

Digital Technology in Choreography: Issues and Implications

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Abstract

This paper examines issues which arise from the use of digital technology in dance. In particular it focuses on the contribution made by, and issues which are raised by the use of interactive technologies in choreographic works. The main features of the interactive technologies are outlined, including its character as a non-linear improvisatory system, as are the effects of such technologies. Amongst the latter, it is noted, is the emergence of a new form of choreographic practice, the performative or choreographic installation. Further argument is forwarded which suggests that interactive dance works embody some of the philosophical changes which have taken place in the second half of the twentieth century, and directly participate in the reconfiguration of the concepts of the artwork and of authorship which has formed an important strand of philosophical debate in the arts during the latter half of the twentieth century.

Introduction

In this paper I will be examining some of the issues which arise from the use of digital technology in dance. These range from discussing the nature of the contributions digital media is making to dance to some more philosophical concerns which are raised through its use in choreography.

As Prof. Yang Sook Cho (2000) has shown digital technology incorporates a number of different types of media, each of which can contribute to choreography in different ways. Digital technologies can be used for a variety of purposes such as facilitating the production of notated dance scores (Labanwriter and Calaban), or the documentation of dance works using video, photography and textual commentary, as well as notation (DanceCodes). These however are not my concern in this paper. Rather my concern lies with forms of digital technology, such as digital animation, the motion capture systems which provides the data from which many such animations are increasingly being generated, digital audio, digital video, interactive media, telematic media, which are used to enhance or supplement the content of choreographic works. These technologies are relatively recent introductions to the choreographer's palette. I will not be exploring the implications of all of these in the context of choreography, as Cho's paper discusses them in some detail.

Digital Technology as Medium or Tool

In a choreographic context, digital technology for its own sake is not of great artistic interest. It is in essence a sophisticated tool which enables the enhancement of the choreographer's art. As with any tool, whether it be a choreographic device, a dance technique, a lighting design, digital technology itself can be used in a multitude of different ways, according to artistic intentions. Its contribution to the work is as limited or as expansive as the artists' imagination (and of course skill in manipulating the digital technology). The self-same digital technologies are used by choreographers, video artists, installation artists, visual artists to produce works with a very different look and feel. In dance pieces may use motion capture and animation technology to generate digital representations of the human body, with which the performance environment is then peopled. However, these animated figures may have textures not generally associated with computer animation technology, as in Merce Cunningham's *Biped*(1999), a collaboration with digital artists Shelly Eshkar and Paul Kaiser of the New York based company Riverbed. However, other artists may draw on more conventional renderings of the raw animation data, as does Yacov Sharir of University of Texas. Or artists may use the data from motion capture to generate fluid non-representational or abstract designs, as in Merce Cunningham's newest work *Fluid Canvas* (2002), also a collaboration with Riverbed.

It is apparent from these examples that the aesthetic contribution made by the animation software is not intrinsic to the software itself, rather it is generated by the artistic ideas which are driving the choreographer and/or collaborating visual artist for that particular work. Because of this choreographers from the world of classical ballet, from mainstream modern dance or from 'postmodern' dance could all develop work using the same digital technologies, yet still make works which remain within their own artistic and stylistic preferences. Similarly, interactive technologies and telematic technologies can be used to generate dances in a multitude of dance styles, for these systems are a merely a very sophisticated means of structuring choreographic events in real-time. The art of the digital dance work, it is important to emphasise, lies with the artist and the use they make of the technologies, rather than in the technologies themselves. As such digital technology is a merely a servant to the choreographer's artistic vision.

However, some technologies are more than tools. Indeed some may be more akin to a medium than a tool. In the 1980s the medium of video allowed the development of a new genre of choreographic practice, which developed its own conventions and opened to door to new ways of thinking about choreography. So too might certain forms of digital technology provide a framework for choreography which opens up new modes of

practice, and new ways of thinking in and through dance. Amongst these are those forms of digital media which allow for real-time interactivity . These may prove to be a new medium , not merely a new tool, for choreography. This is indicated by the fact that some features of this digital medium raise interesting philosophical questions which have the potential to extend and enhance our understanding of what constitutes the choreographic art.

