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Line/form/movement: circulation diagramming as plan technique

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Abstract:

The emergence of line diagrams in architectural plans for the purpose of mapping human circulation through buildings is a feature of twentieth century architectural design practice, constituting a key method in the design of functionally complex buildings today. Such a method is currently being explored by architectural design practices in relation to new software technologies, where diagrams of circulation become the base material for the self-generation of architectural forms constructed within computer environments. The resulting explorations are creating unprecedented shifts in the formal vocabulary of buildings designed by architects, producing hybrid and complex forms. This paper presents a comparative analysis of plans drawings by exemplary architects in order to consider the impact of this method on architectural forms and planning. The aim of the paper is to consider diagramming, and the circulation diagram in particular, in the broader historical context of architectural design practice.

Line/form/movement: circulation diagramming as plan technique

The emergence of line diagrams in architectural plans for the purpose of mapping human circulation through buildings is a feature of twentieth century architectural design practice, constituting a key method in the design of functionally complex buildings today. Such a method is currently being explored by architectural design practices in relation to new software technologies, where diagrams of circulation become the base material for the self-generation of architectural forms constructed within computer environments. The resulting explorations are creating unprecedented shifts in the formal vocabulary of buildings designed by architects, producing hybrid and complex forms.

The form making practice implied by the contemporary use of the technique indicates a broader shift in architectural design thinking. This shift is away from a typologically based approach to design towards a less authorial style. Instead of the architect relying on formal precedents, the selection and combination from a stock inventory of forms, he or she allows the process itself, the action of circulation diagramming, to 'select' the formal outcome. The direct alliance of the form of buildings with the diagrams that underpin their arrangement leads to idiosyncratic or hybridized forms that eschew direct precedents and easy familiarity.

While the technique of using line diagrams to map or describe human circulation through an architectural plan might seem obvious - a ubiquitous method of twentieth century design practice - its origins and history are seldom observed.¹ One clear origin for the technique arises from the nineteenth century Beaux-Arts concept of *marche*, which describes the action of moving through built form and volume along a building's principal axis.² Charles Garnier's Paris Opera (1861) offers an architecture that exemplifies this concept as revealed through Garnier's elaborate description of the experience of attending the Opera given in his book *Le Theatre*, published in 1871, as well as in the architectural plans themselves.³ The use of the axial plan to orchestrate *marche* and mark human movement indicates the subtleties of understanding implicit in the late period of Beaux-Arts design practice.

To acknowledge this history and understand the Beaux-Arts axis as a 'line diagram' of human movement or circulation we need to conceptualise that axis in two kinds of use. Firstly, the axis serves as an instrument of projection, by controlling the geometry of the plan. Secondly, the axis serves as an instrument of composition, by serving various rules of architectural design.⁴ As an instrument of composition the axis plays a particular role in allowing the designing architect to distinguish, and to reflect upon, the sequential unfolding of space and volume in a building. By making an axial line on the surface of a drawing and then situating a set of volumes along the line (as Beaux-Arts design practice dictated) the architect was in a position to surmise, amongst other things, the overall experience produced in moving through the building. At the academy, this function of the axis was understood by other architects who

could form a critical judgment of their peers' work from the information laid out in a plan drawing. Using the axial line as their guide, critics could read the sequence of volumes from the plan and imagine the experience of space that unfolded.⁵

Yet Beaux-Arts architects used the axis not simply to reflect on experience of a building but to construct that experience as well. This double function of the axial line was possible because the architect knew, in advance, that the line drawn in a plan denoted the nominal position from which a spectator takes up the experience of architecture. Thus, in the various studios and at the Beaux-Arts Academy itself, the activity of making judgments about the experience of architecture was pre-conceptualised within an architectural design process. Such a pre-conceptualisation understood the axial line as a formal construction of human movement or circulation in a plan drawing.

