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Article:

Salazar Sutil, N (2014) Mathematics in Motion: a Comparative Analysis of the Stage Works of Schlemmer and Kandinsky at the Bauhaus. *Dance Research*, 32 (1). pp. 23-42. ISSN 0264-2875

<https://doi.org/10.3366/drs.2014.0085>

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Salazar Sutil, N. (2014) 'Mathematics in Motion: a Comparative Analysis of the Stage Works of Schlemmer and Kandinsky at the Bauhaus'. In *Dance Research*, Edinburgh: Edinburgh University Press, 32.1 (May): pp. 23-42.

Mathematics in motion: a comparative analysis of the stage works of Schlemmer and Kandinsky at the Bauhaus

Nicolas Salazar Sutil

Despite internal and nationwide political difficulties that led to various relocations across Germany and eventually Chicago, the Staatliche Bauhaus remains to this day one of the most influential programmes in art pedagogy– a model for many art schools and curricula worldwide. The main ethos of the Bauhaus school involved the integration of artistic disciplines through a combination of theoretical academy, arts-and-crafts schooling, and technological innovation. Walter Gropius' vision, as founder of the Bauhaus, remains relevant to this day: to bring together all creative efforts into one whole, and to 'reunify all disciples of the practical arts' (2012: 15). The main pedagogical principle of the Bauhaus, according to Gropius, was that even as 'art rises above all methods; in itself it cannot be taught, [...] the crafts certainly can be' (15).

The school's foundation course was compulsory for all students for a period of six months, after which they could opt for a workshop-based course in a key subject including design, photography, typography, the visual arts, and the stage. These various disciplinary strands were all grounded on a study of Crafts (*Werklehre*) and Form (*Formlehre*), which provided the common methodological basis regardless of whether the student turned out to be a stage practitioner or typographer. The Bauhaus programme placed dedicated emphasis on analytical synthesis through an interrelation of its two core methods. In sum, a specialised understanding of form was intended to enhance craftsmanship, and viceversa. Integration of practice and theory also relied on an integration of three key areas: art in general, science (including mathematics and physics), and industry (in the form of technical possibilities and economic factors). From the above, it is clear that students pursuing a career in the performing arts would have had to acquire basic understandings of geometry in order to embed this knowledge within the Bauhaus' Stage workshop, particularly via: (1) construction techniques or modelling, and (2) diagramming, or the drawing of plans.

This essay addresses the cultural-historical impact of the Bauhaus' celebrated method as it inflects on the school's highly influential works for the stage. In particular, this essay focuses on two leading figures of the German Bauhaus movement: Wassily Kandinsky and Oskar Schlemmer. In addition to

discussing the importance of mathematical methods used by both these artists, the essay also speaks to the specific techniques used for the representation of a 'mathematics in motion', within a synthetic and cross-disciplinary choreographic context. I argue for a basic difference exemplified by these practitioners to the understanding of motion design- one ensconced within a visual approach (abstract dance), the other proprioceptive (balletic mathematics).

Kandinsky: toward a dramatisation of form

Wassily Kandinsky held the position of Bauhaus Meister from 1922 up until the Nazis closed the school in 1933. By combining constructivist and cubofuturist influences from his native Russia with a classical artistic training obtained in Munich, Kandinsky provided the perfect link between the German fine arts scene and the Soviet avant-garde. He gained a position of some notoriety by developing a unique style of abstract painting, which he championed not simply as a novel pictorial style but as a kind of artistic and spiritual philosophy. Less known, perhaps, are Kandinsky's contributions to the practice and theory of formal composition in the performing arts. In a number of relevant publications, including the essay *Abstract Synthesis on the Stage*, which was written during his Bauhaus years, Kandinsky refined the idea that in order to develop new theatrical form, it was necessary to look at the underlying form behind an image.

The general problem of form, as Kandinsky himself explained, refers to two key considerations: form in its narrower sense- plane and space-, and form in its broader sense- colour and relations between tone and shape- (Kandinsky 2012: 61). In the following pages, I will contend that Kandinsky was a pioneer in the development of abstract theatre and dance, through his application of a theory of elements of form to a 'monumental art'.¹ Kandinsky's vision refers to a multidisciplinary cross-artistic synthesis that would famously engage musical, choreographic and visual elements into a coherent artistic unity. The basic principles of an abstract stage practice could be realized within the interdisciplinary and unifying context provided by the Bauhaus, particularly since the crossover from the fine arts to the stage also led to the radical new applications of mathematical methods and technological tools within experimental dance and theatre performance.²

Kandinsky's colour-tone dramas make up the central tetralogy of his abstract theatre. These four pieces, which were conceived for the theatre between 1909 and 1914 (and whilst resident in Russia), explore Kandinsky's vision of the lyrical and dramatic interaction between shape, movement, and

¹ Kandinsky's notion of a 'monumental art' is reminiscent of Wagner's well known concept of the *Gesamtkunstwerk* (total artwork) both in scope and ambition. The two, however, are fundamentally different. For a comparative analysis see Chiel Kattenbelt's 'Theatre as the site of the performer and the stage of intermediality' in Chapple and Kattenbelt (eds.) *Intermediality in Theatre and Performance*.

