Mapping Motion II: Motion Capture and the Visualisation of Dance

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There is a long and rich tradition of visualising human movement in the history of dance. When considering traditional dance notation in *Envisioning Information*, Edward Tufte pointed to the dilemmas involved in reducing “the magnificent reality of time and three-space into little marks in flatland,” another instance of the difficulty of “escaping flatland” (Tufte 1990, 119). In “Mapping Motion: The Principles of Motion Capture and the Law of Projection,” presented at EVA London 2013, I examined performance capture in 3D animation, as used in films such as *Avatar* and *The Lord of the Rings*, to understand how Wittgenstein’s law of projection could illuminate the broader principles involved in this powerful and rapidly developing art form. In this talk, I will present a parallel case study of projective visualisation in dance, another art form significantly affected by, and in the minds of some of its most significant and creative practitioners extended by, motion capture. LifeForms, a computer choreographic software tool developed at Simon Fraser University, was used by legendary choreographer Merce Cunningham to create revolutionary dances. In “Wittgenstein and Tufte on Thinking in 3D,” presented at EVA London 2012, I argued that the mapping relation captured by the law of projection in the *Tractatus* contributed to our understanding of Tufte’s theories of envisioning information. There, the projective relation mapping information to visual data displays is central to escaping flatland. In this talk, I will explore whether such a mapping relation, and the law of projection informing it, can also ground the principles of representation involved in motion capture as it functions creatively in computer visualisations of dance. While the argument is grounded in concrete practices of electronic visualisation, my concern will be to argue that Wittgenstein’s logic of depiction, informed by his law of projection, illuminates the theoretical underpinnings of these important case studies.

1. INTRODUCTION

How can Ludwig Wittgenstein’s picture theory of language in the *Tractatus Logico-Philosophicus* contribute to our understanding of the principles of visualisation in the arts and sciences? In a series of talks at the EVA London conferences, I have argued that Wittgenstein’s logic of depiction in the *Tractatus* illuminates the principles involved in transforming the flatland of 2D paper and computer screens so as to capture the rich reality of art that is essentially movement in three-space. Dance is an art of movement, and “choreography is the art of crafting movement, developed through a long history of techniques” (Alaoui, Carlson, Schiphorst 2014, 1). Motion capture opened new artistic dimensions for choreography in the hands of visionary choreographer Merce Cunningham and the computer scientists who worked with him to create the tools to take his art even further, much as performance capture transformed acting in film and animation in works such as *Avatar* and the *Lord of the Rings*. In this talk, I will relate dance notation, and motion capture in computer notations and visualisations of dance, to the principles underlying these creative techniques as presented in Wittgenstein’s law of projection.

One of those computer scientists, Thecla Schiphorst, notes that dance “is often described as an ephemeral art form, in constant shift, leaving no remaining tangible traces” (Alaoui, Carlson, Schiphorst 2014, 1). Herbison-Evans, another scholar of computer dance notation, writes that until recently, the ephemeral nature of dance has made it unique amongst the arts. All the other arts have generations of previous work available for study: the paintings at Lascaux, the poetry of Homer, the drama of Euripides, sculptures such as the Venus de Milo. This cultural continuum is part of the basis of Western society. But a dance lives on only in the minds of the dancers who performed it, and the choreographer and the rehearsal staff, if a
company is involved. Unless they pass a dance on to the next generation by the slow process of demonstration and repetition, it will be lost (Herbison-Evans 1988, 45).

Traditional dance notations have recorded patterns of movement, preserving dance over time and creating beautiful diagrams as they did so. LifeForms, and the ongoing evolution of computer choreographic systems since the historic collaboration of Merce Cunningham and the computer scientists at Simon Fraser University, have not only recorded dance as performance, but also acted to collaborate in the design of dances such as Trackers and Biped. The creative contribution of these systems can be seen in the rich computer visualisations of dance now regularly presented at the EVA London Conferences.

