.ac.uk/dap/Ukiyo\\_Sadlerswells\\_movie.html](http://people.brunel.ac.uk/dap/Ukiyo_Sadlerswells_movie.html)>.
14. Sandy Finlayson (sound artist, member of DAP-Lab), email correspondence, June 2011.
15. For an insightful discussion on the vibrational qualities and physicality of sound, see B. LaBelle, *Acoustic Territories: Sound Culture and Everyday Life* (New York: Continuum, 2009), pp. 133–137.
16. See S. Ruiz, "Barong Analog wearable synths and other projects involving sound and performance," <[www.stanleyruiz.com/index.php?/media-arts/barong-analog/](http://www.stanleyruiz.com/index.php?/media-arts/barong-analog/)>, accessed 21 June 2011. For further context on acoustic generation methods and system configuration using organism information, see A. Tanaka, "Sensor-Based Musical Instruments and Interactive Music," in: Dean, R., ed. *Oxford Handbook of Computer Music* (Oxford: Oxford Univ. Press, 2009), pp. 233–257.
17. Kelly [13], p. 34.
18. O. Ben-Tal and C. Wilkins examine their ongoing collaborations including *UKIYO*, in "The embodiment of music/sound within an intermedia performance space," ARTECH 2010, 5th International Conference on Digital Arts, 22 & 23 April 2010, School of Architecture, Universidade do Minho, Guimaraes, Portugal, pp. 19–24.
19. D. Polydorou, *Immersion and Interaction: Creating Virtual 3D Worlds for Stage Performances* (PhD thesis, Brunel University, 2011), p. 60, discussing the creation scene in detail from the perspective of the 3D designer.
20. B. LaBelle, *Background Noise: Perspective on Sound* (New York, London: Continuum, 2007), p. 26.
21. A.R. Damasio, *Descartes' Error: Emotion, Reason and the Human Brain* (London: Macmillan, 1994), p. 138.
22. Polydorou [19], pp. 60–61.

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Michèle Danjoux,  
in conversation with dancer Vanessa Michielon and choreographer Johannes Birringer,  
Interaktionslabor, Germany, August 2013.

## Interactive Technologies, Costume Design and Choreography

**MD** Vanessa, please can you introduce yourself and tell me a little about your background.

**VM** I'm a dancer and researcher, based in Italy. I graduated in Media and Cinema Engineering in Turin and then I got a PhD in Cultural Heritage focusing on natural interfaces in museums. At the same time I trained in ballet, modern, contemporary and community dance, and so at the moment my research is interested in natural interfaces while I dance in a small dance company in Turin. I create freelance projects as well, and I'm particularly interested in interactive performances.

**MD** Can you tell me a little bit about your dance company?

**VM** Yes, this ensemble is lead by a choreographer, his name is Raffaele Irace, and it is quite small, it involves five members depending on the projects and I really enjoy it. We have ballet training every day, the kind of dance is contemporary with a strong base in ballet. One of the pieces we produced, *Mass Distraction - Choreographic Object 1*, was shown at the Venice Biennale 2012. The most recent piece is *Lunar*, which is quite interesting because it involves collaboration with a fashion/costume designer. Her name is Sonia Biacchi and she created these white dresses/costumes with very strange shapes that in a way limit and also protect your body, because they are rigid so they don't allow so much flexibility, and it has been interesting in this case to explore these garments, these materials.

**MD** Yes, you showed this work the other night and I was fascinated to see both pieces. If we could talk about the *Lunar* piece briefly – what materials were used and how did those materials make you feel? What materials were the costumes constructed from, do you know?

**VM** These materials I guess are used also to make sails for boats. It's quite rigid, and so we needed some time to see which kinds of movement they allowed. All three are different, my dress was the longest one, the other dancers had shorter dresses and they also had holes in the sides that allowed the arms to emerge. And we basically could not use the legs so much because they were quite restricted, so we concentrated particularly on the upper body while we were wearing these dresses. And, we also had to find ways to emerge from these dresses, so a way to take them off and then to end the performance, taking these clothes again and offering them in a different way to the public, finding new ways not to wear them but to hold them in our arms so as to construct interesting shapes. And so, I think they were really interesting because as they are rigid, they can also be seen as sculptures when they don't have a body inside and thus you can place them on stage and build some interesting shapes and then leave them as a shape standing alone.

**MD** And once you'd removed the costume how did you continue the performance?



**VM** The performance became much more dynamic because we hadn't any limitations anymore and so yes, it was quite dynamic, we used the legs in all amplitude, we ran a lot and there was this strong opposition to what we had in the beginning which was really, really slow. We started altogether, as a trio, we composed a single structure/sculpture and then we slowly separated from each other and then we emerged from the costume. When we hadn't these clothes on we could move at the maximum of our possibilities, and so yes, you can feel the difference between this limitation and the freedom.

**MD** Did you enjoy it? Was it an enjoyable experience?

**VM** Yes, because in a way, since you cannot move so much and since every small movement has an impact on these costumes you are invited to maintain a continuous flow and use slow motion. I mean everything is slow but I enjoyed it a lot, it's a different kind of sensation of state that you don't experience very often and yes, you have to pay attention because if you move too much, the costumes *amplificate* – does this word exist? – every small movement. In a way, everything becomes bigger because these costumes have processes, and so every small movement becomes so big when you have these clothes on. And so you are invited to move very slowly and make very subtle movements, and this is a state you don't experience so often, and when you don't have it you can appreciate the experience but you also appreciate the previous state because it's a kind of intimacy, you also feel protected by this envelope that transforms you into an alien creature.