The internalization of this technique in twentieth century architectural design practice is particularly evident in certain working methods adopted by Le Corbusier that relate to his concept of the architectural promenade. *Marche* and the promenade both concern the sequential unfolding of architectural space before a spectator and Le Corbusier, like his Beaux-Arts counterparts, is given to representing human movement with lines made across his architectural plans. While Auguste Choisy and his nineteenth century reading of Classical Greek architecture in terms of a 'Greek picturesque' has been seen as precedent for Le Corbusier's thinking about the promenade, Beaux-Arts *marche* also figures as a critical influence, however much Le Corbusier considered it anathema.⁶

In his famous South American lecture series of 1929 Le Corbusier tries at one point to explain the nature of our experience of architecture.⁷ There he explains how our experience is a matter of the sequence of sensations acquired in moving through an orchestrated set of spaces. Experience is thus dependent on where the openings between rooms are situated, and what is seen as one moves through them in turn. When the architect comes to represent his discussion in the form of drawing, he draws a set of basic room plans to which he adds dash marks to represent the point of passage between spaces. He also uses arrows to indicate the direction of movement. These marks and lines are more than just signs for his audience. In relation to the spaces shown they are also constructive; they pin down the movement of a spectator in relation to architectural space in that they deliberately nominate those places from which architectural sensations are received.

In his lecture 'The Plan of the Modern House', Le Corbusier represents ways of moving through building in an architectural plan drawing. The walls denoted in the sketch plan are drawn thickly and roughly orthogonally. The spectator who experiences the building is denoted here by a series of lighter meander lines which move through spaces and around walls. Some of the lines are arrowed, again indicating the direction of circulation. A subtle accord between Le Corbusier's thinking and the concept of Beaux-Arts

marche is also given where the architect declares that architectural problems might be best solved 'if one acquires the habit of strolling with one's pencil, step by step, thinking out well the functions by which our occupant will find pleasure in living in his house.'⁸

In the Beaux-Arts, the use of a line to represent human movement in relation to architectural form was conventionally acknowledged as central to the closed system that constituted the act of design. Thus the means of devising experience of architecture in drawing, and in the plan in particular, was accepted practice. Le Corbusier, for his own part, decried this formal method. He writes directly of the way in which the Beaux-Arts method of allying human movement to axial progression through space misconceives the quality of human movement that is, by its nature, active and meandering. Yet Le Corbusier's working method for constructing human movement in relation to architectural form is essentially similar, with the demonstration of this coming out of a broader analysis of Le Corbusier's drawing output over the life of his studio. An examination of the published Le Corbusier Archive reveals a host of dash marks, arrowed lines and meanders in plan drawings used for the purpose of testing and constructing human movement through space.⁹ The use of lines in this way suggests the internalization of a Beaux-Arts technique at the level of Le Corbusier's working methods; an internalization that allows the technique to be re-cast in terms of an otherwise different way of thinking about movement and circulation.

If we consider the way in which the technique becomes visually evident as an operation in each case then we would observe the following. In the Beaux-Arts the function of the axis in representing and constructing movement is clearly sublimated by the more obvious function of the same axis to set out the plan's geometry – its symmetry. In this sense visualizing the technique that constructs *marche* is relatively difficult without knowledge of the closed system that supports such a reading of the axis. In other words, it is easy to miss the point that human movement through volumetric space is the subject of a Beaux-Arts plan because the movement line is 'hidden' as an orthographic mark. This is not the case in Le Corbusier's plan drawings where the lines constructing movement are often characterized very differently to the grids and abstract rectilinear geometries of the plans.

Le Corbusier's approach allows him to separate his thinking about what constitutes movement through space from the drawing technique for constructing movement laid out in a Beaux-Arts plan that he unconsciously 'borrows'. In terms of the drawing technique, Le Corbusier's discovery is that the lines describing movement can be 'separated' from orthographic marks that describe built form. The movement lines appear strongly in Le Corbusier's drawings as quasi-natural forms – arabesques, loops and meanders - within geometrically determined space. Accordingly, in Le Corbusier's drawings the difference between movement lines and the lines describing built form appear to articulate a difference between subject and object in the drawing more emphatically. Indeed the inability to distinguish subject and object in this manner, and to then reflect this difference in a plan drawing, is identified by Le Corbusier as an

endemic problem of Classical planning. In *Towards a New Architecture* (1923) Le Corbusier writes accordingly:

When at the Schools, they draw axes in the shape of a star, they imagine that the spectator arriving in front of the building is aware of it alone, and that his eye must infallibly follow and remain exclusively fixed on the centre of gravity determined by those axes.¹⁰

On the contrary, he then observes that:

The human eye, in its investigations, is always on the move and the beholder himself is always turning right and left, and shifting about. He is interested in everything and is attracted towards the centre of gravity of the whole site.¹¹

While Le Corbusier could decry movement lines that ape axes he is not averse to adapting the technique for his own use. In his own plans, it is the new decentred subject, 'turning right and left' who is represented by the now meandering movement lines, reacting to and exploring architectural space. The relationship between human movement and architectural form conjured by Le Corbusier might be worlds apart from the Beaux-Arts but there is undoubtedly in each a type of choreography of movement.

Contemporary architectural discourse situates the diagram, and diagrammatic thinking, as critical to new forms of architectural production. The human circulation diagram is cited as a key generator of form, evident in works by Ben van Berkel (UN Studio) and Foreign Office Architects.¹² Diagrams have become a much theorized tool and in the introduction to Peter Eisenman's *Diagram Diaries*, R. E Somol situates diagrammatic thinking through sources such as Colin Rowe's seminal analyses of Le Corbusier's Villa Stein, Peter Eisenman's *House* series and the philosophy of Gilles Deleuze.¹³

The approach of this paper is to consider diagramming, and the circulation diagram in particular, in the broader historical context of architectural design practice and not to be limited to already acknowledged 'sources'. Instead the paper seeks to understand the internal rhetoric that constructs the technique within the act of design. It is in these terms that the paper reflects on the education of architects in learning to design (learning that involves the internalisation of techniques).

Techniques in practice differ and transform over time and Alan Colquhoun suggests that there are critical differences between techniques such as composition and design in the production of architectural form.¹⁴ In the nineteenth century Beaux-Arts tradition, composition is characterised by fixed rules for the combining of elements. Composition identifies a rule bound and self-contained system (and one that is

somewhat mechanical in its application). In twentieth century modernism the technique of design is characterized by a free play in the combination of forms, where the fit between form and function is a loose one. Forms do not carry fixed meanings, like in the classical tradition, rather they are open to interpretation and use. Thus Colquhoun says that the twentieth century construct of architectural design constitutes a variation on composition, one freed from 'fixed rules of combination.'¹⁵

To move forward in time to consider present day techniques of circulation diagramming, a consideration of the form generating method employed by Foreign Office Architects for the Yokohama International Port Terminal is instructive. The architects describe their method and its formal outcome as follows:

...the project is produced as an extension of the urban ground, constructed as a systematic transformation of the lines of the circulation diagram into a folded and bifurcated surface.¹⁶

They continue:

...the folded ground is configured as a void space where the distribution of loads is not solved through orthogonal elements but distributed rather through the diagonal surfaces of the structure.¹⁷

Once again the technique proposes an alliance between lines describing human movement and the production of form. Once again also, the architectural outcome is a type of choreography of the body in movement. The relation between the diagram of movement and the form is direct. The swelling and curving of the surface suggests points of convergence of human movement - imagine the building surface as a warped billiard table that channels the public through it. At the same time there is a distinct echo of Beaux-Arts technique. The building's axis of composition, the line denoting movement – the circulation diagram – is also synonymous with the axis of projection that constructs the geometry of the form. Form production is couched in relation to the drawing media itself; axial orthography in the case of the Beaux-Arts and the possibilities of technologically based media in contemporary practice, by which non-orthogonal lines are directly converted into grids that subsequently form surfaces.

The rhetoric of contemporary practice is that circulation diagrams produce new forms via self-generation yet in Alan Colquhoun's terms this technique implies fixed rules in the combination and making of elements with a further implication that form production occurs as an enclosed or totalised system once the lines themselves are determined.

Le Corbusier's technique in the use of circulation diagrams is collagist by comparison. His technique plays up the distinction between lines of movement and the orthogonal lines describing the forms themselves. By this means the circulation diagram or architectural promenade becomes the device that puts on display the 'modern' means of tectonic expression – pilotis, strip windows, the free plan and so on. Le Corbusier's work is, of course, exemplary of Colquhoun's concept of design, a process that provisions the free combination of elements within the whole, where the diagram and the assemblage of forms exhibit their own discrete logics.