Interactive Digital Media

Interactive digital media are, in many ways, simply very sophisticated structuring systems which allows artists to engineer the integration and layering of multiple strands of the dance medium in real-time. It allows an interactor to change the form, content and quality of the artwork as they engage with it and, in the dance world, has given rise to the development of new modes of dance performance in which the performers generate and modulate the setting in which they perform. It has also given rise to a new mode of dance event, the 'choreographic', or 'performative' installation (of which more later). Additionally, it has brought into sharp focus questions concerning the nature of authorship. If the performer, or indeed 'audience' is empowered to change the environment in which they perform, in what sense can the originating artist/s be said to be the 'author' of the work? Because interactive technologies require us to ask such questions, I would suggest that they not only extend the possibilities available to the dance artist, both in terms of form and content, but also open up the possibility of using choreography to interrogate complex philosophical issues.

But first a brief explanation of what an interactive environment is. An interactive CDROM, such as that I am using at the moment, is a simple version of a screen based interactive environment. Here buttons or hotspots are activated when the mouse passes over them or clicks on them and trigger an event, which might be a change of image, or the display of new text or sound. They can be used for the most simple of purposes, as I am doing now, or can be used to generate an art work in its own right (e.g. *Windowsninetyeight* (1998) by Igloo). More complex versions of screen-based interactive environments are found in computer games such as *Myst*, or *Doom*. Here a complex network of rules which respond to user responses are built into a game system, and generate ever changing behaviours on the screen. These highly sophisticated systems could very well be adapted for use in choreographic works.

There are, however, other types of interactive environment which go beyond the screen. These are more complex than the simplistic click and go technologies of the CDROM, though not yet as complex as the game systems mentioned above. These interactive environments extend the world of digital media from the screen and have been designed

by artist-programmers specifically with embodied or spatial interactivity¹ in mind. Some systems comprise forms of wearable technology (Troika Ranch's MIDIdancer, for example, and the system developed for Cho's recent interactive work *Survival Game* [2000])². These allow the performer to generate imagery directly from the movement of their limbs and torso. Electronically sensitised spaces, such as The Intelligent Stage, Isadora (Troika Ranch) or those designed by companies such as Palindrome Dance Company³, extend this potential into general space. Here the installation or performance environment itself is sensitised by invisible electronic triggers and processing devices which are embedded in the 'empty' space which lies between the boundaries of the physical environment. They are activated by the motion of a body, or several bodies, as they move in and through the space. By virtue of this performers, and in an open installation the viewer, can control the presence and absence of the imagery in the performance environment or installation, and modulate its qualities in real-time. The electronic triggers and processing devices comprise part of in a complex network of interactive possibilities which are programmed to respond in certain ways to certain types of movement. A simple example might see a slow gesture moving in a clockwise direction generating one kind of sound event, and a similar gesture in an anticlockwise direction producing another kind of sound event. Or a travelling movement towards one area of the space might increase or decrease the volume of a sound, or change its pitch, or make a video image fade, or move towards you, or retreat from you, or change colour, whilst another would create a different series of effects. Or the generation and modulation of sound might be generated by relationships between people in the space. Two or more performers moving close together, for example, might cause the sound to change, or the lighting to fade, or a series of images appear in the space.

Such environments clearly allow performers and/or audience to modulate the environment in which they perform in real-time. In this way they are able to generate mood, to create the musical score, to conjure up and dance with a virtual cast of dancers, or to change the physical characteristics of the world they are inhabiting (from city to country in a second for instance by changing the projected video environment). For the first time the performer/s have the power to control the way a work is seen and

¹ Spatial interactivity is effected through full body motion, either through immersion in an electronically sensitised space, or through the wearing of an electronically sensitised garment of some kind. It engages the "...sensitivity of sculpture and/or dance, the kinaesthetic aspects of embodiment" (Penny,1995), and is used extensively by digital artists who come from an installation or performance background.