**MD** You said when we were looking at the work the other night that you also worked with a choreographer as well as a costume designer to develop the movement.

**VM** Actually we only worked with the choreographer (the designer just made some final comments after the preview), he gave us some time to spend with the dresses to figure out what shapes to generate and understand how to move in a very slow way. When we work with dresses we always need time to spend alone with the costume but then the choreographer maybe says how it can work from the outside, whether it makes sense; the final decision is of course that of the choreographer who also has some kind of image visual/image in mind. But it's necessary to experiment alone also for familiarity with the dress because otherwise, there are moments when you don't feel you have the control. You need first of all to feel the control over the costume so that the audience can feel the connection this harmony/union between dancer and costume. It's something you have to experience in a private and intimate way.

**MD** That's very, very interesting to hear you say that because as you know I'm coming from a costume design background wanting to understand how the presence of costume can impact on a dancer/performer, on their movement and whether that might initiate a new form of dance both from a visual perspective and also from a sensorial perspective of how the dancer might be touched by the materiality of the costume. In the first piece, which you showed last night, *Destruction*, what was the title?

**VM** *Mass Distraction*

**MD** Oh, yes, you were wearing the stretchy leotards, very simple not to inhibit any movement. Can you talk a bit about that piece, the dynamics of the piece and how you felt?

**VM** The piece was created by this choreographer and was a duet between two dancers, it's composed in two parts. The first one is really dynamic, with strong music just made of noises, and it seems like a fight between two women, and in the second part, everything

slows down, and the music is much more harmonic and you can feel the harmony, the peace between the two dancers. And it's really athletic and so of course you needed to wear very flexible clothes, and in the beginning we actually had some problems with these leotards because they are constructed of two parts, an outer and an under. We had one leotard which was really stretchy and flexible but the other one is made from a transparent material which is not so elastic, so it was a problem the first time that we had this performance because we needed to feel comfortable in these different materials. Even if they are both leotards and in a way flexible, the material was quite different so sometimes you needed to practice in it to become used to sensations provoked by the second layer.

**MD** It's interesting to me that offering freedom to the dance, offering complete liberation to the performer, obviously changes – anything you place on the surface of the body begins to offer some element of restriction. I'm thinking now of what you were saying about dancing with technology because you've had some experience of interactive dance and you've got some quite strong sensations from that experience, and I wonder if you could talk a bit about that?

**VM** I think that this happens also with technology even if it's not tangible, I mean you work with cameras for example, even if it doesn't impact your body physically, it has an influence on the possibilities of your body. So for instance when you wear accelerometers, and they maybe aren't heavy and also they can be small but in a way, you have to limit yourself because in this case, you have to make generally very subtle movements because the smallest variation on the orientation of your limbs can cause enormous effects. So maybe you don't perceive physical limitation, as in a big dress, but you have to limit yourself because you know some kinds of movements that can be very free and big make no sense when your movement has an impact on the sound for example or on the projection. It's a different kind of limitation that you give to yourself, and it's sometimes frustrating because you would like to express yourself and use the body in all possibilities but you know you have to make everything more subtle, everything smaller, because otherwise the audience cannot understand the relationship between your movement and the effects – the sound or the acoustic or the visual effects. And so in my experiences, I always felt a little bit of frustration but I know that many artists have found a way to overcome these limitations, and for example when you work with camera vision and big projection, you can use your body completely. I saw wonderful pieces by Chunky Move, for example; this is a different kind of technology, a much more immersive environment. I think that there are beautiful examples where you can use the dance without limiting the dancer and you can also use the technology, but some kinds of systems – when the smallest movement can have a great impact – in a way makes you surely limit yourself, so you need to accept this, yes, maybe develop something new, an entirely different language.

**MD** Yes, and spend probably a long time rehearsing.

**VM** True, because in a certain way you should be able to predict the effect/impact before you actually do the action of course, so you need to spend a long time.

**MD** Do you think improvisation is still possible in that situation?

**VM** I think yes, absolutely, improvisation is necessary in the exploration phase, so you should really try every possible way and every time try to remember the effect/impact of your actions, and then you understand which kind of movement is the most appropriate to gain a certain effect and then you will maybe know that you can move inside a range and then you can improvise inside that range.

**MD** Yes, so thinking of those experiences and relating them to that piece you showed the other night with the two Wii's and the Kinect camera, can you perhaps talk about your movements and what you were doing there please.

**VM** An interesting project in which I was involved is called the FraMESHift project and was created by choreographer Renata Sheppard in Turin with Asa Lab, a company which produced the animations, the sound and the visual effects. In this project, my role was to control a robot in 3D through a Kinect and two Wii remotes. So basically, my body was controlling the body of the robot through the Kinect; in the first phase, I needed to practice a lot and also to work with the computer scientist to find an appropriate way to do the mapping between my movements and the robot. It was interesting work with a computer scientist, as we tried to modify the parameters in order to make it comfortable for me and also interesting, to make this interaction work. Then in the second phase, I also used these Wii remotes to control some animations, to trigger some animations of the robot and also to control other contents, media objects on other screens. Therefore, for me it was quite challenging to remember the relationship between different buttons, because in each scene certain buttons control the trigger for different actions, and also to make this robot seem as human. Initially we noticed that the animations, produced by the animation department, were not so human-like. I mean you could feel that this was just a robot. But when there was this coupling between my body and the robot, in a certain way, it seemed to be much more human and have emotions because of course, there is a difference between using the human body in motion capture and simply creating an animation through a computer. And so, yes, for me it was interesting because in a certain way, I had to orchestrate different media objects, always paying attention to the impact that my movements had on the robot, but in this case, I was not dancing, I was just moving in an appropriate way because I was on the stage, but I was totally at the disposal of this robot and of the contents, my role was functional.