² For a study of mathematical influences in the historical avant-garde see Salazar Sutil, N (2010), *Theatres of the Surd: mathematical thinking and its impact on European avant-garde theatre (1890-1980)*.

colour. Kandinsky's *Yellow Sound* is perhaps the most representative, insofar as it explores in some depth the artist's enduring preoccupation with synesthesia; that is, stimulation of one sensory or cognitive process leading to experiences in a second sensory-cognitive pathway. Kandinsky's synesthetic art was particularly poignant in terms of a crossover between sight and sound, as it is clear from the piece's title.³ Kandinsky also sought to achieve the effect of colored tone or colored sound by the innovative blend of multiple artistic disciplines and media, especially through novel lighting techniques, as I will explain in due course. The role of text, furthermore, was highly specialized. As Kandinsky himself explained in his article 'On Stage Composition', dating back to 1911-2: words and sentences were used in *Yellow Sound* only to generate 'moods'. Kandinsky wanted the sound of the human voice to be used 'purely', that is, without being obscured by the meaning of the words (1994: 264). This attempt to consider dramatic art in terms of inner means, activated via synesthetic sense schemata, rather than word-based meaning, enabled Kandinsky to experiment in a kind of stage practice that was primarily visual. Having said this, Kandinsky's work was also synesthetic, which enabled a sensory crossover from vision to sound and kinetic sensation (but never to a semantic domain). So against established dramatic notions like 'action', Kandinsky argued for a sense of dramatic progression based on subtle variations in the three 'elements' that make up the drama: music, movement, and colour.

Likewise, the characters in *Yellow Sound* function in purely formal terms: the Giants, the Child, the Fat Man, the People in Flowing garbs, are valuable as dramatic elements inasmuch as they embody fundamental elements of form in the visual and sonic composition. Any psychological traits found in the characters of Kandinsky's play can be deduced from these formal properties. Kandinsky's abstract theatre can elicit tension, vibration, harmony, and ultimately, conflict, by means of contrasting size, volume, shape, and colour. For an experience of drama to take place there is no need for realistic representation, with all the psychological and emotional baggage stylistic realism carries with it.

In his book *Point to Line to Plane*, Kandinsky introduced the art of composition as a basic arrangement of elements moving from point to plane, applicable to the visual as well as the performing arts. Kandinsky also introduced the notion of 'dramatization' to speak of lines in a pictorial plane that are close to, and not touching, the edge of the plane. So whereas a line that touches the edge loses its tension and thus become still and quiet ('lyrical'), lines approaching the edge increase in tension, thus producing a sense of pictorial sound or 'dramatization'. For Kandinsky, the notion of 'dramatization' is also key to understanding diagonal lines that do not link the centre of a square to one of its corners, but rather deviate in a way that is a-centered and which does not touch any of the four corners. According to this analysis, pictorial representation could be said to be dramatic when four elementary lines, two diagonals, vertical and horizontal, are spread unequally across the plane. The attribution of a dynamic

³ Other contemporary art practitioners to have explored the concept of synesthesia, like Kandinsky, include Alexander Scriabin and the Italian futurist stage artist Enrico Prampolini, who pioneered the idea of 'chromophony'.

quality to the relationship between a point and a line, or a line and a plane, is key to understanding the way in which Kandinsky's points, lines and planes can be given life not only as geometric properties, but also dynamic elements in an artistic composition (whether it be a painting, a play, or a dance).

[INSERT FIGURE 1 HERE]

**Kandinsky's representation of 'lyrical' and 'dramatic' lines in a pictorial plane.
Drawing by the author, adapted from Kandinsky's 'Point to Line to Plane'
(published in Complete Writings on Art, New York: Da Capo Press, 1994)**

Abstract dance

Point to Line to Plane is also relevant to this discussion not least because it contains traces of a theory of abstract dance. After acknowledging the mathematical notion of point Kandinsky generalized the object in question to represent spatial dynamics of many kinds, including the notion of *pointe* work as understood within balletic technique. Thus, abstract dance can be constructed from basic representations of stillness or stops, which can be generalized to mean the holding of a position, a position *en pointe*, the taking up of a literal point in space, etc. Even at such a fundamentally abstract level, Kandinsky saw the various embodiments of 'point' as a tension, a conflict. The point further on manifests itself as a temporal period, as well as a spatial period; i.e. the punctuation mark or the full-stop symbol. In like manner, Kandinsky saw no end to extra-mathematical generalizations to the line: temperature, hue, force, sound, and of course, locomotive movement occurring in the dance; they all stand for the object of the line and linear composition in general. Kandinsky moved finally to a discussion of the picture plane, which generally, he saw as rectangular or square surface. The plane could also be actualized as the dance floor, which constitutes a canvas on which the points and lines embodied by the dancer are drawn.

