Inscribing structures of dance into architecture[1]

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Abstract

Alternative models of dance as spatio-temporal form are used as a basis for discussing the interaction between the bodies of buildings and subjects in architectural environments. The aim is to enrich the ways in which we describe and design the spatial structure of built space in relation to the spatial structure of embodied experience.

Keywords

Dance, spatial experience, spatial structure, design diagrams, Balanchine, Cunningham

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Can choreology contribute to spatial theory in architecture?

This paper looks at dance, and the theory of dance in order to retrieve principles of movement, co-ordination and spatio-temporal form and that can potentially illuminate and enrich the manner in which we understand buildings as generators of spatial experience. Specifically, looking at dance offers a good starting point for asking questions about the relationship between movement and visual understanding, generators of form that might have tactile or kinetic foundations and their visual consequences. This endeavour involves a reconsideration of our awareness of the human body: recent theoretical discussions (Johnson, 1987; Lakoff and Johnson, 1999) have brought into focus the importance of embodied experience as a foundation for the development of abstract frames of understanding. However, the body involved in embodied experience should not necessarily be treated only as a biological given. It becomes itself a construct and is amenable to redefinition based on perceptual and cognitive schemes. Dance offers a good way to understand how this may occur precisely because the body is the instrument for the production of form while at the same time the experience and the communication of the experience of the body is expressed as an aim of movement. Thus, dealing with dance in the context of architecture is aimed at bringing a richer understanding of the body to bear upon our descriptions of spatial experience and upon our treatment of such experience as an end of design formulation.

In earlier work, Hillier (1996) and Peponis (1997) have pointed out the complementary relationship between architecture and dance in so far as movement and form are concerned. While dance realises some of the patterns of movement that are potentially implied by empty space, architecture restricts potential movement through the imposition of boundaries and the creation of spatial structure. Thus, a heuristic comparison between dance and built space has been used to suggest that our understanding of space involves an exploration of how generative forces interact with constraints, how patterns of movement reveal underlying patterns of order within everyday spatial experience. At the same time, consideration of embodied spatial experience is embedded in commonly used analytic techniques for spatial analysis. For example, consistent with other theoretical approaches (Gibson, 1986), the architectural analysis of the visual field, as articulated through a multiplicity of computational tools, requires that we consider not only the individual visual frame, but much more fundamentally, the manner in which the visual field is constructed as a function of potential movement and layout structure. However, while movement and its relationship to physical setting is central to the body of theory and the analytic techniques associated with "space syntax", no attempt has yet been presented in previous syntactic symposia to learn from the way in which space is constructed in and through dance. Thus, this paper is an exploratory attempt to ask whether the study of dance can make a specific contribution to our description, conceptualisation and formulation of spatial patterns and spatial meaning in architecture.

Dance can be defined as patterned, rhythmic movement in space and time (Copeland and Cohen, 1983). This is a broad definition that links dance to common everyday patterns of movement, perhaps as a conscious elaboration of relationships and potentialities that are also manifest in such everyday patterns. The theory of dance, choreology, addresses the principles that generate dance movements as they interact with the body. These can involve a vocabulary of individual moves, a syntax governing the sequence of such moves in time, and a syntax of co-ordination between different moves occurring simultaneously or in parallel. Most importantly, the principles that generate dance include a reflective awareness of the interplay between a locally applied rule, or force, that becomes visible as a movement, and an overall form that unfolds over time as the collective effect of such rules or forces. Dancers and viewers alike consider the individual moment as part of an overall flow, and the individual movement as part of a complex co-ordination of other movements, the difference being that the dancers are immersed in the very flow they are creating, while viewers are presented with it. However, the overall form of dance cannot easily be described. First and foremost, the whole form is only present in the imagination, it implies an "imaginative space of dance" (Sheets-Johnstone, 1980). The imaginative form of dance is not constituted as a series of images but as a

unified and continuous image, an almost paradoxical synchronic capture of a diachronic phenomenon. As Foster (1986: 58) has put it, "only the viewer who retains visual, aural and kinesthetic impressions of the dance as it unfolds in time can compare succeeding moments of the dance, noticing similarities, variations, and contrasts and comprehending larger patterns – phrases of movement and sections of the dance – and finally the dance as a whole".

Below, it will be suggested that the imaginative form of dance itself is spatially structured in different ways, each with different implications regarding the definition of the dancing subject, the viewing subject and the manner in which dance is generated over time. The subsequent attempt to relate dance to architecture will primarily address aspects of underlying structure.