Contemporary practice might 'internalise' the form and intent of Le Corbusier's circulation diagrams, which characterize human movement as active and meandering, but the relation of those 'same' lines to the production of architectural form is something else altogether, indicating both the extension and iteration of 'existing' diagramming techniques as presented here.

Today in architectural design education the attraction of techniques such as circulation diagramming seems to be in their availability as a method rather than in a broader understanding of their discipline specific history. And yet a greater understanding of the history of such techniques over a larger time frame produces a more conscious and deeper understanding of them. What is necessary to acknowledge, in doing so, is the internalisation of techniques in architectural design practice and their appropriation and iteration in pursuit of the new.

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- ¹ In a recent article, Paul Emmons has cited the use of circulations diagrams in the late nineteenth century work of Viollet-le-Duc and Robert Kerr as original examples of the technique. Paul Emmons, 'Intimate Circulations: Representing Flow in House and City', *AA Files*, 51, 2005, pp. 48-57.
- ² David Van Zanten, 'Architectural Composition at the Ecole des Beaux-Arts from Charles Percier to Charles Garnier,' in Arthur Drexler [ed.], *The Architecture of the Ecole des Beaux-Arts*, New York: Museum of Modern Art, 1977, p. 163.
- ³ David Van Zanten and Christopher Mead, writing separate accounts about the Paris Opera, refer to the Garnier's book *Le Theatre*. See David Van Zanten, 'Architectural Composition at the Ecole des Beaux-Arts', pp. 111-324 and Christopher Mead, *Charles Garnier's Paris Opera: Architectural Empathy and the Renaissance of French Classicism*, Cambridge [Mass]: MIT Press, 1991.
- ⁴ David Leatherbarrow, *The Roots of Architectural Invention: Site, Enclosure, Materials*, Cambridge: Cambridge University Press, 1993, pp. 13-15.
- ⁵ Van Zanten, 'Architectural Composition at the Ecole des Beaux-Arts', p. 163.
- ⁶ For a discussion of Choisy's picturesque theory and its 'influence' on Le Corbusier refer to Richard Etlin, 'Le Corbusier, Choisy and French Hellenism: The Search for a New Architecture', *The Art Bulletin*, LXIX, 2, 1987, pp. 264-278. For a discussion of Choisy in relation to Le Corbusier work see Richard Etlin, *Frank Lloyd Wright and Le Corbusier: the Romantic Legacy*, Manchester: Manchester University Press, 1994, pp. 76-149.
- ⁷ Le Corbusier, *Precisions: On the Present State of Architecture and City Planning*, Cambridge, [Mass]: MIT Press, 1991.
- ⁸ Quoted in Paul Emmons, 'Intimate Circulations: Representing Flow in House and City,' *AA Files*, 51, 2005, pp. 48-57.
- ⁹ See Antony Moulis, *Drawing Experience: Le Corbusier's Spiral Museum Projects*, University of Queensland, [unpublished thesis] Brisbane, 2002.
- ¹⁰ Le Corbusier, *Towards a New Architecture*, London: The Architectural Press, 1987, p. 191.
- ¹¹ Le Corbusier, *Towards a New Architecture*, p. 191.
- ¹² UN Studio, *Unfold*, Rotterdam: Nai Publishers, 2002.
- ¹³ R.E Somol, 'Dummy Text, or the diagrammatic basis of contemporary architecture', in Peter Eisenman, *Diagram Diaries*, London: Thames and Hudson, 1999, pp. 6-25.
- ¹⁴ Alan Colquhoun, *Modernity and the Classical Tradition: Architectural Essays 1980-1987*, Cambridge, [Mass]: The MIT Press, 1989.
- ¹⁵ Colquhoun, *Modernity and the Classical Tradition: Architectural Essays 1980-1987*, p.35.
- ¹⁶ 'Foreign Office Architects: Yokohama Port terminal, 1995-2002.' *Lotus*, 108, 2001, p.82.
- ¹⁷ 'Foreign Office Architects: Yokohama Port terminal, 1995-2002.' p.82.