



The Sound of Movement Wearables: Performing *UKIYO*

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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 kinaesonic 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 *Mã*, 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, amplificatory and kinaesonic garments to be worn by dancers, actors and musicians in interactive/responsive environments.

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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.



Fig. 3. Interfacial design development: RedMutant prototype for Katsura Isobe's character in UKIYO [Moveable Worlds], 2009. (Photo © DAP-Lab)

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-

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 reinforcing the dancers' movements through avatic 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* wearable synths 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)



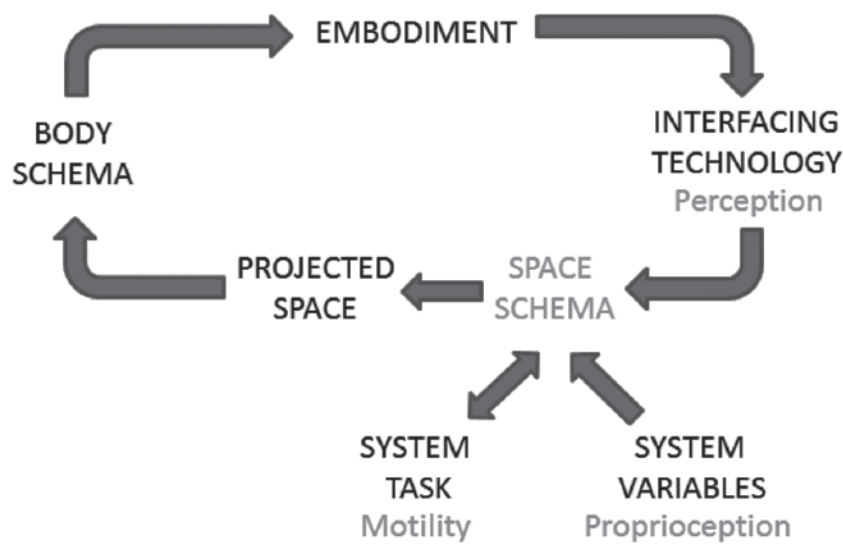


Fig. 7. The Space Schema connections for Creation Scene, 2011. (Diagram © Doros Polydorou)

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 leafness, 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-

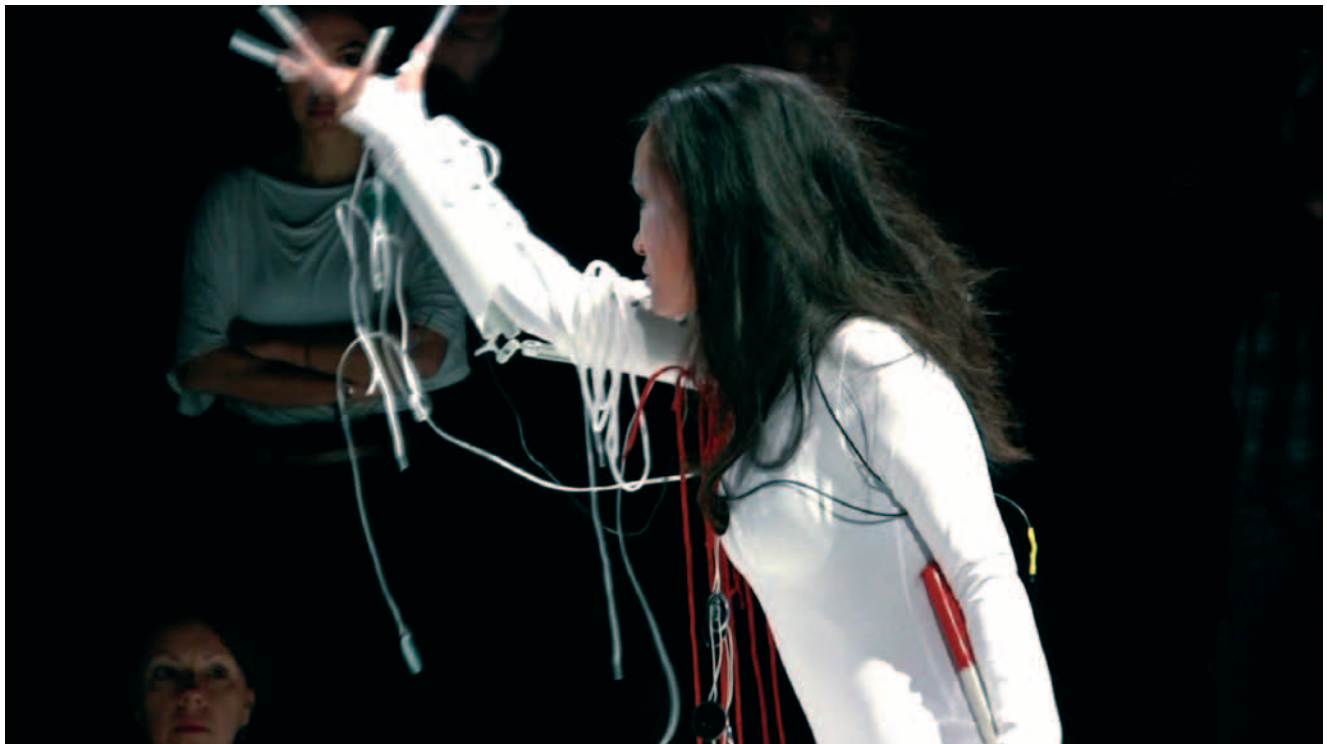


Fig. 8. *UKIYO*, Sadler's Wells, 2010. Helenna Ren as HammerWoman wears lycra all-in-one body, necklace of tiny speakers and hinged polypropylene prosthetic arm with integrated bend sensor, eyelets and lacing feature, talon extended, hand clutching hammer. (© DAP-Lab)

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>. For a video excerpt, see <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. Rollig, 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>.
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/>, 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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No. 1. Katsura Isobe as RedMutant with acoustic sleeve and partial corset, performing in *UKIYO*, in front of Olu Taiwo (at back left) as The Trickster with wireless headset and audience members. KIBLA Media Arts Center, 2010. (© DAP-Lab) (See article by Johannes Birringer and Michèle Danjoux in this issue.)



No. 2. *UKIYO*, KIBLA Media Arts Center, 2010. Helenna Ren as SpeakerWoman wears PVC trouser suit, shin pads and foam asymmetric hat and carries martial bo (staff) with 20W suspended spherical loudspeakers. (© DAP-Lab) (See article by Johannes Birringer and Michèle Danjoux in this issue.)