Contrasting paradigms of dance: Balanchine and Cunningham

Following arguments by Foster (1986) we can treat works by choreographers George Balanchine (1904-1983) and Merce Cunningham (1919-) which can be used to illustrate two contrasting paradigms of dance. Many of Balanchine's choreographies are composed from one elegant picture or pose to the next. In other words, certain positions and certain moments in time are given particular emphasis, through momentary pauses. Movement can be perceived to occur so as to bridge between such privileged moments and in turn, the privileged pauses can be perceived as culminations of motions. This implies that dance is treated as primarily visual not only in perception but also in conception, specifically that it brings to the fore specific visual frames. Also, the idea of a vocabulary of key discrete positions is clearly present, not only as a compositional device, but also as a clearly perceivable aspect of the language of dance. Movement is exploited for its capacity to highlight the tensions and forces that are involved in the composition of such frames. It also serves to suggest that the idealised or privileged moments are transformable into one another. Accordingly, the syntax of the dance can be considered in terms of sequences of transitions, or transmutations, from one pose to the next. In this context, however, the body is exploited for its ability to realise ideal forms, in a seemingly effortless manner. The direct experience of the body, or its mechanics are not as important as the pictorial compositions that bodies fit in. The emphasis is on overall harmony, including a good fit between pictorial image and music. Stravinsky (1966:24), for example, has said that "to see Balanchine's choreography of the *Movements* is to hear music with one's eyes; and this visual hearing has been a greater revelation to me, I think, than to anyone else. The choreography emphasises relations of which I had hardly been aware – in the same way – and the performance was like a tour of a building for which I had drawn the plans but never explored the result".

This choreographic emphasis can perhaps be traced back to earlier traditions, including the ideas explored by French court dance in the 18th century. In 1760, for example, Noverre encouraged choreographers to consult paintings in order to identify harmonious visual compositions and then to think of the sequencing of the elements of dance in terms of their theatrical effect (Copeland and Cohen, 1983: 12-13). However, for Balanchine, the visual composition of the dance and the unfolding of movements is more important than the potential narrative contents, even if it is not independent of them (Balanchine, 1945).

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The choreographies by Cunningham are built upon a continuous inquiry as to the potentialities of the human body, what arms and legs, torso and head can do in relation to gravity, time and space. The movements of different parts of the body are often elaborated independently of each other, through a process of combination. Thus, the evolving lexicon of moves is open-ended, dense and provisional. The syntaxes of arrangement are often unpredictable regarding their overall structure. Choreographies do not provide a sense of flow from one predetermined privileged composition to another and in many cases do not even suggest such privileged positions, or moments of definitive conclusion of movement. In some cases the impression is of parallel flows occurring simultaneously but distinguished not only as spatial forms but also as patterns of accentuation of time. In other cases, contrasts between local spatial forms and rhythms are evident. In the terminology used by Hillier and Hanson (1984) to describe morphic languages, Cunningham's choreographies suggest a tension between local and global dimensions of spatial order, evolve from multiple local generators to global effects, and imply a tension between generative rules and randomness. Thus, the dances invite an active engagement to retrieve descriptions of pattern, to search for alternative focal points of attention, to recognise emergence.

The admission of differentiation, heterogeneity, contrast, and circumstance extends into the manner in which Cunningham relates dance to music. The dance is not treated as an interpretation or visualisation of the music, nor is the music treated as a rhythmic, narrative or descriptive scaffolding for evolving the dance. Cunningham allows sound to be present as yet another layer of a composite and multi-sensory morphology, intersecting the morphology of movement. The relationship of music to dance is often not known until the moment of the performance. Equally, colour, lighting, and stage design do not act as inert backgrounds that contribute to the imagistic interpretation of narrative; nor do they assist in visually accenting and highlighting specific patterns or focal points of attention. They too are treated as spatial morphologies that intersect with the

morphology of movement. Viewers are invited to seek the meaning of the dance in the form itself, rather than in relationships of representation or reference, internal or external to the elements of the dance.

Contrasting choreographic principles can be treated as indexes of broader paradigmatic shifts. Foster (1986) has sought to identify paradigms which encompass the manner in which subjectivity, perception and the awareness of the body as well as more directly evident principles of movement. For example, she contrasts Balanchine's emphasis upon technique as the attainment of control and prescribed skills with Cunningham's emphasis upon technique as the articulation of bodily movement into partly distinct independent motions; she also contrasts Balanchine's treatment of the body itself as a medium to attain ideal forms with Cunningham's exploration of the potential of bones, muscles, nerves and ligaments to produce and articulate complex and novel structures of movement. Regarding expressive aims, she contrasts Balanchines's emphasis upon resonance and harmony with Cunningham's emphasis upon enunciation. Similarly, viewers' responses are seen to oscillate between the contrasting poles of exhilaration and attentiveness, as dancers' sense of subjectivity is seen to oscillate between an empathetic dedication to the ideals of an art and an instrumental immersion on the exigencies of an activity or a complex motion. Such contrasts form part of a more complex argument that makes sense of the evolution of choreography in the United States in terms of four major paradigms.