2. DANCE NOTATION

The effort to record, preserve, and teach dance through visual notation systems goes back centuries, reflecting the important role of dance in the lives of European elites in the early modern world. Fifteenth and sixteenth century dancing notations are intricate and often beautiful, reflecting the complex and significant role dance played in European courts. Historically, the “greatest flowering of dance notation occurred in the eighteenth century when it was used by and for the educated classes” (Guest 1984, 4). Louis XIV of France actually ordered Pierre Beauchamp, his dancing master and the dancing director of the Academie Royale de Musique (the Opera), to “find a way to put dance on paper---that is to develop a system of dance notation” (Pierce 1998, 287).

Analyzing these systems, Edward Tufte finds standard techniques for inscribing rich information in visual diagrams, in this case for mapping motion as dance. “The texts begin taxonomically laying out fundamental movements in a virtual dictionary of dance elements,” a theme that will recur in this history (Tufte 1990, 115). He also notes that

now and again, the paper encoding reflects the refinements of dance itself—a flowing graceful line embellished by disciplined gestures, a dynamic symmetry inherent to both individual and group proceedings. Moreover, some notation systems engender a visual elegance all their own, independently of the movement described (Tufte 1990, 114).

The diagrams of these dancing masters are indeed beautiful information.

These intricate diagrams, where movement translates into symbols representing the elements of the dance, map the patterns created by the movements of the dancers. Lincoln Kirstein of the New York City Ballet argues that this is even more beautifully explicit in Kellom Tomlinson’s Art of Dancing, Explained by Readings and Figures.

There, “the finest representations of the minuet to be found are rendered more complete by a series of careful portrait engravings of dancers on a floor track of a choreographic short-hand” (Tufte 1990, 114). The symbols tracking the dance steps map directly to the tableau of the moving dancing partners, through feet literally touching patterns of the dance.

Tufte argues that “systems of dance notation translate human movements into signs transcribed onto flatland, permanently preserving the visual instant” (Tufte 1990, 114). That is extremely important, if not unproblematic to accomplish. Dance that is not preserved is lost. Ann Hutchinson Guest, one of the major historians, practitioners, and teachers of dance notation in the twentieth century, noted that “choreography has been called the throwaway art because so many ballets were allowed to be forgotten” (Guest 1984, xi). What if music notation did not exist? How much of the
musical canon would have been lost, and how could it be reconstituted? She argues that

in the traditional handing down of dance from person to person, the knowledge has been transferred visually through physical demonstration, accompanied usually by verbal explanation. Translating movement to symbols on paper allows the information, the knowledge thus captured, to be used by people around the world (Guest 1984, 3).

This is not easy. “Of the eighty-five or so systems, major or minor, which have evolved through the centuries, each has certain weaknesses and certain strengths.” Most importantly, for this master of modern dance notation, “music notation is a creative tool, the means of communication in dance” (Guest 1984, xi).

The twentieth century saw significant development of sophisticated dance notation systems. One of the most important is Labanotation, the dance notation based on Laban Movement Analysis, “a comprehensive language for movement description, representation, expression, and performance” (Alaoui, Carlson, Schiphorst 2014, 2). It was created as a system for recording movement on paper by Rudolph Laban in the early twentieth century. George Balanchine has recounted how, as a choreographer, he became aware of “the need for an accurate and workable method for notating my works.” Labanotation was the most developed method for meeting this need, and he noted that

after studying the system and watching Ann Hutchinson, America’s leading notator and teacher, at work, I realised that this was indeed the answer and I decided to embark immediately on the long-range project of having my ballets recorded (Hutchinson, 1954, xii).

At the time, five of his major works had already been completed, and he felt confident that these ballets would be accurately performed in the future. universal understanding of movement and hence serves as a common language through which workers in all fields and in all countries can communicate. The system is, therefore, a “Rosetta Stone” by which the kinetic content of all forms of movement and styles of dance can be understood…Its nonverbal symbology poses no language barriers to international exchange and research (Hutchinson 1954, 6).