² Cho (2001) pp.131-136

³ Palindrome (<http://www.palindrome.de>) is a dance company based in Germany which specialises in dance works designed for interactive spaces. The Intelligent Stage is a system developed by Robb Lovell and John Mitchell at the Institute for Studies in the Arts at Arizona State University (<http://isa.f.a.asu.edu>) Isadora is a system recently developed by Mark Coniglio of Troika Ranch (<http://www.troikaranch.com>)

experienced in all its dimensions. They become responsible for altering the ambience and content of their performance environment and ultimately for controlling the aesthetic shape of the work-event⁴. This introduces a significant change in the role of the performer, whose responsibility prior to this in a performance context has always been to provide the movement strand of a dance work only.

Interactive technologies and Choreography

However, interesting though this might be, the capacity to change the environment in which one performs, although novel, does not necessarily constitute a major shift in choreographic practice if the performers' movements are strictly choreographed according to a predetermined choreographic structure. Interactive digital media only begins to make a significant contribution to choreography as an art when its underlying principles are taken on board, and become central to the choreographing thinking which underpins any work using interactive media⁵. Some of those principles are explored below.

An interactive, or responsive, environment is by nature improvisatory. It is non-linear in structure, and can produce several different work-events from a single compositional framework, or system. Each interactive environment is designed by the artist-programmer to create a means through which multiple strands of digital imagery can be articulated. As such it serves as a structuring system through which the multiple strands of work-events can be generated spontaneously in real-time.

Interactive art works are composed of two distinctive parts, each of which is designed by the artists involved in the making of the work⁶. It is probably easier to think of this type of work as having both a visible and an invisible component. The visible component of an interactive dance environment generally comprises a combination of video imagery, digitally generated animations, 'VR' environments, and electronically generated sound which are either played through a computer screen or projected onto the environment in which the work is mounted, and of course the movement material and relationships generated by the interacting performers. The video imagery will inevitably include movement images, whether these be representational or abstract, and the sound is generally spatialised, that is it travels from one part of the performance environment to another.

⁴ I use the term 'work-event' rather than 'performance' in this context to enable me to accommodate under this description the spontaneous rendering of the interactive work by viewers as well as performers.

⁵ It is perfectly possible to create a conventional dance work, that is one which remains the same from presentation to presentation, using an interactive system. This does not however, exploit the principles which underly the medium to the full, and is therefore not a central concern of this paper.

⁶ Interactive artworks tend to be made by two or more artists working in close collaboration. One of those artists is generally a choreographer, the other a digital artist, programmer, or digital composer.

The invisible component of an interactive environment is of central importance to its intentional logic. It constitutes a complex non-linear system of electronic triggers and computerised instructions for processing the sounds and images which are generated by the triggers. The system is designed and built on a computer, using a programming language of some kind⁷, and then mapped on to real space⁸. This 'invisible' environment drives the work, determining a variety of factors concerning its presentation, including the kind of electronic manipulations which are to take place during the event. As such it is an intrinsic part of the work's content and is an important part of the intentional logic of the work.

The interactive system is an open-ended system. Because its network of triggers and rules for responses are non-linear in form, at any point in the process of generating a work-event in an interactive environment a choice as to what to do or see or experience next is available to the performer or viewer. Indeed, in many ways the interactive digital system resembles the rules for a structured improvisation. The system constitutes, if you like, an electronically generated improvisational framework. The digital imagery which comprises the fluid environment in which the interactor moves is brought to presence, and in some instances its qualities modulated in real-time, when the electronic triggers and processes⁹ are activated by the performers/viewers. Each of these strands of imagery (sound, image, text) is regulated by an individual set of rules for action which is embedded in the computer programme, and which initiates the display of the imagery, and the form of electronic processing which takes place as it is presented.

These rules are complex and are frequently devised by the designer of the interactive environment, generally in collaboration with the choreographer. In a very real sense they constitute part of the underlying choreographic system or structure. That structure is not however the closed structure of the conventional dance event, but an open-ended structure in which the imagery can appear in any order, and be imbued with a multitude of qualities, according to the decisions of the interactors. As individual systems of imagery intersect when the interactive environment is activated by a viewer or performer, they generate a fluid, interplay of the strands of imagery which make up the dance event.

⁷ This programme may be written in a pre-existing piece of software (e.g. MacroMedia Director), or may be a new software environment designed specifically for the work.

