The dancing body as a screen: synchronising projected motion graphics onto the human form in contemporary dance

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Introduction

The use of the human body as a canvas for artistic expression has been deployed throughout the history of mankind. The adornment and marking of the body is a facet of humanity that distinguishes us from other beings. With the development of digital media and emerging technology the human body has become a site for projected motion imagery, thus visually hybridising the virtual and real worlds. Instead of projecting indiscriminately onto the dance stage in mere mimicry of the cinema form, choreographers are working with projection artists to synchronise the moving image with the moving dancer physically immersing the performer within the digital world.

The technical difficulties of synchronising the projected imagery with that of the performer in the past has been tedious, frustrating and fraught with risk. Up until recently one of the biggest disadvantages has been that pre-rendered animation locked the performer into the choreography. It was argued that some of the spontaneous aspects of the actual, live performance were lost because the projections dictated the performer's movements. A solution to this problem is through the technology of *motion-sensing*, where the dancer is able to control the projections through his or her movements, making the projections a live interactive prop. Rather than being a separate entity, the performer becomes a vital agent of the projected digital imagery, hybridising the human form with technology.

This article will refer to Elizabeth Grosz's definition of the cultural body as a site of culture itself and Donna Haraway's definition of the *cyborg* as a means of establishing a relationship between the digital moving image and the performer. Bringing these two theories together to show how projecting onto the body is a natural evolution in contemporary dance, bearing a new type of collaboration through the use of digitally mediated technologies.

The works of three different contemporary artists will be discussed to exemplify how technological developments over the past decade have dramatically changed the relationship between the performers and the projected image on stage forming a new kind of contemporary dance performance.

The cultured body and projections; the human body natural and manipulated

> The body is not opposed to culture, a resistance throw-back to a natural past; it is itself a cultural, *the* cultural product. The very question of the ontological status of biology, the openness of organic processes to cultural intervention, transformation, or even production, must be explored.[1] (Grosz 1994: 23).

The manipulation and decoration of the body has been a part of civilisation in cultures across the world for millennia. Tattooing, branding, piercing, and stretching the skin are seen across cultures; they are all forms of permanent markings to the skin that transform the 'natural body' into the 'cultural body'. In primitive times, the marking of the body stood on the wearer as a symbol of status and heritage. As Elizabeth Grosz writes:

> Inscriptions on the subject's body coagulate corporeal signifiers into signs, producing all the effects of meaning, representation, depth, within or subtending our social order. The intensity and flux of the sensations traversing the body become fixed into consumable, graffitiable needs and desires.[2] (ibid: 141)

In art, the idea of merging the human form with technology was born shortly after the industrial revolution, particularly spurred by the First World War in the Futurist and Dadaist movements. Donna Haraway's concept of the *Cyborg*: 'a cybernetic organism, a hybrid of machine and organism, a creature of social reality as well as a creature of fiction,' [3] (Haraway 1991: 151) was in many ways anticipated in the work of the Dadaists and now-a-days widely demonstrated through the work of many contemporary artists. Not unlike other art forms, dance has responded to the cultural trends of a technology-

[1] E. Grosz. *Volatile Bodies, Towards A Corporeal Feminism,* Indiana University Press, 1994: 23.
[2] E. Grosz. *Volatile Bodies, Towards A Corporeal Feminism,* Indiana University Press, 1994: 141.
[3] D. Haraway. A cyborg manifesto: Science, technology, and socialist-feminism in the late twentieth century. In *Simians, Cyborgs and Women: The Reinvention of Nature,* Routledge, London,1991: 151.

infused society, using the body as a site for cultural expression and advances in digital arts.

The body as screen

The projection of digitally mediated graphics onto the moving body conceptually evokes a relationship of the natural human body with technology.

Klaus Obermaier and Chris Haring's work, *Vivisector, Intervention in the Sweating Body* (2001-02) saw four dancers on stage with virtual reality characters projected onto their human forms. In a review of this work, Catherine Hale of London Dance wrote:

> In our world of cloning, artificial intelligence, and virtual reality,
> Intervention asks at what point science displaces our humanity.
>
> [4]

Figure 1. *Vivisector, Intervention in the Sweating Body* (2001-02)[5]
(Director and composer, Klaus Obermaier; Choreographer, Chris Haring)

Obermaier's intention was to bring the virtual environment into real space through the

[4] C. Hale, "Klaus Obermaier & Chris Haring, Vivisector". A review of *Vivisector, Interventions of a Sweating Body*. www.exile.at/vivisector/index.html.
[5] Vivisector, *Interventions of a Sweating Body*, 2001-02. www.exile.at/vivisector/index.html.

use of live bodies. As Obermaier comments:

> Here, I project the moving image of the dancer again on to his body, so I can manipulate the appearance, and control when the performer appears. I break the linearity of movement that we are familiar with in the virtual characters of video games.[6]

By giving an actual voluminous form to the virtual body via projection onto the live body, Obermaier was able to bring the digitised world into real space thus creating a *cyborg* illusion.