She also fostered the development of the Language of Dance, simplifying the notation to a dance language aimed at teaching.

One of the major institutions of dance notation is the Language of Dance Centre in London.

Established by leading Labanotator and scholar Ann Hutchinson Guest in 1967, the Language of Dance Centre (LODC) has been instrumental in the furtherance of movement study and Labanotation in the UK and world-wide. The major aim of the organisation has been to establish movement and its alphabet of accompanying Labanotated symbols as a living language which can enjoy the academic and socially communicative value that all written and spoken languages have had for centuries; allowing for the creation of libraries containing notated texts which preserve the world’s dance heritage in an intelligible form, and facilitating discourse and education concerning movement (Sparhawk 1998, 67).

Guest also developed Motif Notation, providing “an easy introduction to dance literacy through the visual symbols and clear movement vocabulary.” Labanotation is intricate and involved, explicit but difficult. Thus, Guest also explored using the notation symbols more freely when teaching children. “The experience inspired her to identify the list of prime movement actions universal to all movement forms…she codified what she felt to be the ABC’s of movement, now termed the Movement Alphabet® (lodc.org).

**Figure 3a and 3b: Labanotation (Hutchinson 1977, 178)**

Guest developed Kinetography Laban, coining the term Labanotation, and described it as

a triple-edged tool because it provides a means of recording movement on paper for future reference, a sound, fundamental analysis of movement, and a carefully selected terminology which is universally accessible. It provides a

**Figure 4: The Movement Alphabet Poster**

Describing these two related systems, she notes
the main difference between Labanotation and Motif Notation is the type of information they communicate. Labanotation gives a literal, all-inclusive, detailed description of movement, so it can be reproduced exactly as it was performed or conceived. In contrast, Motif Notation depicts just core elements. A Motif score might convey the overall structure and intention of a dance improvisation, but allows the individual performing the movement to decide how that movement should be carried and therefore allows for a creative approach in dance notation (lodc.org).

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Kelly Hamilton

49

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Kelly Hamilton

3. MERCE CUNNINGHAM AND LIFEFORMS

Merce Cunningham needs no introduction to those who know twentieth century dance. A towering creative figure as a choreographer and dancer, and the acknowledged master of modern dance, he was a protean spirit who never stopped moving until his death at 90 in 2009. Leaving Martha Graham’s company as a young dancer, he formed his own company, collaborating with John Cage to create revolutionary dances in the 1950s. After public recognition of his controversial work finally came following the famous world tour in 1964, he kept exploring the possibilities of movement.

He was a consummate dancer. Concerning his performance with Cunningham in *Occasion Piece*, Mikhail Baryshnikov said, “Every dancer would kill for this opportunity to, I mean, to be in Merce’s new work and dance with him on stage.” He engaged with video and film, then went on to create with computer dance notation in his eighties. As dance critic Deborah Jowitt said, “after having been shockingly radical in the fifties, he then, to me, in the nineties became radical in a different way” (American Masters: Merce Cunningham 2000).

In the panel discussion, “Four Key Discoveries: The Merce Cunningham Dance Company at Fifty,” the theme of the panel was determined by his own assessment of his achievements in dance. He once said that his company’s work could be considered through the prism of the following discoveries: (1) the separation of music and dance as influenced by John Cage; (2) the use of chance operations in choreography; (3) the possibilities of film and video; and (4) experimentation with computer technology. My argument focuses on the fourth discovery, his work with *LifeForms*, the computer notation for dance, and how computer dance notation transformed his art. (Brown, Cunningham, Kuhn, Melillo, Schiphorst, Vaughan 2004).