This said, abstract dance does not involve the figurative interpretation of the notions of point, line and plane by a live dancer. Rather, it involves a removal of concrete objects, especially in terms of taking the concrete body of the dancer out of the dance. Abstract movement, in Kandinsky's approach, becomes an act of re-moving, by which I mean the internalization of the movement to inner gestures, diagrammatized traceforms, and geometrized figures that are reductive and extractive representations of the human body. Movement, at such an abstract level, is simply the process of adding dimensions to a geometric coordinate. When a point moves, it becomes a line; when a line moves, it becomes a plane. The reason why Kandinsky's approach to dance is distinctly abstract, as opposed to Schlemmer's approach (which was not), is that the movement originates from points that are derived from human bodies. The concrete human body, however, and concrete representation in general, is ultimately eliminated. Abstraction thus transcends the corporeal, so that what remains on stage is pure movement, pure formal tension provoked by points, lines and planes. Thus, Kandinsky's dances are performed not by live dancers at all, but by geometric

figures extracted or indeed completely removed from dancers or other concrete objects. As such, any point, line or plane in movement, even if totally removed from concrete life, could be given artistic life through movement. The need for removed movement, as it were, derives from the belief that figuration otherwise imprisons or conceals the true nature of things. The same applies to elements that are only incidental to the existence of the art object. By a principle Kandinsky called 'inner necessity' (quoted in Ingold 2011: 206), the 'abstract content' of the work of art becomes a truth that could directly touch the soul of the perceiver and set it in motion.

Abstract composition could thus recover from the noise of figurative dance an image that does not depend on bodies and concrete dance figures for its realisation. The abstractions 'open the mind to inner truths that are ontologically prior to the outward forms of things' (Ingold 2011: 206), as figuratively performed in a live dance. Ultimately, by simplifying anatomical shapes to a series of lines and arcs Kandinsky argued that he could touch upon the essence of the dance. Thus, in the same way that he turned the dancer into a stick figure or geometric object (as we will see presently), so complex dance phrases were reduced to single 'dynemes', that is, to the most basic units in the grammar of movement.

Kandinsky's vision was realized in his set and choreographic staging of Modest Mussorgsky's *Pictures at an Exhibition*, performed at the Dessauer Friedrich-Theater in 1928.⁴ Mussorgsky's ten 'pictures' were turned into sixteen animations combining music, stage movement, lighting and decoration. Kandinsky's concept rests on this inner need for abstraction, which is realized through the geometrical stylizations of the figures described in the original paintings by Viktor Hartmann, and musicalized by Mussorgsky. In Kandinsky's version, the exhibition contains a clear sense of movement, as the geometric objects shift on the canvas, and as the sixteen paintings that make up the exhibition alternate. 'Ballet of the Unhatched Chicks', for instance, features a meandering white line on a black plane, upon which yellow points move gradually. The bright yellow of the unhatched chickens (represented as abstract

⁴ Mussorgsky's original piano suite in ten movements, composed in 1874, was inspired by 10 drawings and watercolors of Russian architect and painter Viktor Hartmann. The piece would have no doubt appealed to Kandinsky as a case of synesthetic art, but also as an example of the kind of artistic re-mediatization that was to become a key feature of his idea of a 'monumental art'. Thus, the same paintings that Mussorgsky had turned into piano music in the late 19th century, were brought back into the medium of visual arts via Kandinsky's design, albeit in a more synthetic and abstract form. The complete set of original watercolor drawings produced by Kandinsky for the 1928 performance was exhibited by the Centre Pompidou, together with the animated images, and published as part of the comprehensive exhibition *Danser sa Vie* (2011–12), celebrating interactions between art and dance from 1900 to the present. Mikhail Rudy produced a version of Kandinsky's work in 2011, featuring music from Mussorgsky and an animated experimental video based on Kandinsky's watercolors.

spots of light), and the shape of the line upon which the dancing points shift, are the only elements needed for the ballet in question to take place. Kandinsky realised the movement of the dancing spots in his 1928 stage production in terms of an imaginative use of lighting. Thus, while the central portion of the set was at first concealed by a black cover, hand-held spotlights positioned behind the scenery illuminated the various patterns of dots and lines cut into its left and right sides (Guggenheim 1983: 72). Real dancers were also used in the production, serving 'quite different functions in the different scenes in which they participated' (72), particularly by adding visual information by bearing a 'map image', and providing the necessary sense of traction to the formal elements along the composition, or else by gesticulating to provide the kind of 'moods' Kandinsky speaks of in his description of *Yellow Sound*, quoted above.

The Gret Palucca drawings

In 1926 the impresario and socialite Fritz Bienert contacted Kandinsky in an attempt to promote the work of aspiring dancer Gret Palucca. Palucca, it might be worth noting, also happened to be Bienert's wife. Given the enormous influence played by the Bienert family in artistic circles, Kandinsky obliged. The Bauhaus Meister even agreed to write a multipage essay based on promotional photographic material of Gret Palucca's dances. Bienert provided Kandinsky with four stills taken by photographer Charlotte Rudolph, on the basis of which Kandinsky drew four diagrams.