**MD** Yes.

**VM** So this was really an opposite side...

**MD** You were saying that you weren't dancing, you were just moving and have you worked with technology where you feel you're dancing with the technology as opposed to moving?

**VM** Yes, for example in different workshops, I used accelerometers. I took part in an interesting workshop with a famous Italian company which is called AIEP, and they gave us some accelerometers to put for example on the feet and on the wrists so that we were able to control sound, small variations in the sound through moving/rotating the wrists or moving faster or slower, and in that way we tried to create choreography first and then to do this choreography with the technology. But we understood that this does not work because the effects were not so interesting, so the audience could not understand what was going on. We had to start from the beginning and just try to explore and to adapt the movement to the technology. So we first tried to understand how each rotation could affect the output and then inside that range, inside those limitations, we decided to dance, but sometimes it doesn't work just using an old choreography with the technology because the effect/result maybe unpleasant or it can make no sense.

**MD** So it needs for you to be pleasant, it needs to have a very good sensation and make sense, this idea of sense making. But you're wearing these sensors on your body, have you ever worked with technologies that are integrated into a garment?

**VM** No, actually, I've never used wearables before, so, the only experience was with those accelerometers. They were on the body but not in the garments.

**MD** You've experienced costumes and quite avant-garde costume design, and you've experienced sensors, and now my interest is to really focus your attentions a little bit on whether you enjoy working with garments that have technologies integrated. You worked so far with me in this lab with the RedMicro dress, so first off, I would like you to tell me a little bit about the experiences of the red neoprene dress with the black leatherette trim.

**VM** Yes, I enjoyed a lot using this dress, and I think that in this case, the fact that some parts of the dress were a little bit rigid, this is not a limitation in a negative way, but it's maybe a suggestion to create specific shapes. For example, I felt like using my elbows in this way [shows right angles with the arms bending downwards], making angles with my elbows and/or keeping them really straight; this kind of costume suggested to me to make lines or to make geometric forms instead of circular forms. And also the skirt – it is not so light, I mean it's a little bit heavy and it makes a kind of sound when you move it; this suggested to me to walk with different speeds to see how the skirt slaps in a certain way or to try and stretch my legs to make it stretch too. I think limitations are suggestions: they are not obstacles in a negative way but they just give you a frame to develop specific kinds of shapes and movements. And in this way, I think it really helped me to create shapes/futurist shapes and to re-create in a way the pictures [Rodchenko and Russian productivist posters] that we used for the brainstorming because it really suggested to me these kinds of positions, that was helpful in a way.

**MD** It's really interesting to hear you mention the fact that you enjoyed the sounding possibilities of the cloth, as if you were to animate it through movement. I was thinking that maybe if we were to give you an accelerometer or a bend sensor in one of your elbows, because the garment is stimulating the bending, this would be an interesting aspect of the wearable to work with...

**VM** Yes, I think so...

**MD** And in terms of output, what that might create. Do you have any thoughts on that, the sort of thing you'd like to control if you had a sensor?

**VM** Yes, I think we could try experiments with this variation of the sound, some parameters of the sound for example, and so depending on the tilt, you can control some parameter; and maybe using just one accelerometer because when you have too many it also can become complicated for the audience to understand the relationship. So maybe starting from one using all this range of movements [demonstrates from memory of working with the RedMicro dress] you can in a way impact on the audio. This is an experiment.

**MD** Yes, so that could be something interesting to try. Just to end the interview, I wanted to ask you how you felt about working in the duet with Emi Watanabe. As you know, you're wearing a microphone on your shoulder and she's interacting with that with her flute. How did that work for you as a performer, were you aware of her, were you listening at all to the sound?

**VM** Yes, when I'm working with the musician Emi, in the beginning, I just paid attention to the sound and so in a very simple way, I tried to find a relationship between the duration of the sound and the quality of my movement; we didn't have any contact but we could feel the tension between us. Sometimes we were close, sometimes we were on opposite sides and sometimes, when we met in the space, I just decided to stand still to let her play

in the microphone and then I would try to move a little bit to see how this distance impacted on the sound. And it's always funny when you have someone else to improvise with because in the end when you are alone sometimes the energy goes down and your imagination may suffer but with Emi present there was always some sense of surprise and it was nice to build the shapes, in the pattern of the space. So we were distant and then we were close, yes, it was nice also to think about the position in the space it's really important even if our movement was not so dynamic inside the kinesphere, it was interesting to move in the space and see how the distance between us can impact the sound.

**MD** Is there anything you would like to try with Emi as a next experiment to move on from these things?

**VM** Yes, I would like to play more with these subtle distances between us to see how we can distort the sound based on our position because we spent a lot of time separated and so she could not use my microphone and we spent only a small time when we were close, now I think we have to stay in a medium position, to play with the sound, I mean we need more time to play with these variations.

