
Lifting Bodies: interactive dance – finding new methodologies in the motifs prompted by new technology – a critique and progress report with particular reference to the Bodycoder System

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This paper offers a critique of what are seen as key issues which are problematised within the field of interactive dance, centring on the role of the various artists and technologies involved in the development of interactive dance systems, the notion of interactivity versus non-interactivity, and the influence of traditional single art-form practices. The paper proposes that it is only through identifying the particular motifs promoted by the technology itself that a way forward can be found, and an interactive dance aesthetic can begin to emerge in earnest. The arguments presented in this paper are framed within the context of the authors' long-term work and collaboration within the area of interactive dance, and provides a detailed case study of the piece *Lifting Bodies* (1999).

1. THE BODYCODER SYSTEM – A BRIEF DESCRIPTION

The Bodycoder System is a sensor array designed to be worn on the body of a dancer.¹ It is a performance mechanism which enables the movements of a dancer to generate, affect, manipulate and control all aspects of a multimedia performance, comprising both audio and visual material. It is therefore a robust and reliable kinetic interface which is powerful enough to offer realtime control, and compact and tough enough to withstand the rigours of human movement. As well as movement detection sensors, the Bodycoder System also includes a

number of switches which provide the dancer with the means of orchestrating and determining the nature of certain compositional structures from inside the performance. This is a unique feature of the Bodycoder System, and is derived from the particular working practices and performance ideologies developed by the authors.

Because a dancer requires maximum mobility, a radio system is employed. The radio transmitter/receiver utilises licence-exempt 418 MHz circuitry. The transmitter and PWM coder (which is worn as a small belt pack by the dancer) is designed to accept either switched inputs and/or proportional resistive information from up to eight bend sensors. The coder/transmitter is used in conjunction with a customised eight-channel PPM receiver. In addition, a customised Peavey PC1600 MIDI controller is used to accept eight external control voltages from the radio decoder circuit which can then be routed to a variety of MIDI hardware/software options. The Bodycoder System uses small resistive bend sensors, backed with spring steel and enclosed in heat shrink sleeving. These are placed over the dancer's joints and are usually incorporated into a skin-tight costume, or sewn into support bands which can be positioned over the arm and knee joints. The bend sensors are accompanied by four (expandable to eight) switch elements which are housed within a glove. The switches can be assigned a variety of functions from piece to piece and from software patch or preset. Similarly, the expressivity and range of the bend sensors can be changed during the course of a piece. This will be discussed in more detail within the main body of this paper.

2. GROUND ZERO

When in 1994 we began to formulate our ideas for an on-the-body sensor suit, our main objective was to develop a system which reflected and enhanced, in terms

¹See publications which chart the evolution of the Bodycoder system: Bromwich, M. 1995. A single performer controlled interface for electronic dance/music theatre. *Proc. Int. Computer Music Conf.* San Francisco.

Bromwich, M. 1998. Bodycoder, a sensor suit and vocal performance mechanism for real-time performance. *Proc. Int. Computer Music Conf.* San Francisco.

Wilson, J., and Bromwich, M. 1999. *Inside/Outside – The Bodycoder System for real time manipulation of sound and images within an electronic theatre environment.* KlangArt Osnabrueck, Germany (publication pending).

of its technical function and ideology, the type of collaborative process we had been developing – a creative process in which we became increasingly involved in each other's musical and choreographic compositional processes. From the beginning we set out to develop a system which was an embodiment of the depth and coexistent nature of our collaborative process, and in the firm belief that 'communication, creativity and growth occur together or they do not occur at all' (McLuhan and Zingrone 1995: 187), the system was to become a physical platform for the continuation of our creative development. Since its inception, the Bodycoder System has indeed allowed both our compositional and aesthetic ideas to grow, though not without some revelations and tough realisations along the way.

As early as 1995, and after the first piece entitled *Bodycoder* had been composed and premiered,² it was clear that there were some fundamental problems which needed to be addressed. These were not so much technical as aesthetic and art-form based.