Susan Funkenstein argues in her essay 'Picturing Palucca at the Bauhaus' that the performance embodies Kandinsky's expounded theories of composition, particularly his idea of a balance of warm and cool, light and heavy; which were paralleled in Palucca's choreographic work (2012: 49-50). Kandinsky's visual essay also reads as a fine example of abstract dance, inasmuch as the choreographic figures drawn by the dancer's body changing over time are re-moved and segmented, producing basic tensions between purely formal elements. There are many ways in which these formal elements elicit a dynamic contrast, but it is clear from the drawings below that Kandinsky is keen on establishing a juxtaposition of: (1) the arc and the straight line, (2) the dancer's joint angles in acute and obtuse degrees, and (3) the dancer's body-lines drawn in relation to the plane of composition within which the body lies framed. The tensions drawn from the above enabled Kandinsky to translate the key contours and axes of the dancer's body into 'dramatizations', as defined earlier. In this third stage of the choreographic analysis, the dance also serves as the basis for a formal composition, in the broader sense used by Kandinsky, such that the division of primary and secondary axes and areas could be pictorialized by the addition of colour.

Kandinsky argued in his accompanying essay that an instantaneous photographic capture of dance movement could be translated into diagrammatic form (1994: 521), in order to better understand how the dance, which is essentially a temporal art form, is in fact made up of cut-off forms or still shapes in space. Thus, Kandinsky was expanding on an idea he had already explored in

his colour tone dramas, namely, that the temporal variable in kinetic art could be obtained from a progression of stills, to produce moving paintings. One could argue that this approach is, in a manner of speaking, chronophotographic. Indeed, plenty of similarities could be drawn here between Kandinsky's Dance Curves, and Etienne-Jules Marey's so called 'geometric chronophotography'⁵, where the moving human body is likewise turned into a moving stick figure. In both cases, the moving human body is reduced to lines and joint angles, allowing a sense of movement to emerge from the sequencing of still-photographic geometric images. The parsing mechanism that is the time-lapse photographic medium recomposes the geometry in movement, but in such a way that it removes the movement from the body (or the dancer), and artificially reactivates it via the sequencing of still images.

The Palucca dance could be recomposed analytically into a sequence of motion segmentations, if more frames were available. Instead of experiencing the living moving body as concrete dance, an abstract dance would occur as the animated rendition of the stick figures, or indeed the purely abstract and imaginary shapes, move sequentially along an animation strip. The dance is not only a sequencing of images; it is also an imaginary sequence. Ultimately, abstract dance relies on a purely optical and projective re-composition of movement. If motion is contained in the movement of still images, and not in the live dance itself, motion becomes thus subject to the regime of the retina- that is, it happens as a purely optical effect, projected onto the screen of the artist's imagination. Movement does not occur in itself, in the ambit of a movement sensation (proprioception). Summing up, the fact that movement could be recomposed chrono-photographically enabled Kandinsky to position the art of painting and drawing at the heart of the choreographic imagination, which is why he could speak of paintings as frozen instances of choreographic or scenic art. Conversely, the dance could be seen to be a drawing or painting in motion.

[INSERT FIGURE 2 HERE]

Diagrammatisation of Gret Palucca's dances, by Wassily Kandinsky (1926)

Schlemmer and the mathematics of motion

During his time as Meister of the Stage Workshop at the Weimar and Dessau Bauhaus, Schlemmer devised a number of theatre works, dances, circus acts, cabarets and Fasching parties, which came to encapsulate the Bauhaus' highly influential contribution to performance-making in the inter-war years. Like many of his Bauhaus colleagues (including Kandinsky and Paul Klee), Schlemmer first grappled with the question of whether abstract space ought to be

⁵ For a study of geometric chronophotography see Nicolas Salazar Sutil and Sebastian Melo (2014) 'Exposed to Time: cross-histories of human motion visualisation from chrono- to dynamophotography', in Douglas Rosenberg (ed.) *The Oxford Handbook of Screendance Studies*.

adapted in deference to the human body. Furthermore, Schlemmer asked himself whether space should be transformed into the imitation of nature, or whether, conversely, the human body would be recast in the mold of abstract space. Schlemmer resolved this question by arguing that abstraction could not be achieved for the sake of abstraction, as Kandinsky claimed it should. For Schlemmer, geometric abstraction should be extracted from shapes inherent to the human body; e.g. the star form of the spread-out fingers of the hand or the sign of infinity (∞) of the folded arms. In other words, Schlemmer argued for mathematical objects that should be embodied and felt: 'geometry, the Golden Section, the laws of proportion' he wrote:

'... they are lifeless and unproductive unless they are experienced, touched and felt. We must surrender ourselves to the miracles of the proportions, the magnificence of the mathematical relationships and correspondences, and derive our laws from the results' (1990: 142).

Oskar Schlemmer wrote that his work found great delight in mathematics: 'not the kind one has to sweat about in school, but rather in the kind of artistic, metaphysical mathematics that suggests itself by necessity, as in art' (Schlemmer, quoted in Trimmingham 204: 138). In other words, what Schlemmer (and by extension I myself) mean by mathematics is most certainly not what a trained mathematician might have in mind. Mathematics here refers primarily to an innate sense of regular and formalised space and number derived from physical life, and also from the process of mentalisation or internalization of movement that generates thought out of physical motion. Schlemmer's notion that mathematics in motion is produced by necessity echoes Kandinsky's 'inner need' for abstraction. Rather than being a language one acquires through learning, mathematics in motion is a language one produces naturally and by necessity, given the fact we possess proportionate and symmetric bodies that move in space. In Schlemmer's own words: mathematics in motion 'corresponds to the inherent mathematic of the human body', which 'creates its balance by means of movements' (1961: 23).