⁸ This is achieved by placing a camera in the space. The image it captures, and the changes which take place in the image frame by frame is sent to the computer. This data is fed into the computer programme which uses the information to trigger and process the sound and/or visual events which make up the environment

⁹ The processes referred to here are akin to the processes which allow an electro-acoustic composer to process raw sound to make of composition, or the video artist to manipulate various parameters (e.g. example, colour, scale, luminance) of the video image.

I noted earlier that the activity of the performers constitutes but one strand of the imagery which is integral to the interactive art work. It is not, however, necessarily the most important element of the piece, as it might be in a more conventional dance performance. Ideally, in an interactive digital dance work the shifting, modulating digital images which are generated by the performer become an integral part of the choreographic structure, part of the choreographic content, not merely a setting against which movement takes place. Indeed, some of the images the performer manipulates might even be representations of dancers, and thus become a 'virtual' cast. In this case the 'setting' or environment ceases to be a background in which the dance takes place, but instead operates as a second, even third, layer of performance imagery, an extra cast of virtual dancers if you like, with which the performers can interact. Similarly, when the performers modify the mood and expressive form by changing the qualities of the musical environment, or the direction of the motion of video images, or the dominant colour of the imagery within which they move in real-time, they are generating part of the choreographic whole, not merely a background to the dance.

Now, if the performance system which guides the behaviour of the interactive environment constitutes a structured improvisation, the interweaving of the strands of imagery, both real and virtual, will always be different. The performers will thus generate different expressive emphases from one work-event to another, and reveal different facets of the work. If they have a fixed choreographic form to follow, any differences will be minor, and a stable dance artefact will result. Thus the use of interactive media does not necessarily extend the possibilities available to the choreographic art. However, the use of an performance improvisation system in an interactive space, because it is itself a form of interactive system (i.e. it is a set of rules for making choices with respect to the behaviours and relationships within in one strand of the dance medium¹⁰), exploits the particularities of interactive digital media more fully than a fixed dance work, and does extend the possibilities available to the choreographer. Now whilst this does not invalidate the controlled use of interactive systems in performance, it does allow the choreographer embrace the intentional logic of interactive art, which is in part concerned with problematising the role of the author. And it is here that one of the more interesting issues which is raised through the use of technology in dance lies.

¹⁰ See Valerie Preston Dunlop & Ana Sanchez Colberg (2002) for an elaboration of the concept of the strands of the dance medium. Also Hue-Won Hwang (2001)

Implications of Interactivity in Choreography

The implications of the full use of interactive technologies to the role of the choreographer are legion. Interactive art, which Roy Ascott (1988) and Landow (1994) amongst others suggest is the art of the new century, reconfigures the relationship between artist and their performers and in the case of interactive installation art between artist and public. Instead of the artist producing invariable forms and structures which the viewer or listener must absorb, but in which they cannot intervene, and the performer can only provide with a layer of expressive intent, the interactive artist produces an environment for performer or viewer/listener to explore and compose as they carve their own path through the environment. Any interactive work is, in conventional terms, unfinished at the moment it is placed in the public domain. Indeed in conventional terms it is never finished, for each work-event differs significantly one from the other as a result of differences in response to, and from, the environment. The work as work is thus less a finished artefact than a collection of materials and a framework within which they can be organised into a multiplicity of temporary material forms. In making an interactive work, for the originating artist, the artistic process is truncated at a point which is, in a conventional work, considered to be sited somewhere in the middle of the compositional process. From that point on the composition of the work lies in the hands of the interactor.

Thus the artist, instead of producing a work upon which the viewer's, or performers' imagination can play, produces materials and designs a flexible network through which to link those materials. From this the viewer or performer is given the opportunity to actualise their imaginative vision in material form, rather than merely experience it in a virtual form in their mind. In an interactive work, then the viewer, listener, performer is invited to navigate their way through the network of elements, producing them combining them in different ways, discarding them, and in so doing form up an artistic world uniquely their own. Thus the performer or viewer takes over the authoring process at a certain point, and becomes a co-author of the work. This is something of a departure in the arts. Although the performer has been given certain freedoms within improvisational forms of performance since the 1960s, the viewer has rarely been given those freedoms, the originating artist consistently maintaining his or her control of the form of the work that the viewer sees, or hears.