**MD** Yes, that's great, thank you very much for your time and your answers. Wonderful.

**JB** If you were to be able to come away from your Italian Post Doc and work on a research project in England, what would be the kind of topic that would interest you?

**VM** I would like as personal research to investigate and find a way not to feel frustrated when I use the technology, so see how much of my free movement I can use inside a computational system.

**JB** In a system.

**VM** In an environment, but in an appropriate way because you cannot simply use your whole movement when you work with technology, and you have to find a balance and I would like to find a balance that can be satisfying for me because now sometimes I feel a little bit afraid of doing too much when I use technology.

**JB** Yes.

**VM** And I limit myself a lot and I suffer from this.

**JB** Because you enjoy moving, right?

**VM** I enjoy moving. I also enjoy doing very small things but I would like to find a compromise in order to do something that can be understandable for the audience who can enjoy the relationship between my movement and the effects it generates. At the same time I would like not to limit the possibilities of my dance too much. For example, I was talking about the accelerometers, which Vanessa Vozzo showed (Officine Sintetiche Lab 2011, with Ariella Vidach Dance Company: <https://vimeo.com/44880120>) and in this case you had to make very small movements to make it understandable but I would have liked more to dance and not just move my wrists. I know many artists have found a way to express themselves in this kind of context but I still need to.

**JB** If I could ask one more question – if you think of some of the dance styles or traditions in our Western contexts, ballet, modern or improvisation, we also have tanztheater and conceptual dance, but do you think that working with a system or with wearable

technology has helped to generate a new dance form? Do you think interactive dance could develop a new aesthetic?

**VM** I think so, from the dancer's point of view in my personal experience, it helped me a lot to perceive a very subtle change in my body and so I was much more conscious about small movements, and so for me it was a new way of exploring my body because you have to be much more aware of your body movements. I think this is a very difficult question, if it can create a new language, but if you don't pay attention to the sound and to the visuals, when you watch an interactive dance piece, then I think you are watching something different from the body language point of view. So if you don't pay attention to the visuals and you focus on the body, I think you are watching something different. Maybe this is not a codified language but you can feel that there is a different attention; a different focus in the performer and you cannot see the same focus in other dance pieces I guess. Of course maybe we don't have the language, something codified, or if you want to talk about codex, you have to take into account all the other elements but from a strictly bodily point of view, I think you will watch something else.

**JB** Something else, and even if the audience or if we were not to know the system or the interactive parameters, you think you could realise something in the physical expression of the dancer?

**VM** Yes, in the focus.

**JB** In the focus?

**VM** Because the performer is paying attention to something new, this more or less visible partner which is the computation system and the multimedia objects it controls, so it's the attention side that would be different I think. Of course this tension in the performer can be more or less evident for the audience depending on several factors.

**JB** Thank you. Michèle, would you like to add something? In your experience of having designed wearables and costumes, have you noticed that the dancers that the DAP-Lab has worked with changed their style of dancing or created new ways of moving that you had not seen before?

**MD** Again, it's quite a difficult question to answer, I think that within every performer, I have noticed that there is always a particular form of dance that exists in the body, so when I give a performer my costume/wearable to work with that dancer will work with it in the context of their own movements. So for instance, Helenna Ren [trained in Chinese dance tradition] has a very particular type of movement, and it seems that that movement simply will be slowed right down to work with something of weight or fragility, something that requires serious concentration in order to work with it in order to enable it to create sound or whatever it's attempting to do in relation to her body. When the same wearable was given to a different performer, to one of our Japanese dancers, Yoko Ishiguro worked very differently with it. So, I don't think it created a particular type of movement in that instance, I think it just altered the movement.

**JB** Could it be possible to receive a somewhat different outcome if you think of performance artists we've worked with who had less or no dance background – maybe coming from music or theatre training, if we think of Anne-Laure Misme as an example – did they show a greater ability or interest in generating a new vocabulary to work with an interactive tool or with an instrument?

**MD** Yes, I think Anne-Laure is a particularly good example because she was prepared to learn with the technology, she was aware of her movement limitations already and wanted to develop as a performer, so one could say she developed as a performer in relation to the technology she was wearing and to its affective capabilities. I think in that instance it really did alter how she became in the performance space. My hope is that the presence of the wearable on the performing body, on the dancer, will in some way help new movement to become possible or imagined, or extend movement, act as motivation... But I think it's also important to have the choreographer present and to have the other things that will influence the dance because I think in themselves the wearables I produce are not going to create a dance, they will contribute to the dance. That's how I am beginning to feel more and more, that they are a part of a composition.

**JB** To come to a conclusion, what I am interested in asking here is a question that in a way relates to the notion of *technique* and also forms of directing or choreographing interactive performance. So, if you say in the old theatre there's a director or in the old dance protocol there's a choreographer, but now the dancer or performer is wearing sensitive devices and is also actually working with a programmer and with a designer and a sound artist, so the performer in a way is having to integrate their technique with several expertises and therefore it's not just one set of techniques but I think it could be several sets of techniques – and I like to call them performer techniques – how do we then learn about or train performer techniques in interactive art? There is nothing written or established as far as I know that we could refer to, where we could see how other companies or laboratories have addressed the question of technique. How do you train a performer to develop a new focus or different focus or a multiple directional behaviour? Do you want to comment on that, have you come across a methodology or something?