3. TECHNICAL VERSUS AESTHETIC OBJECTIVES

We quickly identified that in spite of our strong interdisciplinary collaborative process, either consciously or unconsciously, we were still attempting to work within the aesthetic remit of our own respective art forms of dance and music. We, like many other developers in the field, had unwittingly fallen into the trap set by our own prejudiced expectations, limited aspirations and essential need to work within familiar frames of reference. The Bodycoder System defied our naive expectation that we could simply throw dance and music together and come up with something worthy. The possibility of establishing a relative proximity between dance and music that new technology seemed to offer became a mirage which shimmered across a problematic desert filled with shallow dried-up concepts, redundant tools and working practices. Nothing would be simple, and nothing could be taken for granted from then on.

Looking at our work from across this desert of disappointment, we discovered that more often than not our perception was coloured by our independent art-form standpoint and our consequential aesthetic gaze; the gaze of a dance practitioner and a composer attempting to pioneer new practice within their respective art forms. As a result, neither one of us felt that our particular art form was in any way enhanced through the use of new technology, or indeed through this type of collaboration. Of course, there were moments of brilliance in the work, and at these times we were able to glimpse the immense possibilities – the articulate fluidity of dance and music. Particularly noticeable at those moments was a sense

that we were looking at a different kind of creative presence on stage, something which had depth and a kind of sensuality which engaged the audience, causing the viewer to see beyond the simple cause and effect of interactivity for its own sake. At such moments we forgot about what the technology was doing, we forgot to look for the causality and instead began to witness the phenomenon which might be described as a dynamic performative osmosis.

Over the next few months, we backtracked through our development process in order to find the origins of our dissatisfaction, finally coming to the conclusion that perhaps some of our initial objectives were naive. We had forgotten the prediction offered by Marshall McLuhan that 'new technology creating new basic assumptions at all levels for all enterprises is wholly destructive if new objectives are not orchestrated with the new technological motifs' (McLuhan and Zingrone 1995: 187). Our initial objective was simply to make music out of dance – to create a hyperinstrument – to naively transform the dancer into a musician/instrumentalist. We were not alone – a number of composers and technologists continue to fall into the same trap. A trap initiated by the ideas that new technology can close the gap between dance and music, dance and visual manipulation, and the highly mechanical notion that dance is merely a raw machine which has the potential to generate data which could therefore be detected and transformed by mechanical, mathematical and computational means into other similarly mappable audio and visual parameters. In this scenario, technology is simply a glorified detection and transformation system, and in accordance with McLuhans' astute prediction, it is therefore the mechanical and computational motif which dictates the aesthetic nature of the work produced. This is very much in spite of the fact that we might create arguments for much grander aesthetic values, reinterpolating the *pin the tail on the donkey* action of what is actually going on as highly refined art-form practice, when in fact the big issues which surround both the development of technology and the practice of interactive dance are barely confronted.

4. CONFRONTING DIFFICULT ISSUES

New technology produces a number of preconceptions. One of the most seductive is the possibility that it might be used to close the gap between dance and music. This in itself has proved to be a highly incendiary concept which has ignited and highlighted a number of basic issues surrounding the whole notion of dance and technology. In attempting to 'liberate' the dancer from his/her traditional role as subservient, by providing him/her with the means of controlling and manipulating sound, in attempting to reduce the gap between composer and choreographer, in attempting to create an interface

²As part of *The Anatomy Class*, Electronic Dance Theatre at the Lawrence Batley Theatre, Huddersfield, England, 1995.