Originally known as Compose, *LifeForms* as developed in 1989 has evolved into *DanceForms* and a version of *LifeForms* for animation. Thecla Schiphorst worked with Cunningham on large computers with a system that required her presence for months to help him understand the software. Today, Tom Calvert, a computer scientist on the SFU team that developed *LifeForms*, is the CEO of the spinoff company Credo Interactive. It advertises iDanceForms (a free iPad app), *LifeForms* 5 character animation software, and *DanceForms* 2 Choreography software. Computer dance notation has taken off.
Schiphorst was on the original design team for LifeForms and collaborated with Cunningham, supporting his work with LifeForms as he created dances such as Trackers. She describes LifeForms as “an interactive, graphical interface that enables a choreographer to sketch out movement ideas in space and time.” She argues that from a user-interface design standpoint this is a question of mapping the internal mental model of the choreographer’s compositional process onto the mental model represented by the software interface so that the computer system can transparently interact with the choreographer as they create, and with the dancer as they learn movement phrases. And from the choreographers’ and dancers’ standpoint, this is an experiment in exploring new approaches to composition that affect and alter the choreographic process (Schiphorst 1993, 11).

In the American Masters documentary, Merce Cunningham: A Lifetime of Dance, Cunningham described his creative process. “I’ve thought for years that dance and technology—because the technology is 90% visual—because they’re mated, because you look at dancing and you look at the technology.” He used the LifeForms programs to capture the possibilities of physical movements, visualising performance to creatively imagine potential dance moves (American Masters 2000).

Ten years into working with LifeForms, the program was on his laptop at home,

so I can work when I’m there. This is what is called the stage on which you can place, in this case, a single figure, and this is called the figure editor in which you work, and this is what they call the timeline, which indicates in time where the given movement is, and I would try to work with this (American Masters 2000).

He moved from the computer choreography to his dancers. The figure editor gave him a new range of possibilities. His interest was in what was possible in terms of the limitations of the human body, but this was extended by the computer. He pointed to a computer-generated movement and said “You will say that that’s impossible to do— if you thought in terms of a dance company it could be that there could a person or two holding that person in that position so that in that sense it remains possible American Masters (2000).

Paul Kaiser and Shelley Eshkar collaborated with Cunningham to create Bipeds using computer dance notation. Kaiser explained that

when we first began working with Merce we introduced him to this concept of the biped, which is a simulated wireframe of a body, but a body with a good deal of computer intelligence (American Masters 2000).

This is analogous to the use of the rig in 3D animation. Calvert notes the analogies between dance choreography and animation (Calvert, Welman, Gaudet, Schiphorst, Lee, 1991). Both use the human body to create art by mapping movement. The rig enables movement to be both tracked and created on the computer screen.

The rig is critical in the creation of CG characters. As explained in Thinking Animation, which deals with the transition from traditional animation to computer-generated animation, the rig is the CG equivalent of the principle of solid drawing in traditional animation. It is vital to the creation of a CG character. Visually, it looks like a 3D mesh sculpture of the character on the computer screen, and the movements of CG characters are controlled using that representation (Hamilton 2013, 3).

The simulated wireframe body used by Kaiser is analogous to the rig in the creation of a CG character. It is through the rig that the animated character acts, performing its role in the story.

The one important tool you need to create good animation is your rig. The rig is the puppet you use to animate with on the computer...Your rig is
your character...Working with your rigger, you can create the most important tool a CG animator can have—a solid puppet. With a clean and simple model design and a solid rig, you are on your way to creating a memorable character (Jones and Oliff 2007).

When directing Gollum, originally conceived as a CG character, Peter Jackson increasingly turned to motion capture. Jackson wanted Andy’s performance to move the puppet, so they used motion capture heavily to film the performance. Motion capture involved placing dots on a body suit worn by the actor as reference points for joints in his body. They would be picked up by cameras all around the set, which would record the light reflected off these little points to create electronic data that allowed his movements to be recreated on the computer screen (Hamilton 2013, 4).