**VM** I think you can develop a performer technique with these interactive environments only through practice. So you have to immerse yourself and try to integrate the technology inside your body and become expert in trying to predict how your movement can impact the environment, you need to develop a specific embodied knowledge. To understand how your body in a certain way can affect the environment, you have to practice a lot.

**MD** I think that's what you were also saying about the costume, that there's an embodied knowledge that needs to be developed. You were talking about the red costume with the black and how it creates for you the possibility of linear movement, but you were also saying about the importance in your *Lunar* project of having time to work with costume to understand what movement possibilities or limitations are on offer to you. Again it's about becoming almost one with the costume so that you work together. I don't think that for me a costume designed for interactive dance can just be placed on a performer's body and suddenly movement is altered. I think it has to be a knowledge that develops through a growing coupling of things and with interactivity as well, that's also coming in as part of that fusion.

**VM** In both projects when you work with a robot in the end of these three weeks of training, I felt the relationship, an affective relationship with that robot and in some way I missed this "coupling" when the project ended. And at the same time when I trained inside a costume, in this piece by Raffaele, I felt an intimate relationship with this protective shape, and so it's something that should be developed over a period of time. Yes, so this is why I think improvisation is important to discover new ways to move, you cannot simply try to imagine it and impose a kind of movement, you needed to explore the opportunities of the costume and then you can choose which one works better. But it's work you cannot do without the costume, without the extended practical experience.

**JB** Thank you very much.

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# Choreography and sounding wearables

## ABSTRACT

*This article 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 and 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] (2012–2014), for which I designed the wearables, highlighting new methods for building sensual wearable electro-acoustic costumes to create kinaesonic choreographies. The article 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  
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, a transmitter at the waist and a tiny microphone located on the left back shoulder (Figure 1). The palpable sensations of the materials and recording capacity of the RedMicroDress 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.

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



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

them to feel the strongest tension. Since elbows are the focus, I use them as motors 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 RedMicroDress 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<sup>1</sup> during rehearsals for our latest production, *For the time being [Victory over the Sun]*

1. 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)



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).

and *For the time being* [*Victory over the Sun*] (2012–2014). *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* (2014) programme on 'Wearable Technologies', 25 February. See: <http://www.brunel.ac.uk/dap/>.

2. *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 (in Böhmig 2012), Compton (1978), Lynton (2009), Milner (2009a, 2009b), Rowell and Wye (2002), Stepanova (1987) and Stern (2004).
3. '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.

(2012–2014). Inspired by the experimental Russian Futurist opera *Victory over the Sun* (1913),<sup>2</sup> our choreosonic performance<sup>3</sup> is not only 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. RedMicroDress 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 synthesized by our sonic art collaborator Oliver Doyle.

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 the 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 a 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 organization 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 subtly 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 onstage, 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 few years has opened up provocative new avenues for our understanding of: 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,<sup>4</sup> I have noted as a designer of costumes that many choreographers prefer dancers to wear garments that do not have an impact on the nature of their movements but rather facilitate them, opting for close to the skin body-contouring pieces with stretchability 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 onstage 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 multi-sensory 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 perceptual 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.

4. 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 (13 October 2010–9 January 2011), which featured work by William Forsythe, Merce Cunningham, Michael Clark, Wayne McGregor and others.

5. 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' (2008). For a more detailed insight see Bokowiec and Wilson-Bokowiec (2006).
6. 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. Serendipitchord is described as a 'wearable musical instrument that invites the user to explore a soundscape through touch and movement' (<http://dimainstone.com/project/5>).
7. For discussions on earlier works see Birringer and Danjoux (2009a, 2009b, 2013).
8. '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 forthcoming).

## SOUNDING WEARABLES

In the work we create at DAP-Lab, *sounding wearables* with real-time inter-  
actional elements (such as microphones, speakers, sensors) are used chore-  
ographically 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 *prac-  
tice of wearing* that becomes fundamental to the performance-making process  
where an intimate interrelationship between the dancer and costume emerges  
to generate design-led performance, to stipulate the 'technogenetic' processes  
that Erin Manning seems to be thinking about when she criticizes the lack  
of attention to the moving/becoming body in interactive dance-technology  
systems seeking to map the performance gestures to 'predefined paramet-  
ters' (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, program-  
mers, 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 poten-  
tials 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 poten-  
tials of the wearables in 'kinaesonic'<sup>5</sup> performance, and the emphasis is on the  
potential of processes, not the calculable results of parameterization.

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.<sup>6</sup> 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 focused  
on the manipulation of visual digital media output) over a number of years.<sup>7</sup>  
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 slap-  
ping sound for instance of a leatherette cloth or a metal coil rotating at differ-  
ent speeds controlled by a dancer can become new material for generative  
composition. Each small sounding was scrutinized for inherent sonic possi-  
bilities, remixed, magnified and re-emitted in real time through technological  
systems in the performance space (using directional and condenser micro-  
phones, 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'.<sup>8</sup>

## HISTORICAL PRECEDENTS: CHOREOGRAPHIC GARMENTS

As I have already implied, costumes – designed for the study both of move-  
ment 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 onstage. 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 (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 mobilize 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 were used under lighting techniques for her billowing silks that she manipulated with wands to create the effects of spiralling, 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 stagecraft 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 with such technological additions or extensions is the precursor 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 spiralling 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 the performer and audience and a shift away from mimetic action. The following quotation from Melissa Trimmingham 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* scrutinized the motion of performers' bodies as they engaged with material forms in space. Dance works such as *The Triadic Ballet* (1922) and *Mechanic Ballet* (1923–1924) 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 kinaesthetic '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 and silent screams.