The significance of Foster's search for fundamental paradigmatic shifts is to underscore that the body, and by implication the generation, perception and understanding of immediate spatial experience can be treated not only as a biological given but also as a cultural construct. If different principles of choreography imply different assumptions, or normative positions, regarding the body and its movement, it might be possible to ask if they also imply different ways of reading a spatial setting from the point of view of spatial experience. At what level of detail and according to what dimensions of formal variability and structure might such differences implicate the architectural object and the manner in which it can be described and designed? The next section discusses some preliminary ideas for the retrieval of descriptions of settings through the lens of the paradigms of dance described above. The final section extends the argument through tentative design exercises.

Reading a setting to design a boundary

A single space used as an office is to be subdivided. At present, the furniture is arranged into the following major behavioural micro-settings. First, a number of tables are clustered to create a large work-surface, or meeting area, in the front of the room. Second, a bookcase is arranged along one of the lateral walls, with a system of deeper drawers at the bottom, creating a platform for arranging objects, including architectural models, at its base. Third, a work desk is placed against the same lateral wall, at the back of the room. An adjoining smaller table holds the peripherals for a computer that sits on the desk. Fourth, a sofa is placed against the back wall, facing forward. It is often used for rest and occasionally extended into a bed. Fifth, a smaller shelf holds the telephone next to a paper sculpture placed on a wall, at one of the back corners of the room. There are four connections, all arranged by the lateral wall across from the bookcase: these include two front doors (one leading directly to a narrow street, the other leading to the lobby of a block of apartments and, through that, to a busier street), an auxiliary bathroom by the first front door and a kitchen, also connected to another bathroom. A boundary needs to be designed to divide the space into a front and a back part so that the former can be classified as a primary use space and the later as an auxiliary space, for the purposes of satisfying building codes. The elementary design question to be treated here is the manner in which a description of the live-in experience of space can inform the design of the boundary and the intentional manipulation of the morphology of space use and spatial experience that will unavoidably issue from its construction. It will be argued that the description can be informed by models of the body, of movement and of spatial experience drawn from the study of dance.

Figure 1 shows the space and the main behavioural settings which are currently fully co-visible and directly connected. The addition of a partition will result in the interruption of some relations of visibility and connection, transforming a very dense graph into a graph with two distinct clusters. The design question is how to interpret, render and qualify this unavoidable structural change in terms of a spatial experience. Two possible readings of this underlying structure will be formulated, leading towards alternative designs. The two choreographic paradigms outlined above will be used as filters towards establishing the readings and developing them into designs. The procedure will be fundamentally diagrammatic. Diagrams are “intuitions, insights, feelings or concepts expressed as shapes and spatial relationships; more precisely, diagrams engender the configurational structure implicit in various forms of understanding” (Peponis et al., 2002). Here, they are used to mediate the transition from an understanding of choreographic paradigms, to an understanding of spatial experience, a reading of spatial setting and finally a projection of new potential experience through the design of an otherwise simple partition.

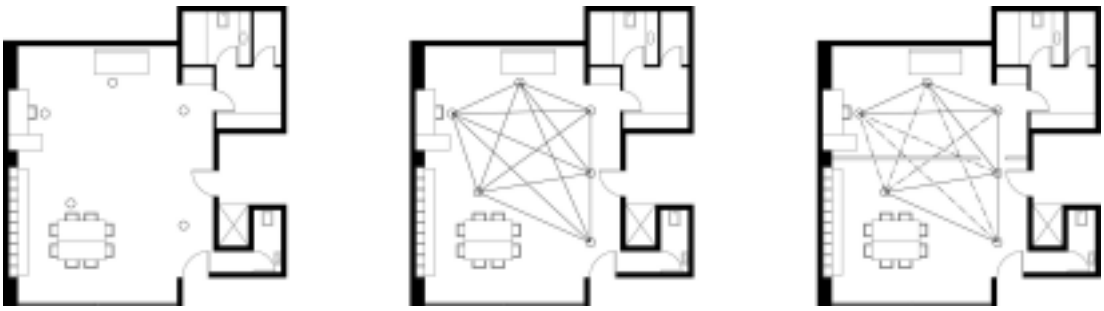

Figure 1: The plan of a setting, with behavioral micro-settings marked. The implications of adding a partition represented as transformations of an underlying connectivity graph