between dance and music through the use of new technology we, like a number of our colleagues, have created another gap; the gap between the interactive and the non-interactive and the skill-based difference between the single established art forms of dance and music, and the seemingly poor and less skilful sister, the interactive genre. This is an issue we will return to in explaining our concept and practice of 'online' and 'offline' working within the following sections of this paper. Perhaps we got our objectives wrong, perhaps they were based on a kind of postmodern romantic ideal which nevertheless hearkened back to old artistic roles, models and tired methodologies. For instance, what do developers mean by an electronic 'instrument' in terms of interactive dance? Where is this so-called instrument located – in the hardware or the software, on-the-body, or off-the-body – is it a thing in itself, or is it a conceptual frame, what are the implications inherent in the use of the term 'instrument', does this then imply that there has to be an instrumentalist? Use of the term instrument has strong historical resonances – one cannot help but think of a piano or a violin when one uses the term instrument, and it seems that a number of composers and technologists have been thrown off their developmental course by attempting to create electronic instruments which adhere to the basic features of historic examples: evidence the preoccupation with creating 'tactile' response of a type which is appropriate for a traditional acoustic instrument, but which is not necessarily appropriate for dance. Another result of this way of thinking has been to limit our understanding of the role of the dancer to 'instrumentalist' at its most sophisticated, and as a site of data initiation and acquisition at its most dehumanised and simplistic. Our dystopia is derived from our inability to move forward, and our reliance on past categorisations and methodologies to shape our would-be advances. We remain 'technological idiots' and 'our most impressive words and thoughts betray us by referring to the previously existent, not to the present' (McLuhan 1970: 16).

The culture of 'allowance' which has grown up around interactive dance, displays itself in the documentation of projects and research,³ and provides further evidence of the influence of traditionalism which consistently marginalises the role of the dancer within interactive dance works. The notion of 'allowing' a dancer to manipulate, 'allowing' a dancer to control . . . suggests that there is an authoritative figure dictating what the nature of that control might be. It is not that this might be a 'someone', but rather that it is a 'something' which is holding the role of the dancer within certain artistic constraints. This 'something' might be the prescribed traditional role not only of the dancer, but also

of the technologist (developer) and the composer. It is perhaps fear of transgression which is holding some artists back from piercing through the traditional roles to explore the new role, responsibilities and nature of the interactive artist which is being prompted by the technology itself, namely that the dancer must become both technologist and composer, and the composer become a greater physiological practitioner aware of the physical consequences of his/her musical and compositional decisions. It is perhaps also fear of departure from pre-existing art-form frames and practices which is holding many artists back from realising the full aesthetic potential of interactive dance practice.

One fundamental principle of the design of any 'expressive' interface which has a human being at one end and a computer at the other, is that although it should be as intuitive and natural to use as possible in terms of its physical modelling, it should not 'eliminate the necessity of concentration, skill and imagination' making it a 'challenging MENTAL interface' (Machover 1992) as well as an effective mechanical one. Within our own work we take this to mean not only the development of our pre-existent skills but the acquisition of new skills and the exploration of new compositional processes proposed by the technology itself. Within the design and implementation of the Bodycoder System, these challenges are faced head-on.

The Bodycoder System has never been a system for collecting 'passive' data information from the movements of a dancer, but it has always been important for us to develop protocols which mean that the dancer can make decisions from inside the performance. The system has always provided the dancer with a primary level of control, such as being able to start a piece, and stop it at any point in the performance, a basic on and off control function which, in other systems, is often abdicated to the technologist/composer who sits behind the computer. From its inception, the inclusion of a series of switch inputs were used not only for musical purposes, but in order to provide the dancer with a means of navigating through the architecture of a piece. This ideological concept also allows for the development of architecturally complex compositional pieces. Switches are also used to initiate or curtail certain events, act as toggles between various musical states or vary internal processes depending, for example, on the time the switch is closed, and to activate or deactivate individual bend sensors.