For choreographer's Lucy Guerrin's *Melt,* 2003, animation was initially devised to simulate a 'sculptural skirt made of ice.' [7] Due to the impracticality a physical prop actually made of ice, projected geometrical animations were deployed to abstractly represent the melting skirt.

The challenge for motion graphics artist Michaela French was to make it seem as though the tactile human body and the digital motion graphic projections were indeed a part of each other. As French comments:

> I actually think that the two things are fundamentally opposed and it is perhaps the challenge that this opposition presents that is the attraction. Always it's an enormous challenge to integrate the two mediums.[8]

[6] K. Obermaier. "When seeing is not believing". A review of *Interventions of a Sweating Body* by Charlotte Cripps, Feb. 18, 2004. www.exile.at/vivisector/index.html.
[7] Interview with L. Guerin, April 2006.
[8] M. French. Personal communication, April 2006.

Figure 2.[9]

Figure 3.[10]

Melt, 2003. (Lucy Guerin Inc. Choreographer, Lucy Guerin; Motion graphics, Michaela French)

Obermaier's follow-up work *Apparition,* 2004 saw the projection as more than a visual prop but a 'potential performing partner'. As writer Scott deLahunta explains:

> The independent behavior of the physical models for example is not 'controllable' by the performer, but can be influenced by his or her movement.[11]

A camera based tracking system was used to extract the algorithms of the human form from its surroundings, which functions to provide 'qualitative calculations of certain motion dynamics, e.g. speed, direction, intensity and volume.' [12]

[9] *Melt*, 2003, image courtesy of Lucy Guerin Inc, photograph by Jeff Busby
[10] Ibid
[11] DeLahunta, Scott, Klaus Obermaier website, www.exile.at/apparition
[12] DeLahunta, Scott, Klaus Obermaier website, www.exile.at/apparition

Figure 4.[13]

Figure 5.[14]

Apparition, 2004.

(Director and composer, Klaus Obermaier; choreographer Robert Tannion and Desireé Kongerød; interaction designers and programmers, Christopher Lindinger and Peter Brandl from the Ars Electronica Futurelab; motion tracking and analysis, Hirokazu Kato.)

Chunky Move's *Glow,* 2006 *and Mortal Engine, 2008* also deployed camera-based *motion-sensing* to hybridise the performer with the technology. Choreographed by Chunky Move's Gideon Obarzanek and technically developed by German programmer and sound artist, Frieder Weiß the performances aim to find an aesthetic that does not emanate from the contradiction between people and technology. Weiß sees the technology as an instrument for creation that should influence the final visual performance:

> Just like playing the piano can inspire a melody so too can the visual aesthetic created by the technology inspire the performance.[15]

In Weiß's eyes, the technology feeds into the conceptual development of the production.

[13] *Apparition*, 2004, www.exile.at/apparition
[14] Ibid.
[15] Interview with F. Weiß, Jan. 2008.

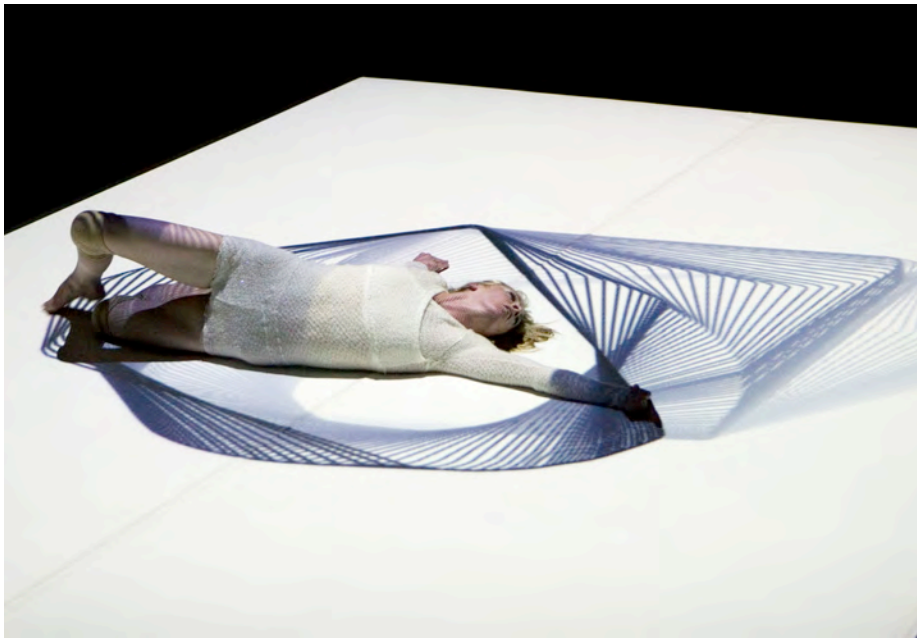


Figure 6. *Glow*, 2006 [16]