In order to sense mathematics, and bring it to life in art, it had to be performed. To achieve this, Schlemmer set himself the task of creating what he called a 'balletic mathematics', which would derive a sense of artistic and aesthetic value from the inherent beauty of formalized dancing bodies. Schlemmer goes on to argue in a diary entry from September 1922 that in addition to seeking an original and primordial impulse in non-intellectual and irrational modes of thought, modern artists discovered 'the new mathematics of relativity'. He continued: 'both these modes of consciousness- the sense of man as a machine, and insight into the deepest wells of creativity- are symptoms of one and the same yearning' (1990: 127). Elsewhere, Schlemmer spoke of two creative paths, one of emotion and one of a mathematics in motion, the mechanics of joints and swivels and the exactitude of rhythmic and gymnastics' (1961: 95).

[INSERT FIGURE 3 HERE]

Geometric Man, from Schlemmer's Man and Art Figure (1927), published in The Theatre of the Bauhaus (Wesleyan University Press, 1961)

Schlemmer's five principles

There are fundamental principles running through Schlemmer's stagework relating to: 1) body 2) space 3) motion, 4) the synthesis of the physical/material world, and 5) metaphysical and spiritual dimensions. Firstly, Schlemmer's theory of space relates to an involvement of a choreographic performance within a surrounding area, not only the stage, but also an entire building. This placed demands on an 'architectonic handling of performance space' (1962: 162). Schlemmer was concerned with combining plane geometry or 2D space (the surface or floor on which the dancer moves) with the 3D, solid geometry of the moving body. This connection was at the heart of Schlemmer's artistic vision. Indeed, most of his dances explore this relationship as a kind of compositional interdependence. The floor holds 'Man the Dancer' (Tänzer Mensch), in the same way that the dancer becomes the receptacle of its floor. They are both an essential component of the choreographic synthesis. There is no dancer without the plane within which this dancer moves, in the same way that there is no dramatization of the line (going back to Kandinsky), without the rectangular plane of the canvas-frame.

Following on the above, Schlemmer stressed the idea of a 'floor geometry' (1990: 162), which he defined as the configurations which determine the paths of the dancers, and which in some cases was identical to the forms worn by the dancers. Schlemmer explored this idea in his trio Space Dance (Raumtanz), first produced at the Dessau Bauhaus in 1926. The body shape and the shapes produced by the dancing automaton as it moves on the diagrammatized dance-floor are the same. Schlemmer also used carpets with various geometrical patterns (particularly chessboards), as a grid-like canvas on which to set the body in motion. In a diary entry dated mid-December 1925, Schlemmer explained how this geometrical carpet ought to be used in rehearsal: 'each field will be numbered, and during the dance the numbers will be called out. A similar procedure with the instruments, and likewise with the colours, the space and so on [...] The immediate goal: discover the different principles that govern the different areas' (1990: 186).

The second fundamental principle of balletic mathematics relates to a novel understanding of the human body. Schlemmer proposed to work out a bodily design based on the 'laws of the surrounding cubical space', which resulted in his conception of choreographic bodies as an ambulant architecture' (1961: 26). In order to make a connection between the anatomical body and its surrounding planar space, Schlemmer made use of stereometry; that is, the study of solid volumes. In Schlemmer's own words: 'Space, when taken as determining the laws of everything that happens within its limits, also determines the gestures of the dancer [...] Out of plane geometry, out of the pursuit of the straight line, the diagonal, the circle and the curve, a stereometry of space

evolves, almost of itself, by the moving vertical line of the dancing figure' (quoted in Wingler 1969: 118). In other words, the floor and the human body are governed by the same properties. They are, effectively, made up of the same formal substance. The difference is that because the human body is moving, it becomes a higher-dimensional projection of the 2D floor or wall, which are immobile. Like Kandinsky, Schlemmer saw movement as a geometric condition. When a point moves, it becomes a line. When a line moves, it becomes a plane. Schlemmer goes one step further. When the planar floor or wall moves, the floor becomes a solid object, a stereometric projection. In other words, the human body is a three-dimensional projection of the two-dimensional floor or wall upon which the dance is embedded.

This stereometric approach would lead to two very significant corollaries: firstly, the dancer's body could be potentially operated and assembled as a mechanical structure. The four models proposed by Schlemmer are: automaton, mobile architecture, marionette or metaphysical entity. These offered a new sense of the body in performance that did not rely on musculoskeletal structures or anatomical bodies, but geometrically articulated structures. A distinctly new type of 'technical organism' emerges from Schlemmer's work, which he famously called the *Kunstfigur* (Art Figure). The performer is no longer a living human being necessarily, but, quite possibly, a robotic mechanism. One other corollary to Schlemmer's principle of embodiment involves Schlemmer's specifications for a performer that should engage in non-verbal actions. Schlemmer's performers appeared masked in order to de-personalize and remove identifiable traits, thus freeing the performer from what Schlemmer saw as trivial parameters (gender, age, race, and so on).