The bend sensors can be similarly used to control any function programmed in a patch whether that be a hardware-specific patch in, for example, a synthesizer/sampler or a patch developed within a computer system such as MSP. The use of System Exclusive programming and the ability to program using raw MIDI strings, via the systems' PC1600 controller, allows an intimate control of external devices without the need for a host computer. For example, in *Zeitgeist* (premiered June 1999 at Klang-Art, Osnabrueck, Germany), we used this type of direct

³Siegel, W., and Jacobsen, J. 1998. The challenges of interactive dance: an overview and case study. *Computer Music Journal* (Winter). Massachusetts Institute of Technology.

audio control to manipulate samples stored in a large-capacity sampler (an Emu4x) with the computer hosting only the visual software and visual images. In this way, the dancer is able to interface directly with the sampler and affect such parameters as frequency and amplitude modulation, depths and rates, pitch either quantised or totally variable, various forms of filter modulation, filter morphing, sample start time, volume, pan, envelope rates, and so on. In *Zeitgeist*, the level of primary control was increased and developed in line with the dancer's increased creative needs and confidence with the system. Particular attention was paid to the manner in which sounds evolved, and most sounds were developed as multi-layered cells comprising a number of structural/textural elements which could be navigated, isolated and mixed in real time by the dancer. The choreography tended to be shaped by a sense of the extra-dimensional significance of gestures executed within the environment of the system. More often than not, the movements found a level of appropriateness which, in terms of this particular piece, may be considered as symbolic. *Zeitgeist* created a strong multi-dimensional world in which the dancer was an initiatory and active participant. The type of skill and focus required to exist within such an inter-dimensional performance environment is unlike the level or quality of concentration and focus which is normal for dance. Acute awareness of the audio and visual projections initiated, manipulated and controlled by the dancer's physicality leads to a sensation of expansion which requires a level of internal focus on detail and precision, and a kind of 'virtual' awareness of the compositional architecture. This extreme internal and external focus at first appears schizophrenic, but in reality forms the basis and reflex of the new interactive performance modality. As McLuhan suggests, the 'user of electronic media bypasses all former spatial restrictions and is present in many places simultaneously' (McLuhan and Zingrone 1995: 370) as both a disembodied and an embodied intelligence. It is this postmodern state of being-in performance which acknowledges the inherent nature of new technology to both explode and implode ideas, images and bodies into the 'technoscape' of the hyper-real (Kronker and Cooke 1986: v). This sensation of both imploding into the sensuality of the body and exploding in terms of the size of the projection created by physicality is largely produced by the type of synaesthetic experience of hearing movement, seeing sound, and being absorbed and intimately involved in the dimensional architecture of the compositional structure. It is a necessary intellectual/sensorial skill and performance modality embedded within the Bodycoder environment.

The sensuality of the environment resists all notions of translation. By translate we mean, in this instance, to change a movement into sound. The notion of one-to-one translation is perhaps a symptom of our isolationist

single-art-form stance, translation meaning the transformation of one language into another. This term does not suggest a combination of languages, or the development of a hybrid language, or even the development of a separate language entirely: the language of interactive dance. Translation actually implies separation. Although we might have hoped for translation, what we discovered the Bodycoder System actually does is 'en-code'. In other words, it does not so much translate as add to and codify with widening significances, both movement, visual and audio gestures. The most sophisticated gestural systems – those of Asian dance, for example – bring into play all segments of the limbs, even the fingertips, and vest them with symbolic, even cosmic significance. In the same way, the Bodycoder System encodes some of the limbs and fingers of the body with audio and visual significance, and *vice versa*. Gestures and movement have an immediate *gravitas* which registers on acoustic and visual levels (online). Even at moments when the dancer moves freely without affecting sound or visuals (offline), there is a gravity and a close attention to detail engendered by the unique atmosphere of significance. The dancer remains in a state of audio-kinetic awareness in which she is simultaneously and dynamically aware and in control of the reactive (offline) and interactive (online) interior and exterior of the performance. Although we have previously referred to this process as a form of navigation, recent compositional developments, and the increased multiplicity of events which take place within the interior of the performance, have exceeded the realms of a single navigational procedure into multi-tasking, informing a type of dynamic perception which is unique. Aesthetic and compositional developments progress in terms of depth as much as they do in terms of linearity. The use of 3D graphics in, for instance, *Zeitgeist*, emphasises this aesthetic drive toward the opening of depth, as do the type of audio palettes used and the kind of interior sound manipulation directed by the dancer.