This took place in real time, allowing Jackson to direct Andy Serkis performing as Gollum, creating a 3D representation of his performance digitally.

In the interview, Kaiser reflects that one way to make dances on a computer would be to collect a library of phrases and we actually found that Merce does this...in his own choreography not just on the level of stitching phrases together but he really decomposes the parts of the body and in a way this is a natural fit for computer choreography. The motion capture cameras would have eyes only for these markers on the dancers bodies and it would record the position of these markers in time and space but not the likeness of those bodies. (American Masters 2000).

Then, in Bipeds, motion capture dancers performed with dancers on stage, changing the possibilities of space in a typically Cunningham innovation.

Kaiser and Eshkar create a virtual environment for a community of dancers, an environment that includes elegant, ephemeral virtual dancers performing movement derived from Cunningham dancers. In...Ghostcatching, Kaiser and Eshkar use Bill T. Jones’s recorded actions to animate abstract dancers in an 81/2 minute virtual dance, a portrait of Jones as performer. Kaiser and Eshkar capture something essential about dancers and dancing in these motional portraits. This is especially true in Bipeds, where the virtual dancers complete a process of abstraction already at work in Cunningham’s choreography (Dils 2002, 94).

Thus, another collaboration where the role of mapping motion projectively is shown is in Ghostcatchers. When it was performed, photos of Bill T. Jones, with the motion capture markers all over his body, were on display in the lobby.

Cunningham choreographed Loops, based on the circular motion of his wrists, in 1971 and never taught it to another dancer. OpenEndedGroup used motion capture to translate Loops into digital performance in 2000. The silver balls acted as the mocap markers, and their digitally mapped movements were transformed into a light ballet.

As the dance historian Sally Sommers said, Just when I think I sort of know where he’s been and I sort of think I know where he is going to go, then he pulls a Bipeds out and it’s like
whoah, where did this come from. (American Masters 2000).

Mapping motion records movement, but, in the hands of a Merce Cunningham, it also creates dance.

Figure 12 Bipeds

4. WITTGENSTEIN’S LOGIC OF DEPICTION

Thinking through the philosophical problems involved in understanding the “logic of our language” in his notebooks, Wittgenstein asked, “What is the ground of our--certainly well-founded--confidence that we shall be able to express any sense that we like in our two-dimensional script? (Wittgenstein 1961, 21). In “Wittgenstein and the Mind’s Eye,” I argued that Wittgenstein’s engineering training developed an already strong predilection towards visual thinking and constructive modeling, providing him with an answer to that question. How do engineers solve problems, communicate ideas, and create designs? The ability to visualise an invention, to solve design problems by creatively altering configurations of its elements, calls for constructive, synthetic, spatial thinking. How does that relate to the Bild theory of language?

It is important to remember that translation of the German word Bild as picture can be misleading. (Wir machen uns Bilder der Tatsache). David Stern captures the true sense of Wittgenstein’s usage.

Wittgenstein used the German word ‘Bild’ to talk about the model, a term usually translated as ‘picture’; as a result, the theory of meaning it inspired is…known as the picture theory. While both words cover such things as images, film frames, drawings, and paintings, the idea of a three-dimensional model is more readily conveyed by the German ‘Bild’ than the English ‘picture’...it is important not to be misled: the theory involves generalizing from what models, pictures, and the like are supposed to have in common, and treats two-dimensional pictures as just one kind of Bild’ (Stern 1995, 35-36).

In the Tractatus, Wittgenstein was concerned with “what is the case,” how things stand in relation to one another in the world, and how that is mirrored in the propositions of our language. A famous illustration of his conceptualisation of the relationship between states of affairs and their representation in propositions is his example of a model of an accident being used in a Paris courtroom to represent the situation, or what was actually the case, in the matter before the court. It was how he came to his basic insight concerning the Bild theory of language. His friend and literary executor Professor Von Wright told the story.