Philosophical Issues for Interactive Art

This departure reflects the changes in philosophy which have been taking place over the last five decades or so. Now developments in art do not take place in a vacuum. The philosophical frameworks which guide our thinking have a significant impact on the way art is understood and practised. During the last five decades Western philosophy has undergone a radical period of questioning which has reconfigured the way we understand the world, and our roles within it. This has seen parallels in certain of the more avant garde practices in the arts. In the 1960s and 70s for example, improvisation, Happenings, and other modes of performance practice which allowed for spontaneous interventions from both performers and audience became an accepted modes of performance practice in the USA and the UK. The artists who formed the collectives such as the Judson Dance Theatre in New York began to collaborate not only with their performers but also their audiences in the performance event, and to produce work which gave the performers, and sometimes the audience, the freedom to actively affect the progress of the work through time, and even to generate the materials from which the work was made. These artists were challenging not only the dominant modernist dance aesthetic, which saw the author exert full control over the form, movement content and movement quality of the work, but also the philosophical framework which underpinned it.

That philosophical framework was based in a mode of understanding the world which has established a hold in the West since the eighteenth century. This mode of understanding the world valorised objectivity. Its aim was to validate what Western thinkers knew to be knowledge through scientific experimentation and rational debate, to establish a true understanding of the natural world, and of the moral framework and aesthetic judgements which guided their behaviour and tastes. These last were embodied in 'civilised' society, represented by those sectors of the European social hierarchy who had money, power and status. The attitudes of this class of people served as the underlying premises upon which Western culture and thought was built. The philosophical aim of thinkers in the eighteenth, nineteenth and early twentieth centuries was to establish the universality of the social and cultural mores which underpinned their society, and of that which for them counted as 'knowledge' and 'truth'. The norms established by western society were thus considered to be universals, givens, non-negotiable 'facts' of life.

In the mid to late 1960s, French philosophers such as Jacques Derrida, Michel Foucault (1972), Gilles Deleuze (known variously as 'continental', or 'post-structuralist' philosophers), challenged that world-view, proposing that knowledge, morality and

aesthetic judgements were not givens, were not universal, but were perspectival, and thus change from culture to culture, within cultures, and even from individual to individual. In doing so they destabilised not only the social but also the conceptual underpinnings of the West's previous understanding of the world. A similar, although less radical questioning of the established world-view was also taking place in the arts in the Anglo-American framework through the work of Morris Weitz (1956), W Wimsatt and Monroe Beardsley (1962) Joseph Margolis (1974)¹¹, and of sociologists such as Peter Berger and Thomas Luckmann (1966). These thinkers, like their European counterparts, began to concede that knowledge was perspectival and partial.

In the latter half of the twentieth century it became accepted by theorists and philosophers (amongst them Roland Barthes (1966), Foucault (1969), Derrida (1969a; 1969b) and Umberto Eco (1969), Margolis (1981; 1995) and Danto (1980) that concepts, and by extension works of art, are 'open'. That is they do not have a single meaning or message, but their meanings change according to the time and the culture in which they are viewed or experienced. The principles underlying this understanding of meaning were that every individual has a different personal history which is superimposed on shared cultural and social histories, which were, even within a single culture, themselves multiple. It is this combination of the intersubjective (shared understandings) and the subjective (personal knowledges) that we bring to our understanding and interpretation of the phenomena we encounter. This we bring our own reading to the world, but ground that reading on shared understandings derived from our cultural and social worlds.

Authorship and Interactive Art

In the world of the arts the result of these insights was a reconfiguration of the notion that the work of art was an utterance which had a meaning which mapped directly onto the intentions of the author, and that the task of the performer or director was to convey that meaning as accurately as possible, and of the viewer to reconstruct the authorial meaning as they viewed the work. If they did not succeed in doing this then they had misunderstood and/or misarticulated the work. Wimsatt and Beardsley challenged this view in their seminal paper "The Intentional Fallacy" as far aback as 1962 as did Weitz (1956), Eco (1969) and later Margolis (1980) and Danto (1981), who all proposed that art works were 'open'. That is, they had no fixed meaning, rather their meaning changed from one time to another and even from viewing to viewing¹².