Instead of creating distance both physical and aesthetic – the Bodycoder System creates the possibility of depth in which the creation of a variety of aesthetic spaces, in which any number of performance events can occur, are being formed organically and enclosed and supported within the kind of performance architecture which the system imposes. Here aesthetics follows a logical and harmonious path set down by the technological motifs of the system itself. One is aware of seeing the performance perspectively. One may speak of 'horizons' both visual/acoustic/performative and atmospheric against which foreground elements are generated and manipulated in real time. Being aware of the multi-dimensional quality of the work is now of major concern during the collaborative/compositional process, as is the attention to allow room for 'spaces', both physical, audio and visual, to occur naturally within the work. This means not allowing ourselves to use the system like

a sledge hammer, i.e. not using all of its potential either physically, acoustically or visually at once, but being aware of the manner in which gestures, sounds and visual images coalesce and develop into a strong multi-faceted language.

5. LIFTING BODIES

In *Lifting Bodies*, premiered 11 October 1999 at The Trafo, Budapest as part of the *Making New Waves* festival organised by the Hungarian Computer Music Foundation in association with the British Council, we used the Bodycoder System in conjunction with MSP to expand and develop an 'open' compositional architecture and a performance philosophy which utilised the artistic and technical skill of the dancer.

Lifting Bodies employed MSP for soundfile manipulation and source generation. The piece consists of two musical compositional elements: a granular patch and a cellular patch. The granular patch, originally devised by Nobuyasu Sakonda, was used as the first of these two elements. Two pre-composed four-second soundfiles were used as the sound sources for the granular patch, and these samples were individually broken up into variable-duration grains to be processed and manipulated by the actions of the dancer. Sixteen presets were pre-programmed to set up control mappings. Realtime control of the patch was achieved by the mapping of sensors to variable elements within the patch. The control elements consisted of soundfile scrolling, random sequencing speed, loop length and playback speed. A dedicated finger switch enabled the dancer to advance through and select any of the sixteen presets.

The second element in the piece consisted of a set of twenty-five sine-wave oscillators, each oscillator harmonically related to each other with pitch transpositions implemented using principles based on cellular automata. The original cellular patch, written by John Eichenseer, was modified to accept external control and used a bank of eight presets to recall different control mappings. The presets were recalled by detecting when the right arm bend reached a maximum value.

6. CONTROL FUNCTIONS, ANATOMY AND PROTOCOL

Three switch elements were dedicated to enable or disable the sensors: finger switch one corresponding to the left elbow sensor, finger switch two corresponding to the right elbow sensor, and finger switch three to the right knee sensor. These switches were held to enable and released to disable the sensors. This enabled the development of an 'online' and 'offline' working practice which will be discussed in more detail in the next section of this paper. The fourth switch initiated granular patch changes and was also used to start and stop the piece.

Within the MSP environment it was possible to use

the whole 0–127 range of a sensor for control or use a portion of the range, for example 50–90, to effect the same amount of control. This provided the dancer with either a wide physical expressivity or a more limited physicality which required delicate, finite control.

The range of control was set for each of the sixteen granular presets by using mapping subpatches to translate the fixed movement range of 0–127 to variable ranges specific for each preset (figure 1). Being able to vary the range of control from preset to preset, and from sensor to sensor, it was possible to build a compositional architecture which was synchronous with varying movement qualities and emerging choreographic ideas developing within our compositional process.

Each preset also held values to set up different loop lengths and pitch control data. This was mapped using the information received from each sensor independently. So for instance, by varying the position of the arm, the dancer was able to manipulate sample scrolling resulting in a wide range of textural control. The same arm sensor could also be used to control random sequencing speed which could be recalled in specific presets by the dancer. The mapping facility also allowed us to compensate for shallow bend information from, for instance, the knee, which only gave values between 0–80. This also gave us the option to either sensitise or desensitise any sensor independently according to the choreographic/musical needs within each developing patch/section of the performance.