Other examples in more recent history of dance where new movement techniques must be found for the dancing body are the 1990s 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.<sup>9</sup> 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

9. <http://www.benoitmaubrey.com/>.



10. <http://www.pamelaz.com/>.
11. <http://www.bodycoder.com/>.

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®,<sup>10</sup> and Julie Wilson-Bokowiec with the Bodycoder System.<sup>11</sup> 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 utilized glass microscope slides, 'blood plasma slides' and ostrich feathers in its construction. There were 2000 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 entwining 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 or 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; kinaesthetic 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 a 'listening organ', a receptacle for sonic experiences (Kozel 2012: 63). Furthermore, the performer will develop techniques that are specific to the wearable, a skilful object/instrument handling using her 'tactile-kinaesthetic 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 Technology: The Intersections of Design, Fashion, Science, and Technology* (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, miniaturized and oversized 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 electro-acoustically – 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 unrealized) slanted spiralling Tower (*Monument to the Third International* [1919–1920]) 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 unrealized 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



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



track her gestures and enables her to manipulate the virtual sun on-screen. For the opening scene of our opera, I emphasize the strange irony to be found in a wearable TatlinTower 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 kinaesthetic 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.

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-kinaesthetic intelligence of the dancers becoming expanded instrument-bodies, generating their own sounds and sonic textures onstage, each presents its own way of working with technologies.

### **TATLINTOWER HEADRESS: PROTOTYPE 1**

The TatlinTower Headdress is a wearable electro-acoustic instrument realized 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 unrealized 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 that 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 prologue 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 on-screen. 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 skilfully to standing, her centre of gravity held low, exploring her body movements in relation to the instrument: head twisting, manipulating

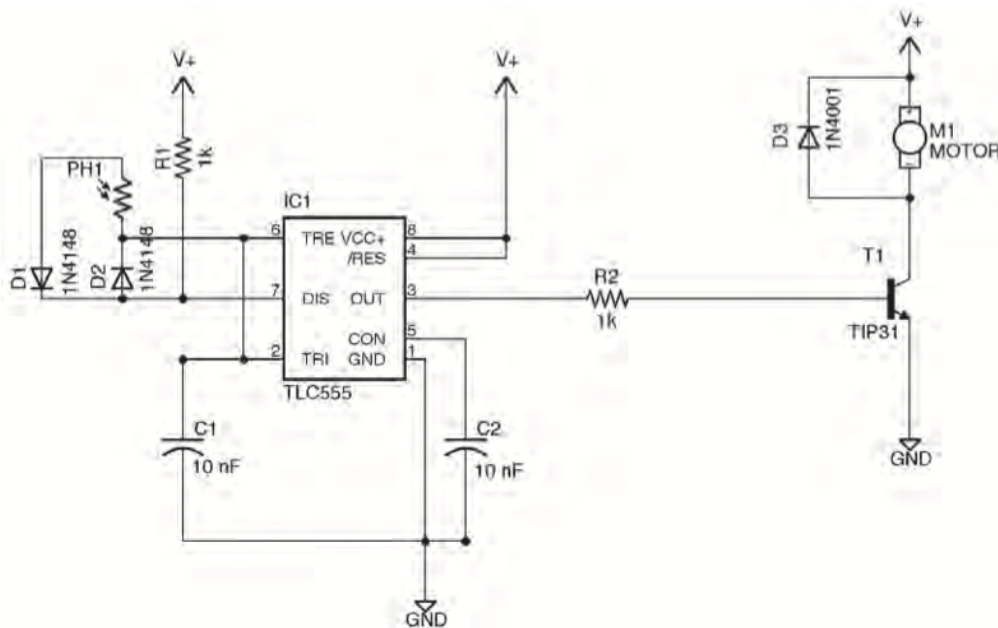


Figure 4: Circuit Diagram for TatlinTower Headdress, 2012 (© John Richards).

the sensor, stopping and starting her sound, shifting it into the space, moving the black box away from her body, arms outstretched (Figure 5).

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 and then restarting 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.

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



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

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.



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

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 had an impact on her movements and a tendency to move slowly, avoiding accelerations. The body in motion transports its kinaesphere 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 kinaesphere 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 examples 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 50 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' (1959: 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 et al. 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.

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





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).

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 90° 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/deactivate 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 interactions to occur.

As McKirdy points out in our lengthy e-mail 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 recognize 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 on-screen 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 (projected 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 kinaesthetic and tactile experience afforded to the dancer wearing a costume that 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, conceptualize 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 ('RedMicroDuet 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 perceptual 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 synthesized 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