¹¹ See Margolis (1980)

¹² This position has led to a vigorous philosophical debate, in which I cannot engage here due to lack of space, as to just how open the meanings of a work are, and whether any interpretation is a valid interpretation. See Iser (1989) and Margolis (1995)

This understanding of the artwork as multivocal rather than univocal underpinned the artistic practices which had their genesis in the 1960s and 70s, and, as we will see, has re-emerged with equal vigour in interactive art in the 1990s. The new philosophies proposed a model of texts and works of art, which took the network, or web, as its framework. This model, which clearly parallels developments in science such as chaos and complexity theory, and indeed in the underlying structure of digital technology, allows the art work to be understood as a collection of elements which are combined into a whole. The poststructuralists proposed that it was not only the originating artist who 'constructed' the whole, but also the viewer in the very act of viewing, or reading, or listening. In spite of appearances, the material combination of the elements which is devised by the artist is not fixed at the level of the 'workness' of the work (although it might be fixed in its physical form). Rather that form is subject to perceptual reconfigurations by the viewers as they impose a structure derived from their own interests on the 'whole', placing some aspects of the work in the 'foreground', and others in the 'background'. Each viewer, it is proposed, does this differently. The work of art is therefore more than an object, comprising a fixed form or progression of events in time, rather it remains a fluid collection of elements which are constantly being reconfigured in each viewer's perception.

The Choreographic Installation

Now you might be wondering what all this philosophy has to do with the relationship between digital technologies and choreography. It is, I would suggest fundamental to an understanding of some of the new works being made by choreographers which use interactive digital technology. Indeed I would go so far as to suggest that the interactive art work is an actualisation of those philosophical positions, inasmuch as it

...reconceives conventional, long held assumptions about authors and readers and the texts they write and read, embodies Julia Kristeva's notions of intertextuality, Mikhail Bahktins' emphasis upon multivocality, Michel Foucault's conception of networks of power and Giles Deleuze and Felix Guattari's ideas of rhizomatic, "nomad" thought (Landow 1994: p.1)

Interactive artworks are designed to not merely to accommodate the reconfiguration of the components of a work in the performer's or viewer's mind proposed by the philosophers, but to actualise that new configuration in the real world. The performer and more importantly from a political perspective the viewer, are empowered and become part of the process of creating the physical work of art.

In interactive art this empowerment of the viewer and performer finds voice in the immersive interactive installation. The immersive interactive installation is perhaps the

epitome of interactive arts practice. An interactive art work which is designed and mounted in an open space, it is subject to being formed and reformed by viewers' presence and movement *in* that space in real-time. Now immersive interactive installations have been generated by visual and sound artists for some years now. However, their works tend to be designed as a space for viewing or listening to the images.. Although the interactor generates and organises the images, it is predominantly so that they can observe or hear them as aesthetic objects. They thus remain trapped in the role of audience member, albeit a particularly active one.

More recently choreographers and theatre practitioners such as Blast Theory, have begun to enter this field of practice. These artists have brought with them the notion of the 'performative' to the installation¹³. The performative installation is that in which the interactivity itself is aesthetically significant, and becomes part of the aesthetic object. Such installations are "...clearly designed to give rise to performances and explicitly account for the audience's role within [those] performances" (Salt 1997: p119). When such installations are generated by, or in collaboration with, choreographers they become what might be called 'choreographic' installations.

These installations are generally immersive electronically sensitised environments, triggered and activated through spatial or embodied interactivity. The rules which drive them are frequently based on understandings of the use of space derived from choreography. In such environments the viewer becomes not merely a trigger for the environment, but an integral element of it. *Trajets* (2000) an installation made with a large team of artists in collaboration with choreographers Susan Kozel and Gretchen Schiller is one such installation, as is *Desert Rain* (1999) by Blast Theory, *Halo* (1998) an installation by Simon Biggs for which I did the choreography, and *Light Room* (2002) by Company in Space. These installations are designed to ensure that the interactors fully inhabit the installation, and in doing so not only generate the installation, but also become performers in it, and thus an integral part of a choreographic work-event. These 'open', public installations, however, may also become a site for a more formal improvised performance, which is enacted by performers who have rehearsed in and with the system. Frequently in these performances the more subtle 'visible' elements of the installation are brought to presence in a more nuanced version of the work than that generated by the novice interactor.