It was in the autumn of 1914 on the Eastern Front. Wittgenstein was reading in a magazine about a lawsuit in Paris concerning an automobile accident. At the trial, a miniature model of the accident was presented before the court. The model here served as a proposition, that is as a description of a possible state of affairs. It had this function owing to a correspondence between the parts of the model (the miniature houses, cars, people) and things (houses, cars, people) in reality. It now occurred to Wittgenstein that one might reverse the analogy and say that a proposition serves as a model or picture, by virtue of a similar correspondence between its parts and the world (Von Wright 1984, 18).

He thought this through in the Notebooks as follows: “the general concept of the proposition carries with it a quite general concept of the co-ordination of proposition and situation...”

In the proposition a world is as it were put together experimentally (As when in the law-court in Paris a motor-car accident is represented by means of dolls, etc.) [Cf. 4.031]...This must yield the nature of truth straight away.

Let us think of hieroglyphic writing in which each word is a representation of what it stands for. Let us think also of the fact that actual pictures of situations can be right and wrong. [Cf. 4.016.]

Figure 13: Fencers (Wittgenstein 1961, 23)

If the right-hand figure in this picture represents the man A, and the left-hand one stands for the man B, then the whole might assert, e.g.: ‘A is fencing with B’. The proposition in picture writing can be true and false. It has a sense independent of its truth or falsehood. It must be possible to demonstrate everything essential by considering this case….while we are not certain of being able to turn all situations into pictures
Mapping motion II: motion capture and the visualisation of dance

Kelly Hamilton

on paper, still we are certain that we can portray all logical properties of situations in a two-dimensional script.

How do we portray those “logical properties of situations” in our two dimensional script? In a proposition, we combine names (standing for objects) to represent concretely three-dimensional states of affairs. We need to look closely at this idea in the context of his engineering training.

Using models of working parts of machines to teach machine construction to engineers was standard. Polhem’s ‘mechanical alphabet’ modeled the mechanical movements necessary for the design of complex machines.

The five ‘powers’ of Hero of Alexandria: the lever, the wedge, the screw, the pulley, and the winch, were the vowels of his mechanical alphabet. No ‘machine limb (could) be put into motion without being dependent on one of these’ (Ferguson 1992, 137).

This alphabet of objects, whose configurations produced various working inventions, gave engineers a tacit understanding of the component parts of machines and the principles underlying the forms of machines, allowing them to visualise these elements combined in new configurations.

The forms of the parts (objects) determine the possibilities of different structures of machines (possible states of affairs). The actual combination of parts (configuration of objects) realised depends on which of those possibilities was realised in the construction of the machine. “If I know an object, I also know all its possible occurrences in states of affairs. (Every one of these possibilities must be part of the nature of the object)” (2.0123). “If all objects are given, then…all possible states of affairs are also given” (2.0124).

Think in terms of dance movements in LifeForms, or choreography in dance notations. In LifeForms, Cunningham pushed the limits of movement by “deconstructing” the limbs of the virtual dancer, combining movements to create groundbreaking dances. In the “Language of Dance,” the movement alphabet represents and records choreography, with the alphabet of movements representing the elements of the dance. Given the combinations of symbols representing movements in Labanotation, a George Ballanchine trusted that his choreography would be faithfully preserved and represented with integrity so that it could live again on stage.

Considering another variety of engineering drawings gives us further insight. In exploded drawings, the elements of the machine are shown as separated pieces in order to clarify how they come together in the machine (fig. 15b). The mechanism can be analyzed into its simplest component parts, much as Cunningham “deconstructed” movements of limbs in the figure editor to create new possibilities for choreographic combinations. Schiphorst comments insightfully that “the choreography and composition of a dance is a complex synthesis task which has much in common with design” (Schiphorst 1993, 115).