The knee sensor was dedicated to control the volume of the cellular subpatch. By bending the knee, the dancer could balance the audio level and mix of granular and cellular components. The second arm sensor controlled the cell update period or the cell randomisation period according to the prescribed and variable protocol within a particular preset (figure 2). A simple nine-way gate ensured that the routing for the sensor was matched with the correct scaling required for that control function. Each preset in the cellular subpatch also recalled variables preprogrammed for each preset; these included harmonic limit, rates of change, random base frequency and whether the cell update function was active or not. The recall of each preset activated a simple envelope shaper to fade out the previous preset and fade in the new preset; this prevented audible clicks and also gave an organic feel to the transitions within the performance. By selecting switch two, and activating the right arm sensor, and by performing a full arm bend (sending the maximum control value of 127), the dancer is able to advance through each of the nine cellular presets.

7. ONLINE AND OFFLINE WORKING

Online and offline working refers to the various levels of interactive control and oblique expressivity which the Bodycoder System enables and enhances.

Being able to dictate when a sensor is 'off' or 'on', in

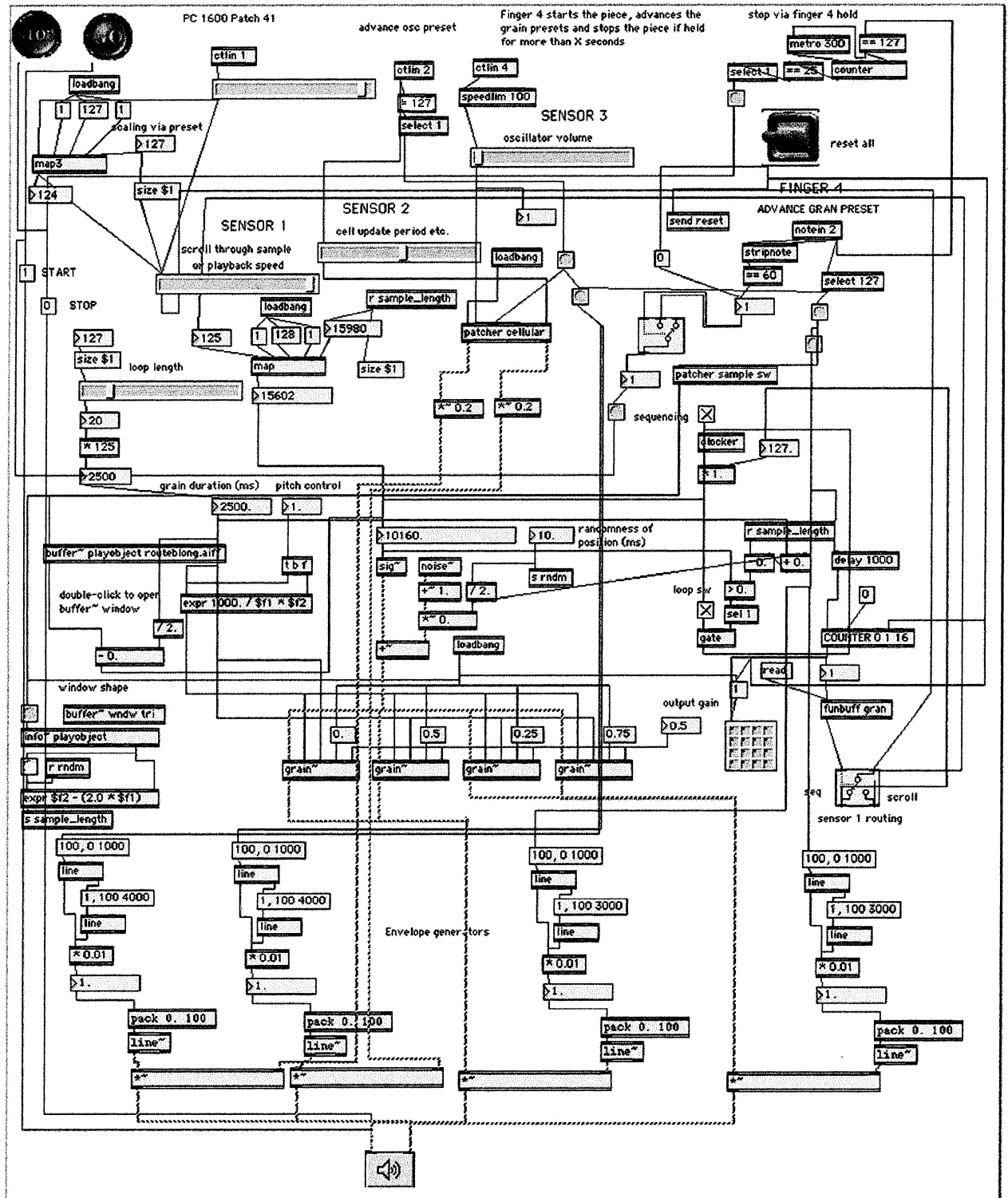


Figure 1. Granular main patch.

other words when a certain part of the body is singularly expressive or a centre for multiple expressivity in the form of physical, acoustic and visual signatures, provides the dancer with an ability to dictate, orchestrate and build expressive complexity spontaneously within the moment of performance. It is a compositional motif

which is generated out of the basic principles of interactive work, and is synchronous with the protocols embedded within the design of the technology itself. Online and offline working is an aesthetic motif within this type of work which, once acknowledged, provides a key to the development of an element of interactive dance