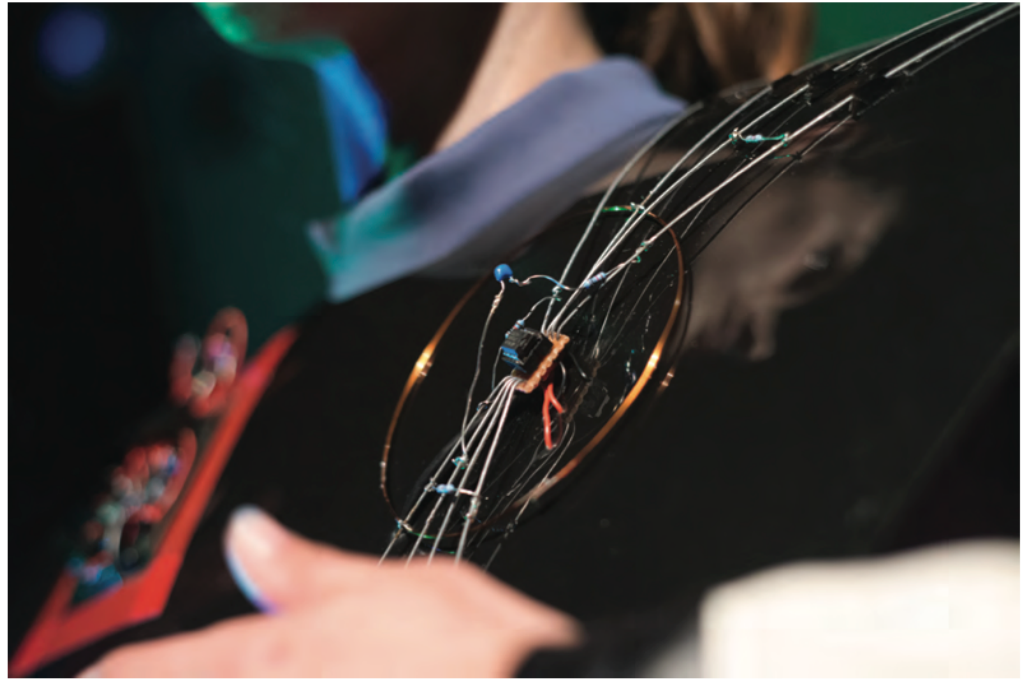


Figure 8: For the time being, *Sadler's Wells*, 2014. Microcircuitry on sounding chest plate worn by Aggeliki Margeti, *Act II* (Photo © Hans Staartjes).

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

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#### REFERENCES

- Becker, Cynthia (2007), 'Awakening the senses: The aesthetics of Moroccan berber dress', in Donald Clay Johnson and Helen Bradley Foster (eds), *Dress Sense: Emotional and Sensory Experiences of the Body and Clothes*, Oxford: Berg, pp. 72–83.
- Biacchi, Sonia (2013), 'Sonia Biacchi', <https://www.facebook.com/media/set/?set=a.617136004982438.1073742037.223418931020816&type=1>. Accessed 4 March 2014.
- Bicât, Tina (2012), *Costume and Design for Devised and Physical Theatre*, Marlborough: The Crowood Press.

- Birringer, Johannes (2008), *Performance, Technology, and Science*, New York: PAJ Publications.
- (forthcoming), 'Audible and inaudible choreography', *Etum*, 1: 1 (accepted for publication 2013).
- Birringer, Johannes and Danjoux, Michèle (2009a), 'Wearable performance', *Digital Creativity*, 20: 1/2, pp. 95–113.
- (2009b), 'Wearable technology for the performing arts', in Jane McCann and David Bryson (eds), *Smart Clothes and Wearable Technology*, Cambridge: Woodhead Publishing Ltd., pp. 308–419.
- (2013), 'The sound of movement wearables', *Leonardo*, 46: 3, pp. 232–40.
- Böhmig, Michaela (2012), 'The Russian cubo-futurist opera Victory Over the Sun: Aleksei Kruchenykh's alogical creation', in Rosamund Bartlett and Sarah Dadswell (eds), *The World's First Futurist Opera: Victory over the Sun*, Exeter: The University of Exeter Press, pp. 109–25.
- Bokowiec, Mark and Wilson-Bokowiec, Julie (2006), 'Kinaesonics: The intertwining relationship of body and sound', *Contemporary Music Review*, 25: 1–2, pp. 47–57.
- (2008), 'Bodycoder', TIEM: Taxonomy of Realtime Interfaces for Electronic Music Performance, <http://vipre.uws.edu.au/tiem/?tag=kinaesonic>. Accessed 17 March 2014.
- Carpenter, Betsy (2012), 'Dance Works III: Merce Cunningham/Rei Kawakubo', Curatorial statement, Walker Art Center, <http://www.walkerart.org/calendar/2012/dance-works-iii-merce-cunningham-rei-kawakubo>. Accessed 12 March 2014.
- Click (2014, London: BBC Radio Theatre).
- Compton, Susan P. (1978), *The World Backwards: Russian Futurist Books 1912–16*, London: The British Museum.
- Cooper Albright, Ann (2007), *Traces of Light: Absence and Presence in the Work of Loïe Fuller*, Middletown, CT: Wesleyan University Press.
- Danjoux, Michèle (2014), 'Interactive technologies, costume design and choreography', in Klaus Behringer and Johannes Birringer (eds), *Manifest der Interaktionskunst*, Saarbrücken: PoCul Verlag, pp. 37–48.
- Doyle, Oliver (2014), e-mail correspondence, 3 March.
- Fullman, Ellen (2012), 'A compositional approach derived from material and ephemeral elements', *Leonardo Music Journal*, 22, pp. 3–10.
- Garelick Rhonda, K. (2007), *Electric Salome: Loïe Fuller's Performance of Modernism*, Princeton: Princeton University Press.
- Kozel, Susan (2007), *Closer: Performance, Technologies, Phenomenology*, Cambridge: MIT Press.
- (2012), 'Embodying the sonic invisible: Sketching a corporeal ontology of musician interaction', in Deniz Peters, Gerhard Eckel and Andreas Dorschel (eds), *Bodily Expression in Electronic Music: Perspectives on Reclaiming Performativity*, New York: Routledge, pp. 61–70.
- Kruchenykh, Aleksei, Malevich, Kazimir and Matiushin, Mikhail (2009), *A Victory Over the Sun Album* (compiled by Patricia Railing; trans. Evgeny Steiner), vol. 1, Forest Row: Artist Bookworks.
- Loschek, Ingrid (2009), *When Clothes Become Fashion: Design and Innovation Systems*, Oxford: Berg.
- Lynton, Norbert (2009), *Tatlin's Tower: Monument to Revolution*, New Haven: Yale University Press.
- Manning, Erin (2009), *Relationscapes: Movement, Art, Philosophy*, Cambridge, MA: MIT Press.

