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SPEAKER

Considering the Diagram and Design Research

Abstract:

While there has been much written on the role of the drawing in architecture as a form of re-presentation and reflective practice, this paper argues that the diagram as a specific graphic type, is an essential generative component of design research and central to claims for innovation or the production of new knowledge through contemporary design, yet not understood in the context of design research more generally. As an abstract and highly idiosyncratic form of notation, the diagram uniquely situates innovation within visual forms of enquiry. This paper speculates on how diagrams communicate, both internally to the discipline and externally to new extra-disciplinary research fields as a function of innovation, and in this sense, what *work* in terms of design research they do.
Keywords: Architecture, diagram, Innovation, design research, representation

Considering the Diagram and Design Research

Architecture makes use of many forms of graphic notation that are central to design practice. While there has been much written on the role of the drawing in architecture as a form of representation and reflective practice (Cook 2014), it is argued here that the diagram in architecture, is a specific performative graphic type, and an essential generative visual vocabulary for contemporary design research and necessarily central to claims for innovation or the production of new knowledge over drawing in architecture.

Diagrams themselves are a form of practice based design research and are concerned with methods of design leading to proposals for not yet existing projects, events or situations. Unique to the diagram is its capacity to integrate non-architectural domains of knowledge into the architectural design process. As a consequence, diagrams communicate, both internally to the discipline and externally to new extra-disciplinary research fields, and in this way perform *work* in terms of design research, structuring relationships and acting as informatic channels, feeding to and from the interiority of the discipline. In this sense, "Diagrams then are active, and the view that sees them as mere blueprints to be translated or reproduced is outdated. The diagram is the engine of novelty, good as well as ill."[1]

Discourse on the diagram has exploded over the last decade, after a flourish of late modern architects and theorists from Colin Rowe, through Peter Eisenman to Anthony Vidler amongst others sought to recast the diagram from its classical and early modernist precedents and began to rewrite the history of the diagram into a contemporary design frame[2]. The motivation for this was largely as a consequence of both a fast moving formal project internal to architecture at the end of post-modernism, the most recent form of which is the impact of digital technologies on design generation and representation, and as a consequence of the rise of external pressures to the architectural project that demanded incorporation into architectures work in new ways. These forces include but are not limited to pressures for research within design and academic contexts, the green movement forming a major restructuring of the performance and certification of architectural projects, the foregrounding of economic concerns within the building context tied to global economic flows and the rapid digitization of design processes, manufacturing and work flows. Architecture has responded to these types of external forces generally

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[1] Kwinter. S., "The Hammer and the Song", *OASE*, no. 48 p33
[2] See Vidler for a discussion of the embrace of geometry and aesthetics of abstraction respectively within diagrams in architectural history, (Vidler, 2000)

though a move to a more informatic characterisation, that is, moving towards an understanding of architecture as information.

This paper accepts the centrality of visualization and representation to architecture as a discipline, and it is against the background of this assumption that the diagram has grown in significance as a consequence of the informatic turn in architecture. Importantly, this has subsequently foregrounded the incapacity of representation as it is understood through the evolution of perspective and figural or "realist" drawing techniques, those aligned to both a visual art history on the one hand, and the thinking hand theories of drawing centered around theorists like Evans on the other[3], to manage new forms of information and new domains of influence that have become dominant in the project of architecture over the last two decades.

Many definitions of the diagram have been attempted yet none have established an agreed position, leaving discourse on the diagram somewhat confused or at least contested.[4] Recognizing this multiple reading of the diagram, it none-the-less remains a key form of visual thinking within architecture that is uniquely capable of working within the contemporary space of design and critically doing work considered central to design research and the production of innovation.

While it is beyond the scope of this paper to interrogate the various positions on the diagram at length, work that has been taken up by others, (Garcia 2010; Vidler 2000) it is important to recognize that at this point there exist at least four types of architectural diagram roughly corresponding to four chronological periods in which it has been most active[5]. With their main proponents noted, these may be considered as; the internally organizing diagram of geometry and proportioning rules (Palladio, Durand, Foucault), the early modern embrace of the abstract and its aesthetic (Le Corbusier, Van der Rohe), the internal generative processes of post modern diagrams and their formal project (Eisenman 1998; Somol 1999), and the non-formal abstract machine of millennial modernism and its technological and informatic obsessions (Allen 1998; Deleuze & Guattari 1987; Kwinter 1998).