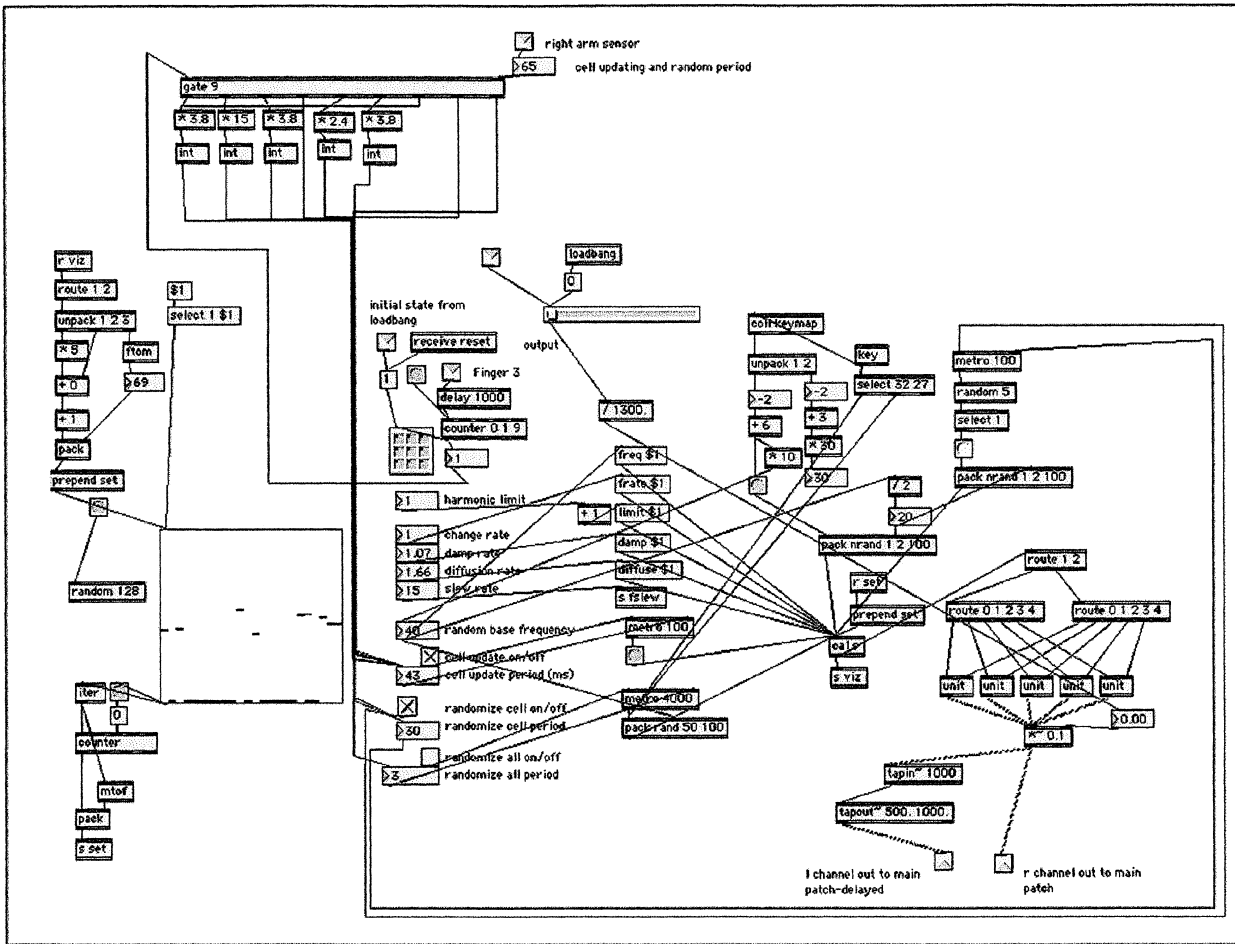


Figure 2. Cellular subpatch.

‘practice’ which initiates a level of equality between the dancer and the composer/technologist, which in turn provides a ‘space’ for the development of a more dynamic and complex interplay of freedom and expressivity.

We would like to propose that the notion that online and offline working provides a conceptual/aesthetic solution to the problem of the integration of interactive and non-interactive states within performance. Online and offline working, within the context of a single performance piece, is an umbrella protocol and performance ideology which enables a dancer to perform without mechanically (physically) affecting other compositional parameters, i.e. music or visuals, and justifies a composer’s use of pre-composed soundfiles within the context of an interactive dance piece.

In *Lifting Bodies*, the dancer works within a structured improvisational frame. Six cellular choreographic sequences are expanded, fragmented and reconstructed through improvisation, and become the departure points for new organically generated sequences. As well as choreographic improvisation, the dancer generates a unique realisation of the musical composition. Both the musical and choreographic composition are completely influenced by the dancer’s realtime in-performance

decisions and her audio-kinetic awareness, which moulds, orchestrates, mixes, balances, generates textures, dynamics, captures speeds and dictates a variety of possible events. A strong compositional architecture provides the dancer with both the freedom to improvise and a structure in which to work with a variety of musical and choreographic elements within an appropriate context, the parameters of which are negotiated and refined during the collaborative production process.

8. SUMMARY

In this paper we have tried to put forward, infer, and open for debate some issues concerning interactive dance. We have attempted to describe and illustrate some of the concepts and ideologies which are beginning to shape our own work within the field. We have outlined a performance modality; a being-in performance, which we have suggested arises out of the relationship of dancer to new technology. It is a state of being-in performance which is prompted by technology itself, and proposes a new performative landscape, the rhythms, nature, language and dynamics of which are yet to be fully explored by interactive artists. Above all, we have

tried to stress the importance of working within the motifs that new technology proposes, and the need to break free from an outmoded traditionalism which continues to restrict both technological and artistic advances within this emerging art form. In the words of Deleuze and Guattari:

We know nothing about a body until we know what it can do, in other words, what its affects are, how they can or cannot enter into composition with other affects, with the affects of another body, either to destroy that body or be destroyed by it, either to exchange actions and passions with it or to join with it in composing a more powerful body. (Deleuze and Guattari 1987)

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