Inscribing still sections of movements

As stated earlier, Balanchine's choreographies can be perceived as flows of movement linking privileged poses and moments in space. Figure 2a visualises this using screen captures from the "Nutcracker" (Balanchine, 1997) as an example. Figures 2b-d propose the principles of a reading of setting: A setting is viewed from a position often occupied in normal space-use; particular frames within the field of vision are identified, corresponding to familiar behaviours and micro-settings regularly occupied and inscribed in the lived-in image of space (Figure 2b). These frames are isolated from their configurational context, their boundaries are blurred and they are allowed to overlap; they get "stitched" together by a line that represents typical sequences of movement and connections between them (Figure 2c). It is as if diachronically dispersed snapshots of everyday life are placed in a composition that functions as the equivalent of a synchronic snapshot, a composite mental image anchored onto discrete visual impressions. This image has spatial articulation, precisely because the focal themes of the different snapshots are linked according to habitual patterns of movement and connection. To express this diagrammatically, the composition of frames is drawn as a folded surface that can be looked at in two ways: first, as a synthesis of typical perspectives (the micro-settings seen or remembered from typical viewpoints); second as a pattern of overlap whereby the sensed properties of objects in each frame are allowed to affect and distort the sensed properties of objects in others (as the sensations and feelings associated with one activity linger and affect the sensations and feelings associated with another) (Figure 2d).

What kinds of design intentions might emerge from such a diagram of ways of thinking and seeing? Figure 3 suggests that the partition can be conceptualised as an interruption of current patterns of movement or viewing from relevant micro-settings, resulting in the creation of new frames inscribed onto the partition.

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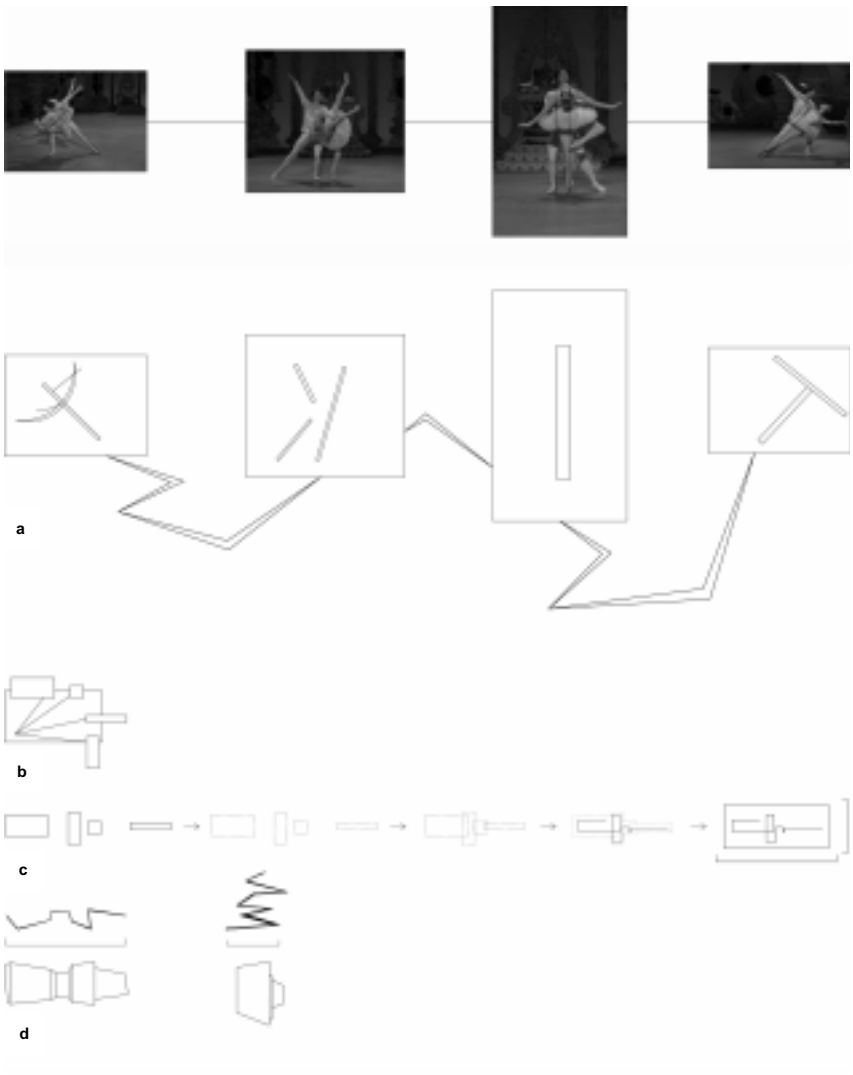

Figure 2: Balanchine's choreographies can be read as sequences of momentarily crystallized visual frames linked by flows of movement. Settings can similarly be imagined as spatial syntheses of visual frames into patterns that correspond to habitual spatial behaviors