Common to each moment within this chronology of the diagram, is the diagrams tendency to move toward abstraction, even while remaining highly specific and

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[3] See for example Robin Evans, "Translation from Drawing to Buildings" 1986 in *Translation from Drawings to Buildings and other essays,* (Architecture Association, London) 1996
[4] Garcia, M. "Introduction" AD reader on Diagrams, 2010 for an overview of the positions taken on the diagram in recent discourse.
[5] Interestingly these periods of the diagram also seem to correspond to moments within architectural discourse where a pronounced ambition to link the discipline to larger frameworks outside of architecture were evident.

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idiosyncratic.[6] This double reading of precision and abstraction, universality and idiosyncrasy, creates the dynamic engine within the diagram understood as a "flow" and explicated through Deleuze's concept of the abstract machine, a position that was championed by Stan Allen (Allen 1998), Sandford Kwinter (Kwinter 1998), Pia Edne-Brown and others.

Kwinter's article, the "Hammer and the Song" (Kwinter 1998) develops an understanding of the diagram through the Deleuzian framework of the abstract machine, explaining "The diagram is real, only incorporeal."[7] This allows him to draw the diagram into a conversation with information science, complexity and the intangible forces of matter at the heart of the post second world war science project. Noting architectures inability to deal with the real yet intangible, "Approaching the incorporeal is one of the major challenges of contemporary design practice."[8] Kwinter makes it explicit that the diagram is not a drawing, or a recipe stating, "one misunderstands the diagram when one conceives of it as a template rather than as a flow."[9] Alternatively, Kwinter draws on the cybernetic and informatic foundations of the modern science project as a way in which to dematerialize and instrumentalise the diagram, through his understanding of the in-formal yet real informational content of the Deleuzian perspective of a world continually in a state of *becoming*. If we then accept that the role of the diagram is to direct this formation, as a channel of *in*-formation, then we can see also that architecture is positioned uniquely to reveal these immaterial yet real information flows. It is worth quoting Kwinter at length here;

> "I believe that architecture plays an important role here – or at least that it could and ought to play such a role – in bringing these processes of organization, integration and coordination to the foreground not only of public and cultural appearance, but to the more subtle arena of experience itself, to the place where the time of things and the body are one, to the space of intuition. Through the materialization of actualization, architecture has the capacity to free the imagination from three-dimensional experience,

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[6] Kwinter concluded "The Hammer and the Song" arguing that the diagram allows for intuition against quantitative information as a novel form of knowledge, recommending that this bipolar position of the diagram should not attempt to be resolved. Kwinter writes, "The diagram gives us the power to program historical becoming, as well as to hack the programs currently in place. Diagrams must be conceived as songs as well as hammers." Kwinter, S. 1998, 'The Hammer and the Song', *OASE*, no. 48, p. 43

7 Kwinter, S. 1998, 'The Hammer and the Song', *OASE*, no. 48, p39

[8] ibid, p 35

[9] ibid, p 35

to free it from the curse of the so-called "invisible processes" and hidden diagrams and to show us that processes and events, the ones that give form to our world and our lives, have shape of their own."[10]

Central to this emergent, neo-vitalist position is the role of innovation. Innovation in this context is the channeling of difference (understood as information in cybernetic terms)[11] from the virtual, or real yet incorporeal, towards its materialization. Architectural design research is uniquely positioned to do this through this performative understanding of the diagram within a disciplinary design context. The perfomative diagram embeds its operations in time, while remaining inherently open information platforms, and therefore able to operate on any number of informatic strata and bring them synthetically to their materialization. This situates the diagram as a core operative platform within the production of innovation in architecture, making it central to the larger question of research within innovation systems, and their relationship to the knowledge based economies that they serve.

Innovation is understood outside of architecture typically along the lines of the following definition; "Innovation is the implementation of a new or significantly improved product (good or service), process, new marketing method, or a new organizational method in business practices, workplace organizations or external relations."[12]

Further, innovation outside of architecture is understood as "at the heart of this knowledge based economy" typically understood in terms of technologies, research and development, products and/or services bound to economic improvement and business development. The definition above has been adopted for example for the *Australian Innovation System*, which is used to determine policy creation and adaptation for businesses to foster economic growth on a national scale. Architecture can have a role in these processes, leveraging the spatial intelligence (Schaik 2008) at the core of the discipline, while equally adapting processes native to design in architecture to these broad, abstract and non-formal domains. This is not the same as arguing for the value of design in economic terms, but rather applying the processes of design research in architecture to national innovation agendas more broadly.