- Massumi, Brian (2002), *Parables of the Virtual: Movement, Affect, Sensation*, Durham: Duke University Press.
- Maubrey, Benoît (2010), 'The history of electronic clothing', *Amber 07*, BIS, Istanbul, pp. 130–136.
- Merleau-Ponty, Maurice (2005), *Phenomenology of Perception* (trans. C.Smith), Abingdon: Routledge.
- McKirdy, Cameron (2012), e-mail correspondence, 9 May.
- Michielon, Vanessa (2014a), e-mail correspondence, 22 February.
- (2014b), e-mail correspondence, 13 March.
- Milner, John (2007), *A Slap in the Face! Futurists in Russia*, London: Philip Watson Publishers.
- (2009a), *El Lissitzky: Design*, Woodbridge: The Antique Collectors' Club.
- (2009b), *Alexander Rodchenko: Design*, Woodbridge: The Antique Collectors' Club.
- Monks, Aoife (2010), *The Actor in Costume*, Basingstoke: Palgrave Macmillan.
- Parviainen, Jaana (2012), 'Seeing sound, hearing movement: Multimodal expression and haptic illusions in the virtual sonic environment', in Deniz Peters, Gerhard Eckel and Andreas Dorschel (eds), *Bodily Expression in Electronic Music: Perspectives on Reclaiming Performativity*, New York: Routledge, pp. 71–81.
- Peters, Deniz, Eckel, Gerhard and Dorschel, Andreas (eds) (2012), *Bodily Expression in Electronic Music: Perspectives on Reclaiming Performativity*, New York: Routledge.
- Polanyi, Michael (1959), *The Study of Man*, Chicago: University of Chicago Press.
- Quinn, Bradley (2012), *Fashion Futures*, London: Merrell.
- Rowell, Margit and Wye, Deborah (eds) (2012), *The Russian Avant-Garde Book 1910–1934*, New York: The Museum of Modern Art.
- Seymour, Sabine (2008), *Fashionable Technology: The Intersections of Design, Fashion, Science, and Technology*, New York: SpringerWien.
- Stepanova, Varvara (1987), 'Today's fashion is the worker's overall', in Tattiana Strizanova (ed.), *Costume Revolution: Textiles, Clothing and Costume of the Soviet Union in the Twenties*, London: Trefoil Publications, pp. 173–74.
- Stern, Radu (2004), *Against Fashion: Clothing as Art, 1850–1930*, Cambridge, MA: The MIT Press.
- Trimingham, Melissa (2011), *The Theatre of the Bauhaus: The Modern and Postmodern Stage of Oskar Schlemmer*, London: Routledge.

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Michèle Danjoux is a fashion designer, illustrator and educator. She was appointed Principal Lecturer and Programme Leader for M.A. Fashion and Bodywear at De Montfort University, UK, in 2009. Prior to that she taught at Nottingham Trent University for a number of years, also coordinating the research activity for the Fashion Subject, 2005–2009. Danjoux's own artistic and research interests centre on design through and as performance and the interactive potentials of wearables in real-time immersive performance contexts. The work is interdisciplinary in nature, linking garment design to

sound and the performing arts, specifically dance. Currently undertaking a Ph.D. at London College of Fashion in 'Design in motion: Choreosonic wearables in performance', Danjoux's investigations are focused on the interrelations of body, movement, sound and garment aesthetics in the generation and exploration of audiophonic or 'sounding' garments to be worn in interactive performance environments. The work involves collaboration with dancers, choreographers, musicians and interface designers in the realization of design concepts and activation of prototypes. Her design films have been shown at Wearable Futures (Newport), IFFTI (Tokyo, Japan), Digital Cultures (Nottingham), Prague Quadrennial, DRHA (Dartington), ARTBAR, Museum of Contemporary Art (Australia). Her Teshigahara collection of intelligent garments incorporating sensor technologies was featured in the premiere of *Suna no Onna* at the Laban Centre, London (2007) and Watermans Art Centre (2008). In 2010, her first collection of 'sounding' wearables featured in the performance installation *UKIYO* at Kibla Multimedijski Centre, Kibla, Slovenia, and the Lilian Baylis Studio, Sadler's Wells, London. In April 2014, her latest collection of choreosonic wearables will be performed in *For the time being*, a dance theatre piece influenced by the Russian Futurist opera *Victory over the Sun*, at the Lilian Baylis Studio, Sadler's Wells. Her co-authored paper 'The sound of movement wearables' was published in the *Leonardo Journal of Arts, Sciences and Technology* in June 2013. She is co-director of DAP-Lab: <http://people.brunel.ac.uk/dap/dap.html>.

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