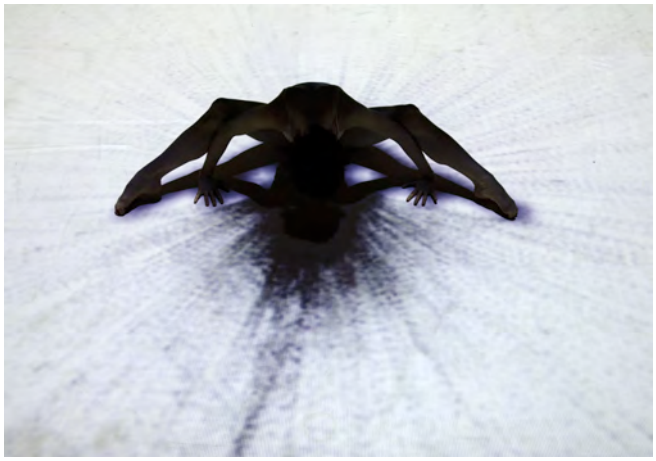


Figure 7. *Mortal Engine*, 2008. [17]
(Chunky Move: Choreographer, Gideon Obarzanek; interactive systems design, Frieder Weiß)

Rather than people being dominated or controlled by technology, choreographer Obarzanek wants to 'explore the kind of relationship that people have *with* technology, one that is more organic and natural.' [18]

As shown in Figure 6 the frame picks the three most extreme points of the body position, creating intricate patterns based on the speed at which the performer moves. The

[16] *Glow*, 2006, image courtesy of Chunky Move, photo Rom Anthoni
[17] *Mortal Engine*, 2006, image courtesy of Chunky Move, photo Andrew Curtis
[18] Interview with G. Obarzanek, Chunky Move, May 2006.

performer is able to push, pull and dance with this elastic shape, making the projection a virtual partner on stage. As Donna Haraway states:

> High-tech culture challenges these dualisms in intriguing ways. It is not clear who makes and who is made in the relation between human and machine.[19] (Haraway 1991: 150).

Deployment and advances in technology

Understanding the technology involved in producing dance performance that is integrated with digitally mediated imagery is paramount to the success of the performance: position of camera, projector and lighting need to be calculated exactly for effective synchronisation of performer and projected imagery.

In *Melt*, French had to pre-record the choreography and make sure that it would cohere with the resulting projected imagery, As French explains:

> I filmed the choreography from the same position and lens angle as the projector would eventually have, in this way it was actually quite easy to predict where an action would take place. I animated with the choreography as a guide, and we would then test the composited sequences in the studio space with the dancers to ensure the theory did translate into practice.[20]

For Chunky Move's interactive performances, *Glow* and *Mortal Engine* the set-up of the camera, projector, and infrared spotlight had to be precise in order for the sensory technology to work. As Weiß explains:

> I usually work with a line set-up, an infrared camera being inline with the projector, covering the same area, the same field. It's important to have the alignment correct, that the projected light is on the same spot as the performer.[21]

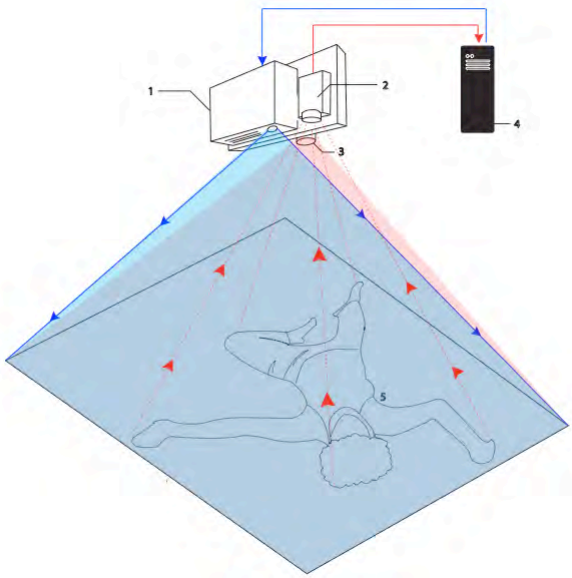
The camera is placed directly above the performer so it can sense the motion below. The

[19] D. Haraway. A cyborg manifesto: Science, technology, and socialist-feminism in the late twentieth century. In*Simians, Cyborgs and Women: The Reinvention of Nature,* Routledge, London,1991: 150.
[20] M. French. Personal communication. April 2006.
[21] Interview with F, Weiß. Jan, 2008.

camera lens must be as close to the projector lens as possible for the projected animation to follow the moving performer. The camera lens which detects visible light is disabled by a filter so that the projection will not interact with itself. As Weiß explains:

> Part of the trick is you try to separate the projected image from the coded image. It's an important step. If the camera would see the projection, it would cause a feedback. In audio, it happens a lot. You have a speaker and a microphone and you might get a feedback.[22]

By disabling the detection of visible light the camera only picks up infrared waveform. An infrared spotlight must be mounted to illuminate the performer for the camera in this light. The infrared spotlight must be in the exact same position as the camera lens to minimise an expanded shadow that would result if additional infrared spotlights were mounted from other angles. Hence when the performer moves inside the space, the camera detects the performer's body and shadow created from the infrared light source.