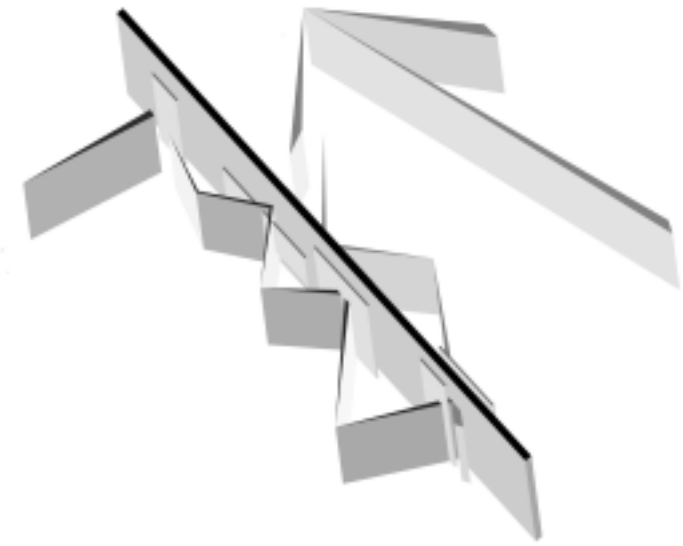

Figure 3: Diagrammatic representation of the inscription of movement and visibility patterns upon a partition plane

The inscription of new frames onto the partition may occur in at least two ways. First, new frames can be treated as literal openings that define the visual relationships between pairs of individual micro-settings. This is equivalent to treating the new partition and its openings as a structure that affects the visual polygons (Benedikt, 1979) extending from vantage points corresponding to significant positions in space. Second, the partition itself can be treated as an object with its own spatial structure that invites movement towards it, tactile exploration, and viewing from particular close-up positions. In addition to inscribing frames, however, the relationship between such frames and mediating movements must itself be inscribed. One way to do this is to think of the partition in terms of surfaces that become distorted and folded as forces of impact are applied to them. In addition, movement can be inscribed by allowing the two sides of the partition to become associated with different materials each of which becomes visible, in a controlled way, from the other side; this can register the idea that the partition is regularly viewed from both sides as the behaviours that occur in the partitioned setting continue to be closely interlinked. These ideas are represented in Figures 4a and 4b which are diagrams of an architectural intention, corresponding to an elevation and a plan respectively.

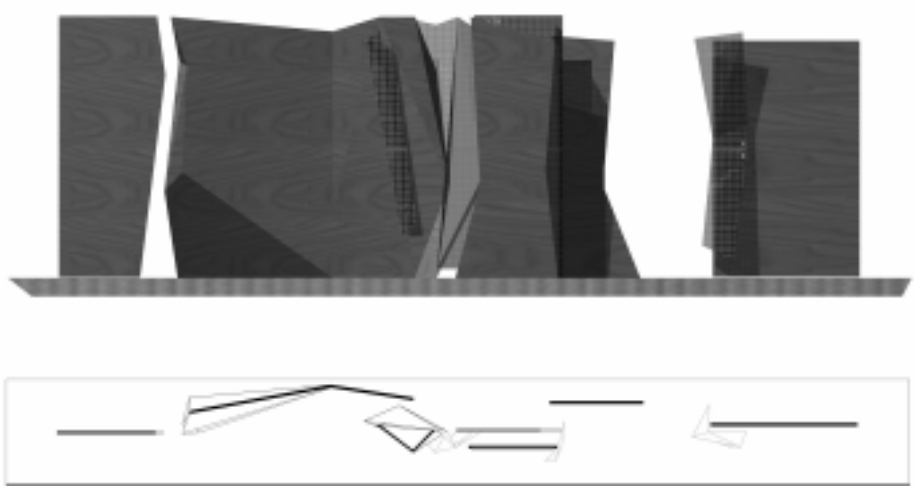

Figure 4: Diagrammatic elevation and plan of a possible partition inscribing frames of visibility and movement

These diagrams are amenable to development into architectural drawings. From the point of view of the present argument, the significant feature of the diagrams is that they orient design intentionality to various forms of relevant elaboration. For example, from a visual point of view, the folds can be approached as perspectival distortions that may work together in a manner that marks positions in space as significant viewing points. Or, from a functional point of view, the thicker areas of the object can be interpreted as small scale enclosures, say shelves, that would engender contact with the body, and therefore behavioural positioning associated with additional viewing points. Thus, the effect upon visibility polygons,

characteristic of either typical positions or typical paths (Figure 5), is only one of the ways in which the partition can be developed to both register frames and to project significant viewing points in space, both at a distance and at close range. Indeed, the engagement of scale, the creation of overlapping frames of reference corresponding to ranges of distance from the partition is a most interesting direction in which design intentionality can be further developed.