Thirdly, the laws of motion of this new body in space resulted in a very particular type of regulated mobility, one that is defined by fundamental types of motion (rotation, translation, reflection, resizing). Schlemmer spoke of the laws of motion of the human body in space, placing particular attention on various aspects of rotation, direction and intersection (1961: 27). Schlemmer was thus attracted to structured patterns of movement such as the one produced by a spinning top, a spiral, or a disk in movement. Movement was not to appear random and unorganized. Rather, and stemming from the very same laws governing space, and by extension the body, choreographic movement should obey the laws of geometric motion, governing geometric objects within the planimetric and stereometric stage.

[INSERT FIGURE 4 HERE]

Schlemmer's linear study of the Moving Figure (*Bewegte figur*), part of his *Mensch* course on figural drawing (from Kuchling, Heimo, ed. Oskar Schlemmer: *Man: Teaching Notes from the Bauhaus*. MIT Press, 1971).

Dürer and the stereometric approach to performance

Schlemmer disagreed with Kandinsky on what the former saw as a lack of historical perspective at the Bauhaus. Unlike Kandinsky, who did not care as much for historical perspectives, Schlemmer was deeply inspired by the 'old masters'. Most relevant to this discussion is Schlemmer's interest in the 16th century painter, engraver and mathematician, Albrecht Dürer. As early as 1915, Schlemmer wrote: 'I aspire for the Düreresque mode in the form of colour and drawing... Adapting and assimilating everything. This is something I must pursue' (1990: 24-5). Crucially, Dürer had explored the role geometry and stereometry play in the formalization of human anatomy and human movement, particularly in his *Four Books on Measurement* (published in 1525) and *Four Books on Human Proportion* (published in 1523).⁶ Schlemmer made a number of graphic studies based on Dürer's original works, including a rectangular division of the human body (also known as Box-person), from 1928, a study based on Dürer's book on measurement, and a study of proportional division of the human body according to the Golden Ratio. These and other studies became an integral part of Schlemmer's theories of figural representation, which he taught as part of his celebrated *Mensch* course on figural drawing in the late twenties at the Bauhaus.

[INSERT FIGURE 5 HERE]

Oskar Schlemmer study of proportions, after Dürer (from Kuchling, Heimo, ed. Oskar Schlemmer: *Man: Teaching Notes from the Bauhaus*. MIT Press, 1971)

Dürer is of relevance to this discussion not least because he was interested in expanding an existing theory of proportion stemming back to the writings of Vitruvius.⁷ Dürer expanded on these and set himself the task of studying different human types (young and old, male and female, athletic and obese). Perhaps most importantly, Dürer's contribution was to study proportion in relation to bodies in motion. Dürer's amalgamation of anatomical figures and geometric figures resulted in the graphic representation of fundamental mathematical rules that govern various body types and typical bodily movements- an idea that resonates strongly with Schlemmer's notion of an inherent mathematics within the human body. One could argue that the

⁶ The first book identifies five differently constructed types of human anatomies both male and female, all parts of the body expressed in fractions of the total height. In addition to basing his studies on the writings of Vitruvius, Dürer based these constructions on empirical observations of, in the author's words, two to three hundred living persons. The second book includes eight further types. In the third book, Dürer gives principles by which the proportions of the figures can be modified, including the mathematical simulation of convex and concave mirrors; here Dürer also deals with human physiognomy. The fourth book, which is devoted to the theory of movement, is perhaps the most significant to Schlemmer's own theory of geometric metricity, which he implemented as part of his theory of 'mathematics in motion', or 'balletic mathematics'.

⁷ See Salazar Sutil, Nicolas (2010): 'Body Manifold: Mathematics (mis)performed by Vitruvian and Acephalic bodies' in *Performance Research* 15(2): 17-22.

application of Dürer's principles of bodily proportion and movement are key to the development of a theory of mathematical performance in Schlemmer.

[INSERT FIGURES 6 and 7 HERE]

Stereometric Man, From Dürer's Book of Measurement (left) and stereometric study of the human body by Schlemmer (right, from Kuchling, Heimo, ed. Oskar Schlemmer: Man: Teaching Notes from the Bauhaus. MIT Press, 1971)

This said, Schlemmer pushed the stereometric method beyond a Düreresque mode, and beyond the pursuit of purely mathematical relations. For Schlemmer, stereometry becomes a key method to the making of stage costumes, which is one of the most celebrated features of Schlemmer's stage work. Thus, the design models published in Schlemmer's essay *Man and Art Figure* clearly evoke Dürer's 'Stereometric Man: thirteen cross-sections of the body', produced circa 1527. Like Dürer's *Stereometric Man*, Schlemmer's stereometric *Kunstfiguren* take from their surrounding space a basic shape, a cube or cuboid, say, in order to arrange a human figure in a more general volumetric space. The difference lies in that the stereometric sensibility in Schlemmer has an artistic value in itself. Stereometry is not a rule to know the correct proportions of the human body; for example, so as to be able to understand tilting, angling and perspectival tracking, which the classical masters applied to drawing. For Dürer, the stereometric man was but an exercise to understand human movement and so as to be able to draw moving bodies in a realistic, figurative fashion. Schlemmer, unlike Dürer, was not concerned with realistic representation. Rather, he was content with depicting stereometric figures as the final representation of a human body transformed by abstract space. Thus, not only did Schlemmer apply stereometry to costume design- he also used it as a central idea in his performances.