1 - Projector
2 - Infrared tracking camera
3 - Infrared light
4 - Computer
5 - Performer
6 - Projection surface

Figure 8.

Figure 8 shows how the projector, infrared camera, and infrared light are rigged. The information filmed by the camera is sent to the computer. The computer takes this data and applies a particular effect. The imagery processed by the computer is sent to the projectors at the same rate of capture (i.e., every 25th of a second) and projected back on to the performer. There is no perceivable lag at all between the capture and what is

[22] Ibid.

projected, making what is projected a *real time* performance.

For *Glow* only one camera/projection/infrared unit was used, however for *Mortal Engine* there were three; one projecting onto the floor and two split for the back wall. For optimum performance the dancers were as close to the projection surface as possible, pushing the integration of media and body to the limit.[23]

Performing with projection light

Traditionally in dance theatrical lighting is used to draw attention to particular areas of the performer, such as the feet and to create a certain mood or atmosphere in the performance. Projections, on the other hand, are at the opposite end of the spectrum. They require limited use of additional theatrical light, if any, for dramatic effect. A dark space is necessary for the best definition of colour and brightness.[24] For choreographers using projection light as the lighting source they have to adjust to the harsher and more piercing qualities. This can be problematic for both choreographers and dancers alike. As Guerin comments:

> It's a particular light, projection light. It's not like theatre lighting where you can sculpt and bring the performer out. It tends to flatten the performance.[25]

The performers also have to adjust as the projection light as it can be disorientating. It does however transcend the performer into another creative space. As dancer Stephanie Lake comments about performing in *Melt*:

> That projection is like a laser in your eye. Everything else is black around it. Normally you'd have lights coming from all different directions. So it's actually really disorienting. It really affects your balance. [...] I found it hard, but at the same time you can really enter the world and kind of feel like you really *are* in this other dimension. And that was cool.[26]

[23] Online Interview with F.Weiß12.00 June 21, 2009
[24] M. Clarke. La Boheme in Naples, *Entertainment Design 34*, 11 (Nov 2000): 9-10.
[25] Interview with L. Guerin, April 2006.
[26] Interview with S.Lake, April 2006

For Chunky Move's *Glow* and Guerin's *Melt* additional theatrical lighting is not used, so as not to compete with the projection light. However in *Mortal Engine* and Obermaier's *Apparition* minimal theatrical lighting was used in conjunction with the projection. In *Mortal Engine* an advanced laser system by laser designer Robin Fox was also deployed to heighten the body contours. As Weiß explains:

> I work with contours and body outlines a lot in projection. They were transformed into laser lines which also follow the body contour. The laser is nice as it is opening the space into the 3D.[27]

As the technology of interactive projection systems advance the dancers have to adapt to very different lighting and stage conditions, yet it is an aspect that is both challenging and exciting for performers and choreographers alike.

Conclusion: towards a hybridised future

This investigation makes it evident that the rapidly evolving technology in modern image making has greatly influenced contemporary dance works. Metaphorically, projecting onto the energised skin surface brings technology closer to the natural body, and in doing so gives the digitally mediated image a life through the living, breathing body. Donna Haraway's notion of the *cyborg* as 'a cybernetic organism, a hybrid of machine and organism,'[28] (Haraway1991:151) is clearly demonstrated in these case studies. The human skin is an energised surface, and it is natural that choreographers want to project onto it. If we consider Elizabeth Grosz's definition of the 'body as culture, and the body as the site for cultural activity [29] (Grosz 1994:23) we need not doubt that this project will be ongoing.

The ways in which digital images are designed to synchronise and interact with the human form communicate an ideal hybridisation between man and machine. When the surface is a moving one, such as a dancing body, and so too is the imagery projected on it, this can become a visually and conceptually powerful mix of the digital with the physical world.

[27] Online Interview with F.Weiß12.00 June 21, 2009
[28] D. Haraway. A cyborg manifesto: Science, technology, and socialist-feminism in the late twentieth century. In *Simians, Cyborgs and Women: The Reinvention of Nature*, Routledge, London, 1991: 151.
[29] E. Grosz. *Volatile Bodies, Towards a Corporeal Feminism*, Indiana University Press, 1994: 23.

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