Figure 5: Interaction between partition and visibility polygons from key vantage points

Inscribing articulated movements

Cunningham's choreographies emphasise the articulation of independent movements. Figure 6a expresses this diagrammatically by superimposing folded surfaces representing movements over a screen capture (Cunningham, 2001). Figures 6b-e propose principles for reading a setting derived from the idea of expressing the articulation of movements. A setting is viewed from a position often occupied in normal space use; particular behavioural micro-settings are identified that can be treated as destinations and nodes of movement trajectories (Figure 6b). A particular path of movement is represented by two sets of superimposed horizontal ribbons associated with the lower and the upper body respectively; both vary in width, while the upper one also varies in inclination relative to the floor; thus additional movements

of the body are represented including outward stretch (Figure 6c). The movement pattern is subsequently represented as a solid surface extending between the two ribbons; the inclination of the surface relative to the vertical plane represents body inclinations; the surface is incident upon frames representing the objects to which movement is directed (Figure 6d). The momentary engagement of the body with these objects is inscribed by absorbing deformations onto the surface; the objects/ frames themselves are no longer independently shown (Figure 6e). It is as if habitual patterns of movement are represented by a plastic form anchored onto the setting at significant positions. Alternatively, the representation can be perceived as a pattern of 3-D extrusions and elaborations of lines that would otherwise merely mark the trace of movement on the floor.

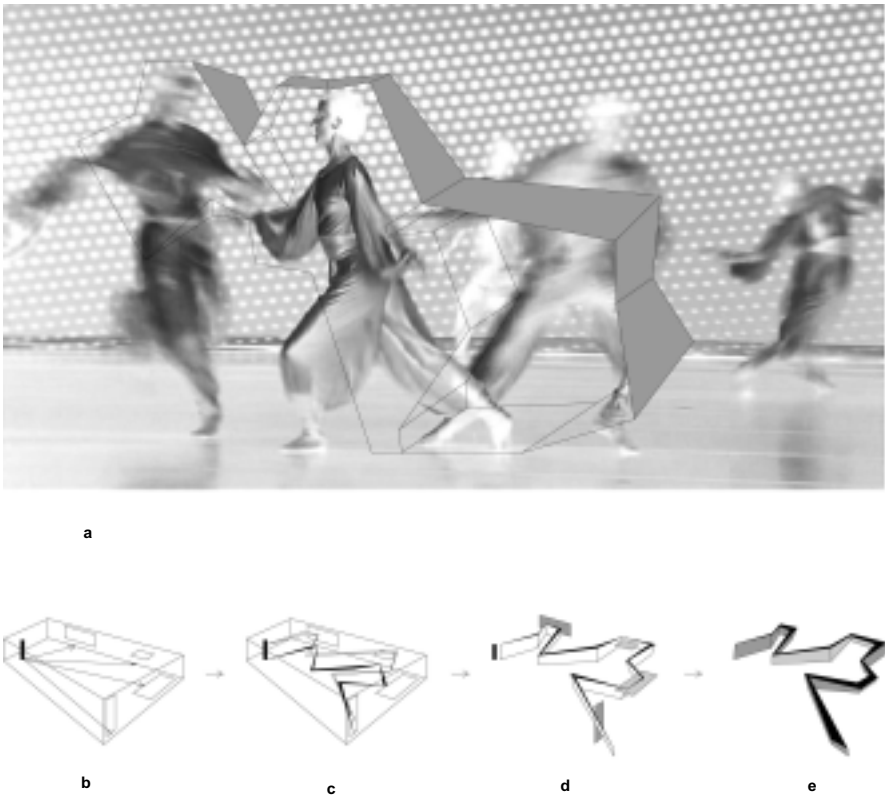

Figure 6: Cunningham's choreographies can be read as patterns of independent movements coming together into localized and provisional interactions. Settings can similarly be imagined according to movement surfaces inscribing interaction between bodies and objects in the setting

What kinds of design intentions might emerge from such a diagram of articulated movement anchored in a spatial setting? Figure 7 suggests that the partition can be conceptualised as a plane intersected by primary (lower body) and secondary (upper body) lines of movement as well as by views upon the pattern of movement from selected vantage points. Thus, Figure 7a emphasises the main traces of movement on the floor, as they are interrupted and reflected when they intersect the boundary; Figure 7b emphasises the movements of the upper body that alternatively get tangent to the plane or distant from it; Figure 7c interprets movements on both sides

of the plane as ribbons intersecting it, in order to suggest that openings or passages are created; Figure 7d inserts the same pattern within the traces of views and transverse movements, some of which are themselves represented as surfaces intersecting the plane. The underlying intuition is that the boundary must directly affect the body and respond to it in such a way that body and boundary become momentarily merged into a single pattern of movement. The body is not to be merely set-up and framed, as previously; nor is the boundary to act primarily as a framing device. Rather, body and partition are to be treated as potentially interacting mechanisms able to generate partly co-ordinated patterns.