In *Box Promenade* (a dance trio from 1929), three dancers were given the task to build a figure resembling a human being with cubes and cuboids strewn on stage. The dance is a Düreresque exercise that engages the performer in a reflexive task: that is, to find fundamental relations between spatial shapes and to find the patterns and proportions necessary to build a human figure out of boxes. Schlemmer's stereometric dances allowed audiences to see the body as a dynamic relation to space. Moreover, Schlemmer's stereometric dance encouraged a vision of the body as space- more distinctly, as a set of volumetric relations in moving space.

[INSERT FIGURE 8 HERE]

Stereometric design of the *Kunstfigur*, by Schlemmer (published in Gropius, W. ed. *The Theatre of the Bauhaus*, Wesleyan University Press, 1961)

Geometric Woman, and the two categories of motion: Dance Curves v. Stäbetanz

I will finish this essay by way of a comparative analysis. From the above, it is clear that at least two categories of motion take place in the stage experiments carried out at the Bauhaus. When comparing Schlemmer's so called Geometric Man (See Figure 11), and Kandinsky geometrization of Gret Palucca, as seen in the Dance Curves images discussed above, it is clear that whilst both models account for a geometric stylization, such that the human body is simplified to straight lines, arcs and joint angles, the two approaches are in fact very different. This differential approach to how mathematics in motion can be embodied produces a fundamental difference in these artists' attitudes to movement. Unlike Kandinsky, who saw the stage as a moving picture, or a succession of still images, Schlemmer saw the stage as a site for continuous movement, or a site for a continuous mathematics of motion. The stage functioned, for Schlemmer, quite literally as a mobile, a space of transformation and change, at once infinitely variable and strictly organized' (1961: 22). A slightly more philosophical way of putting this is that Kandinsky and Schlemmer realize two very different ontologies of movement: one outside itself and the other in-itself, one visual (where movement is seen from the outside, and projectively), and the other proprioceptively, where movement is felt from within.

Whilst Kandinsky turned to geometric bodies or stick figures in an attempt to re-move the body from a concrete anatomy altogether, Schlemmer gives a concrete value to these lines and turns them into real sticks, or poles, for the concrete realisation of the stick architecture as a physical dance. So instead of having abstract lines move in the blank canvas of an abstract dance (like Kandinsky's analytical drawings of Gret Palucca), Schlemmer wanted to remove the body, but not the physicality of the body, by having the lines attached, as wooden poles, to the dancer's limbs. In Schlemmer's conception, what matters is not the dancer's body, but the dancer's physical life, and so what we see dancing before us are the white wooden poles (the lines), changing direction and speed against the black canvas.

Schlemmer described the idea for his famous 'dance of sticks' in these words: 'imagine a space filled with a soft, pliable substance in which the figures of the sequences of the dancer's movements were to harden as a negative form... Aids such as poles (the horizontal balancing pole) or stilts (vertical elements) are... capable of vivifying space in a frame-like, linear fashion' (1969: 118). In 1927, Schlemmer produced a drawing entitled 'Stilt runners' (Stelenzlauf), where he began exploring the idea of extending human limbs and joints as part of a diagrammatic linear choreography involving wooden stilts and slats. The initial design led to perhaps one of the most celebrated of Schlemmer's short Dessau Bauhaus choreographies, which was to be entitled Stäbetanz (variously translated as Pole Dance, Slat Dance or Dance of Staffs). The piece, which was first performed by Manda von Kreibig⁸ in 1927, stands as one of

⁸ Amanda von Kreibig worked as a principal dancer and ballet master in Darmstadt, Braunschweig. She joined the Dessau Bauhaus and assisted Schlemmer with a number

Schlemmer's most daring and impressive attempts to articulate human body's relationship to the space around it. Schlemmer himself wrote that when the Dessau Bauhaus dances went on tour in June 1928, and were subsequently shown at the famous Dance Congress in Essen, the work was well received by 'those whose opinions count and also by the general public'. He added: 'applause, especially for the Dance of Staffs' (1990: 233).

Schlemmer noted in 1929 that the twelve poles fixed to the body of the dancer were part prop and part costume: 'an intermediary state between that which the actor wears and that which he manipulates' (1986: 145). Unlike many of Schlemmer's previous dances, which had featured the use of masks, Schlemmer opted for a black-clad costume covering the entirety of the dancer's body, including her face. Twelve white wooden slats were attached at knees, elbows, shoulders, and ankles. From the scant photographic records available it appears the dancer wielded a stick in either hand. Stills taken from the original performance also show Kreibig lunging, stepping, stretching her arms, in such a way that emphasis is drawn out of her bodily movement and focused on the shapes created by the sticks. Because the black-clad dancer is set against a black backdrop, these lunging movements are intended to highlight the changing position of the white sticks, whereas the dancer's body remains invisible, like the black-clad puppeteer in a Black Light Theatre.