In 4.0311 Wittgenstein repeats the idea of spatial objects standing in relation to each other. “One name stands for one thing, another for another thing, and they are combined with one another. In this way, the whole group – like a tableau vivant – presents a state of affairs.” Names in propositions

Figures 15a and 15b: DaVinci’s Engineering Drawings (Hamilton 2001, 74 and 81)
present states of affairs in a tableau vivant? Names as signs for objects, objects as concrete as real tables, chairs, and books, standing in relation to one another, for, after all, “logic is interested only in reality. And thus in sentences only in so far as they are pictures of reality” (1961a, p. 9e).

To represent situations we put propositions together experimentally. We construct their sense, then test them against reality to see if they match. “In a proposition a situation is, as it were, constructed by way of experiment. Instead of, ‘this proposition has such and such a sense,’ we can simply say, ‘This proposition represents such and such a situation’.” 4.031.

Propositions answer yes or no, true or false, in order to represent reality. This is their truth-value, and a proposition (a Bild) that captures a possible logical form that exists, and is realised as a structure of a state of affairs, has represented something true about reality. We can now consider the most complete presentation of the logic of depiction and the law of projection.

4.01 A proposition is a picture of reality. A proposition is a model of reality as we imagine it.

4.011 At first sight a proposition---one set out on the printed page, for example---does not seem to be a picture of the reality with which it is concerned. But neither do written notes seem at first to be a picture of a piece of music, nor our phonetic notation (the alphabet) to be a picture of our speech. And yet these sign languages prove to be pictures, even in the ordinary sense of what they represent.

4.012 It is obvious that a proposition of the form ‘aRb’ strikes us as a picture. In this case the sign is obviously a likeness of what is signified…

4.014 A gramophone record, the musical idea, the written notes, and the sound waves, all stand to one another in the same internal relation of depicting that holds between language and the world. They are all constructed according to a common logical pattern.

4.0141 There is a general rule by means of which the musician can obtain the symphony from the score, and which makes it possible to derive the symphony from the groove on the gramophone record, and, using the first rule, to derive the score again. That is what constitutes the inner similarity between these things which seem to be constructed in such entirely different ways. And that rule is the law of projection which projects the symphony into the language of musical notation. It is the rule for translating this language into the language of gramophone records.

4.015 The possibility of all imagery, of all our pictorial modes of projection, is contained in the logic of depiction.

Guest argues that “dance notation is to dance what music notation is to music and the written word to drama” (Guest 1984, xiv). How does the logic of depiction allow one to think projectively with computer dance notation systems like Lifefoms? As in the motion capture that created Gollum in Peter Jackson’s Lord of the Rings and the Navi in James Cameron’s Avatar, the movements of the dancers were recorded by the camera to reproduce patterns of spatial relationships, mapping that artistic movement in three space into the flatland of the computer screen, the two dimensional script. “That is what constitutes the inner similarity between these things” 4.0141.

5. ON ELECTRONIC VISUALISATION IN THE ARTS

Electronic visualisation as practiced in the multiple forms of computer dance notation now available allows choreographers, artists, and teachers to imagine, create, and instruct, helping them visualise and record choreographic design. Thecla Schiphorst’s recent work showcases the possibilities inherent in this creative work.

I continue to work with movement as material. Movement is integral to expression within dance and to learning within somatics. An example is immerce, an interface to an archival database application exploring multiple navigation modes based on Cunningham’s choreographic methods…This work won three IDMA (International Digital Media Awards) and was exhibited in Canada and abroad (Schiphorst 2009, 36).

Cunningham used visualisation of movement in computer dance notation and motion capture to choreograph that movement into revolutionary new dances. He transformed electronic visualisation into the art of movement, choreographing dances and realising the last of the four key discoveries of one of the greatest dancers and choreographers of our times. That work continues, and Wittgenstein’s logic of depiction provides insight into the theoretical principles underlying these ongoing creative possibilities.

6. REFERENCES

Mapping motion II: motion capture and the visualisation of dance
Kelly Hamilton