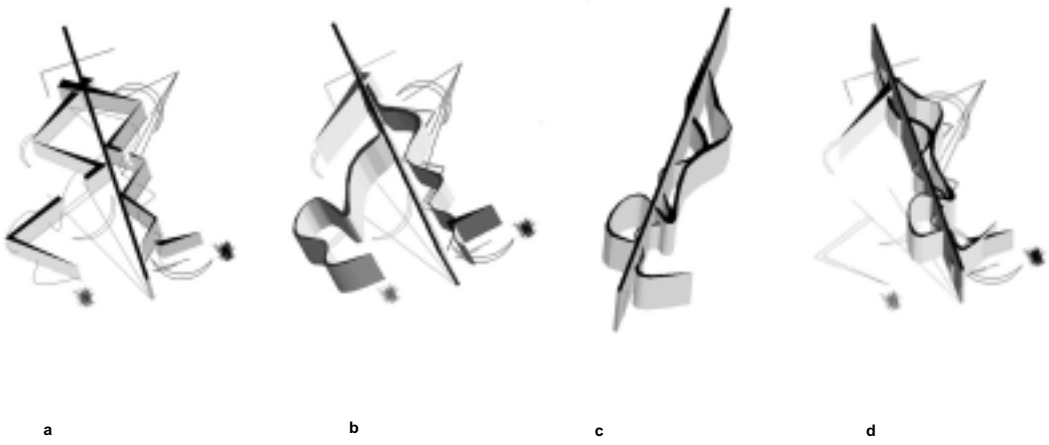

Figure 7: Diagrammatic representation of the interaction between the partition plane and movement and visibility patterns affected by it

Two alternative diagrams of architectural intentions are developed from these premises. The first (Figures 8 and 10a-c) breaks the partition into four sections. The two end sections are formed as strips of wire mesh and are, therefore, partly transparent. The middle sections are made of wood strips differentially angled around pivoting axes about which they rotate. The strips can be locked together to rotate as a single element, functioning as a door; or, they can be locked into separate sets, so that the upper set rotates as a window; or, finally, they can be unlocked and rotated independently. In this manner, each of the two middle sections can function in multiple ways. When both sections are rotated, various configurations are possible. These include a bi-permeable enclosure in the middle, with one door on either side; or a uni-permeable enclosure facing inward, also with one door on either side. The shorter and longer angled strips are made of different material, so that the colour difference can be used to differentiate the two sides of the partition. At various positions, the simultaneous exposure to both colours would imply a virtual synchronisation of the two boundary faces. Figure 10a shows the partition inserted in the plan of the setting.