To highlight this black-theatre effect, Schlemmer had the stage infused with stronger light, which, it appears: 'dematerialized the objective content from within, dynamising it and emphasizing certain forms while others receded into the background, with a resulting rhythmic alternation between plan and depth' (quoted in Litke 1986: 40). In this way, Schlemmer developed a 'sort of X-ray technique' (40), which employed light that seemed to penetrate a solid body to reveal its skeletal inner structure. This inner geometry of the dancer is not entirely dissimilar to what Kandinsky might have read as the inner truth of the image. Such formulation expresses a technological experience of space that Schlemmer himself speaks of in connection with the 'aura of magic', and the metaphysical dimension of the dance, as categorized above.

[INSERT FIGURE 9 HERE]

Oskar Schlemmer, Bauhaustänze, Stäbetanz (Pole Dance), 1928, Vintage Print, altered and mounted by the artist, 17.5 x 11.3 cm. Photographer: T. Lux Feininger; dancer: Manda von Kreibig. Bühnenarchiv Oskar Schlemmer/The Oskar Schlemmer Theatre Estate Collection UJS.

of choreographic works produced between 1926 and 1929, including the celebrated Stäbetanz. Her father, Artur von Kreibig was a German mathematician, so it is not entirely unlikely that Kreibig might have had some understanding of Schlemmer's ideas of a mathematics in motion, from a more rigorous mathematical education. Whatever that may be, and due to injury, Kreibig had to end her career as a dancer in 1931. She spent the rest of her life in San Remo.

How von Kreibig herself felt whilst performing this supposedly magical dance-theatre we will probably never know. In a brief note found in his diaries Schlemmer described von Kreibig as 'very hard-working'... '[She] feels her way quickly into the role, also adding a great deal herself' (1990: 227). A reconstruction of Stäbetanz by Debra McCall in the mid-eighties is also helpful toward an understanding of the dancer's own experience. McCall suggests that the dancer had to be able to project a sense of body into the farthest reach of every pole. According to McCall:

As the dancer began rehearsals with the twelve white poles attached to his limbs and torso, he had difficulty breathing and fought the confinement. Gradually he came to feel less encumbered by imagining the poles as naturally exaggerating his movement. Next he sensed his body interacting with and defining the surrounding space. Only then did the dance become three dimensional and sculpturally alive. (in Root-Bernstein 2001: 177)

The poles become, in the words of American choreographer Alwin Nikolais, 'extra bones and flesh',⁹ which extend the dancer's physical size in space (in Root-Bernstein 2001: 178). The difficulty of moving a body that likewise extends in terms of added weight and unnatural balance is evident from the original photographs of Schlemmer's dance. The experience of the pole-dancer, which as we can begin to tell from the works quoted above is one of added effort, brings us to a final consideration of how these two ontologies of movement are actually divergent at a very basic level. Visualised movement, as represented in the abstract dance, also removes from the experience of movement the effort, and ultimately, the struggle that is moving a body in space, in order to release the image as a purely intellectual and analytical sense of motion. Because movement visualisation removes movement from a physical life and automates it by a simple sequencing of still images (a cinematographic automation), the effort, which is an intrinsic element of human movement, is eliminated, or at least, delegated to a machinic effort.

By making moment abstract, Kandinsky objectified the role of the dancer to a mechanical and geometric apparatus, and so a very fundamental disconnection occurs that distances the viewer and alienates view from motion. Movement is relegated to an animation technique. What is gained in moving from within movement, or rather dancing from the concrete body in Schlemmer's approach, is the bones and flesh, the sweat, the breathing, the kinetic materiality, the staging of physical work and effort. I do not wish to finish off with a statement

⁹ Schlemmer's Bauhaus dances could be said to comprise the roots of American choreographer Alwin Nikolais' work, which is strongly reminiscent of Schlemmer's mathematics in motion. Dancing with poles and geometric shapes was a trademark of a number of works by Nikolais including *Kaleidoscope* (1956) *Allegory* (1959) and *Sanctum* (1964). For a study of similarities between Bauhaus dances and Nikolais' work see Marcia B. Siegel 'Artisans of Space', in Gitelman and Martin (eds.) *The Returns of Alwin Nikolais: Bodies, Boundaries and the Dance Canon* (2007).

that antagonizes the two positions, even though Schlemmer and Kandinsky, as it is clear from their diaries, had a somewhat tense and sometimes acrimonious relationship over the course of their shared careers at the Bauhaus. Visual movement and proprioceptive movement are not antagonistic, in my analysis, but complementary. This parallel history of the Bauhaus' mathematics in motion presents us with the possibility for a kinetic art that can be articulated equally from within and from without the experience of movement.

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