¹³ Composers have explored this idea, with the interactor taking the role of musician (Saltz 1997), but have not developed the notion of the interactive performance in a choreographic or theatrical sense.

Authorship and Interactive Choreographic works.

The use of interactive media in choreography raises genuine questions concerning the role of choreographer as author. For example, it is clear that if interactive systems are used to their full potential, that is as improvisatory systems open to performers or the general public, and thus control of the formation of the work as event given over to the performers, the author relinquishes control of the form his or her work takes, and in doing so relinquishes his or her role as author. But does it follow that this is that the case? I would suggest not. The choreographers of even improvised interactive dance works, including choreographic installations, do not relinquish their role as author, but remain firmly implicated in the work. The degree to which this occurs, however, is dependant upon the originating choreographers' approach to the choreography. If the choreographer chooses not to give the performers the opportunity to improvise in real-time within the system then the role of choreographer as author is unchanged from that of the conventional dance piece. The choreographer here is ultimately in control of the behaviour of both the performers and of the installation environment.¹⁴ If the choreographer sets up a structured improvisation performance system allowing performers to make certain choices but not others, and this is used as a further interactive system within the interactive environment, then he or she is maintaining a significant degree of control over the work, even though not total control over the work-event. Nevertheless the performer is not authoring the work, merely the work-event. The amount of freedom given to the performers is determined by the choreographer, as is the type of freedom they are allowed. However much advantage they take of the freedom given it is the choreographer who devises and sets the parameters within the improvisation system, and who consequently maintains a substantial role in the authorship not only of the work but also of the work-event.

If, however, the choreographer allows performers to become familiar with the rules underlying the installation, to 'rehearse' with it, and devise their own choreographic response to the installation, they relinquish much more of their authorial control. If the installation environment is opened to the general public, in which case uninitiated viewers become 'performers', the choreographer relinquishes even greater amount of authorial control. However, I would argue that even then the originating artists remain inextricably implicated in the work. It is the authors' materials, their themes, their ideas, which provide the frame within which the interactions take place, and which subtly guide the responses of even the uninitiated interactors. This is the authored work. The actualisation of that work by interactors, whether as viewer or skilled performer,

¹⁴ Unless, of course, the installation system has choices of behaviour inherent within it which are independent of the behaviour of the interactors, as did *Halo* (Rubidge 2000).

constitutes authorship of the work-event, not of the work itself. The interactors are therefore not co-authors of the work, but authors or co-authors of the individual work-events in which they are participating. Issues such as these, which are inherently philosophical, are implicit in the use of interactive digital media in the arts, and form part of the challenge facing the choreographer who works in the domain of the digital.

Conclusion

The last twenty years have made it clear that digital media has had a considerable contribution to make to choreography as an art form, to choreographic thinking, and to our understanding of the dialogue between artist, performer and viewer. The use of digital imagery in a performance setting, whether this be visual or sonic, generates a mobile world with which the performer can engage, and thus extends the contexts in which dance performance can take place. It allows live dancers to interact with virtual worlds, rather than merely be represented through them. However, it has been argued here that it is interactive technologies in particular which offer an innovative new domain for the development of choreographic thinking. The advent of sophisticated interactive technologies are now allowing the viewer and performer to make a genuine contribution not only to the interpretation of the work, but also to the authorship of digitised dance-events in the moment of performance. This is leading choreographers, in collaboration with interactive artists, towards a new mode of choreographic practice, the 'performative' or 'choreographic' installation. These installations increasingly challenge the role of the choreographer as author, and indeed the notion of performance. Of perhaps even greater importance, they are generating new ways of thinking choreographically, and reconfiguring the roles of the choreographer, the performer and the viewer.

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