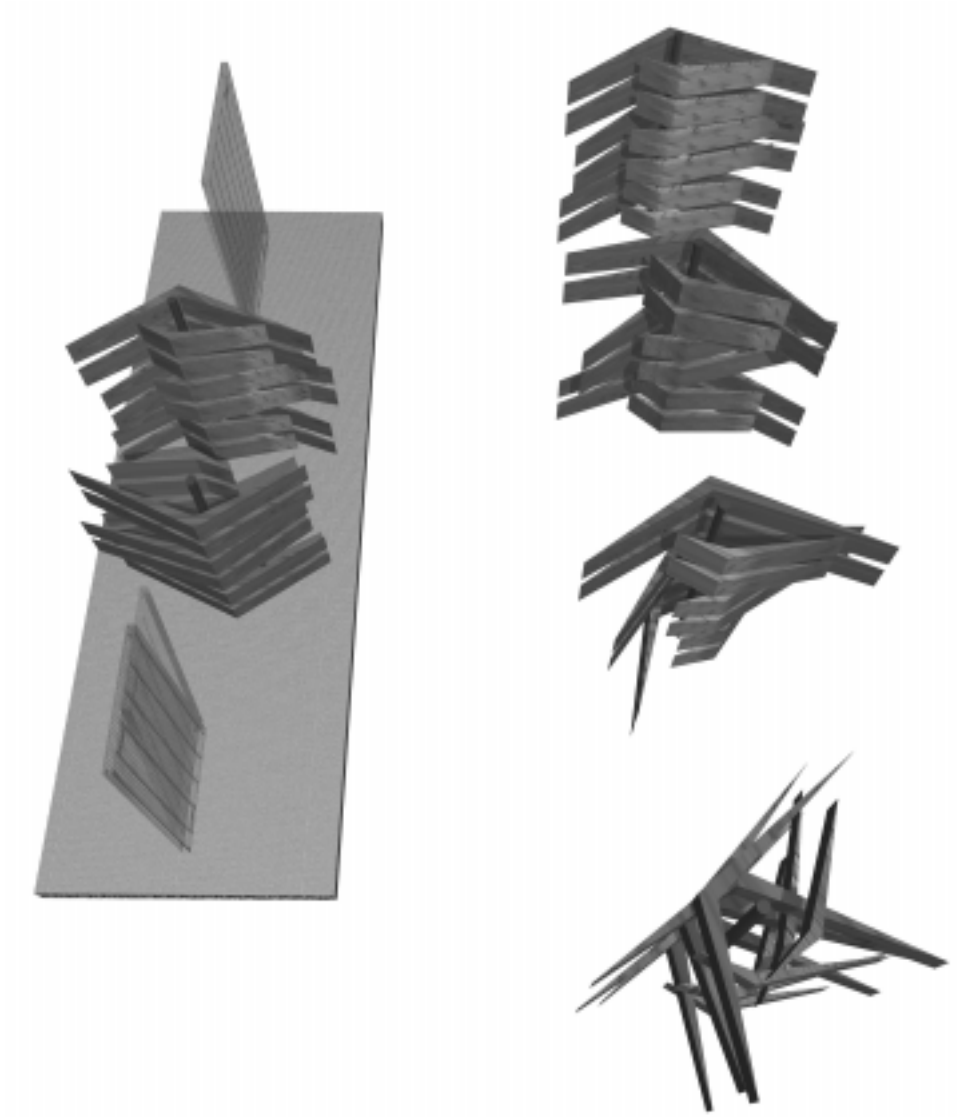

Figure 8: Diagrammatic representation of partition

The second diagrammatic alternative, (Figures 9 and 10d-f) treats the partition as an integral articulated mechanism. There are two ways in which the partition functions to control connections between the front and back rooms. These can be better explained with reference to figure 10. The first way is to enter the narrow passage which is formed near the bookcase wall, pointed towards the front room and leading towards a closed door (Figure 10d). A subject proceeding down this passage can push the door so as to enter the back room (Figure 10e). The action results in closing the passage behind, as if to squeeze the subject through. This action simultaneously starts to open a second passage at the other end of the partition, near the entrance wall. This second passage, which is much more direct, provides an alternative way for returning back towards the front room (Figure 10f). The co-ordination of the mechanism is achieved by means of a wheel with arms, situated above head height, but clearly visible within the volume of the overall space.

Figure 9: Diagrammatic representation of partition

Figure 10: Alternative partitions inserted in the plan of the setting

Discussion

The diagrams discussed above represent experimental devices that structure the micro- scale of spatial experience. They render, or qualify in particular ways, elementary relationships of division, transition, and visibility. By doing so they question what we mean by a boundary, and, by implication, what the relationship is between the body of built form and the spatial structures and experiences generated by built form. Several lines of theoretical discussion issue from the experimentation. First, how to enrich the ways in which spatial structure is represented in order to be analysed. Within the context of "space syntax", attention is placed on the manner in

which the perceivable geometry of built space is read prior to the representation of intelligible connections in terms of graphs. But more is at stake than simple degree of detail, or resolution, adopted for the analysis. For instance, the linkages between visual structure treated in terms of visibility polygons and visual structure treated in terms of perspective or other representational frameworks need to be examined systematically. Also, the manner in which different frames of reference overlap or are nested into each other needs to be further conceptualised and represented (how can we deal with the simultaneous presence of different scales of spatial structure within the perceptual field, for example).

A second family of questions concerns the representation of spatial experience as a morphology with objective dimensions. All space-occupancy oscillates between the two poles of movement and rest, and the idea of representing space as a relational structure from these two points of view is fundamental to representations of spatial structure such as the lines map, the various convex partitions and the visibility polygons. The exercises reported here suggest potentially fruitful developments that would take us from the representation of the structural scaffolding of behavior to a representation of aspects of spatial experience. The idea of turning lines representing paths into 3-D surfaces whose shape (variations of width, slope, inclination) can register more about the movements that occur on the paths than their mere trace may be fruitful in other studies. The combination of local visual information, including particular points of view, into constructions that summarise aspects of global spatial structure as imaginatively remembered may also have potential for more analytic development. The aim would not be to abstract connecting movements out of our representations of global structure, but rather to complement our analysis of global structure as a pattern of connections that are explored through movement, by an analysis of global structure as a virtual synchrony of locally elaborated conditions.

Such questions can be approached from different points of view, some of which are taken up by other papers presented at this symposium. Studies of dance provide a particularly interesting point of departure for discussing them, precisely because they call us to look at spatial structure in terms of patterns of potential co-ordination that arise between otherwise discrete and independent entities, rather than merely as patterns fixed into the shape of material things. This paper has emphasised the potential patterns of provisional co-ordination between the perceiving and thinking human body, and the body of the building. In the context of this paper, the much more interesting, but also more difficult step, of looking at space as a field of provisional co-ordination of collections of individuals has not yet been approached from the point of view of dance. This is the topic of current work extending the studies reported here.

Notes

[1] This paper is based upon studies in the spatial construction of meaning that formed part of the post-graduate course in architecture offered by John Peponis, Ken Knoespel and Andreas Kourkoulas at the National Technical University of Athens and at the Georgia Institute of Technology. An associated MSc thesis, on spatial paradigms in dance was supervised by John Peponis

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