Innovation policy "has only recently emerged as an amalgam of science and

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[10] ibid, p 41
[11] See Claude Shannon's information theory for further explanation on this.
[12] OECD (2005) Oslo Manual: Guidelines for collecting and interpreting Innovation Data, 3rd Edition, OECD and European Commission. P6 http://oecd.org, last accessed 2.5.2014

technology policy and industrial policy."[13] Since the first edition of the OECD innovation manual in 1992, there has been a growing tendency towards systems approaches to innovation "shifting the focus of policy towards an emphasis on the interplays between institutions, looking at interactive processes both in the creation of knowledge and in its diffusion and application."[14] This in turn foregrounds the significance of channels of communication as a central issue in evolving innovation systems.

Further, "Within the knowledge-based economy, innovation is seen to play a central role. ... At the macro-level, there is a substantial body of evidence that innovation is *the* dominant factor in national economic growth and international patterns of trade."[15]

While it is recognized then that innovation organizes and manages external and internal flows, most models of innovation prioritize research and development as fundamental even while generally marginalizing design from broader innovation contexts focused on technology, bringing products to market and process development. As an example, the chain-link model of Kline and Rosenberg (1989)[16] effectively articulates a design and prototype process, linking research and knowledge without recognizing this as a design process, one that is familiar to architecture, but sidelines design as a marginal and discreet action within this schema and therefore peripheral to research in national innovation contexts.

More positively in this model, which could be said to describe a design process, the role of research is "not as a source of inventive ideas, but as a form of problem-solving to be called upon at any point." The OECD report also notes, "research in this context is an adjunct to innovation not a precondition for it. ... Accordingly, for the chain-link approach, research cannot be seen simply as the work of discovery that proceeds it."[17]

What is important about this recognition is that research is tied into the work of
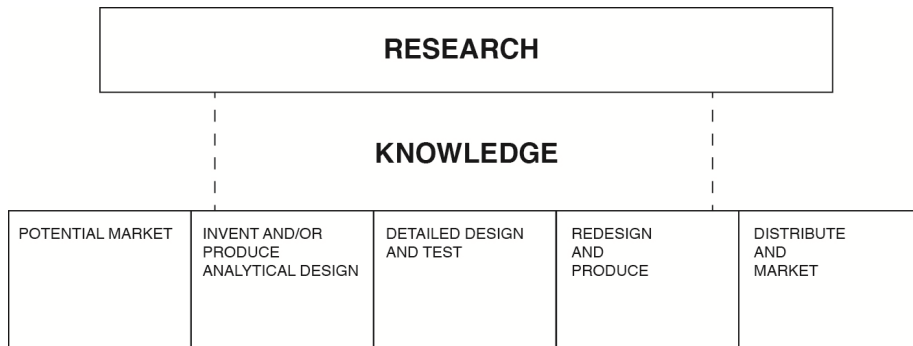
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[13] ibid, P 6

[14] The full quote reads, "Systems approaches to innovation shift the focus of policy towards an emphasis on the interplays between institutions, looking at interactive processes both in the creation of knowledge and in its diffusion and application." OECD (2005) Oslo Manual: Guidelines for collecting and interpreting Innovation Data, 3rd Edition, OECD and European Commission. P6, http://oecd.org, last accessed 2.5.2014

[15] ibid P 15

[16] Kline, S.J. and N. Rosenberg, (1986), "An Overview of Innovation" in Landau, R. and N. Rosenberg (eds.) *The Positive Sum Strategy. Harnessing Technology for Economic Growth*, National Academy Press, Washington D.C., p289

[17] OECD (2005) Oslo Manual: Guidelines for collecting and interpreting Innovation Data, 3rd Edition, OECD and European Commission. P24, http://oecd.org, last accessed 2.5.2014

innovation not as a-priori work but embedded within the processes of innovation, and considered through a design, test and prototype framework. Design Research as opposed to base line traditional research fits this definition in the innovation context as it is situated as a process.

RESEARCH

KNOWLEDGE

POTENTIAL MARKET	INVENT AND/OR PRODUCE ANALYTICAL DESIGN	DETAILED DESIGN AND TEST	REDESIGN AND PRODUCE	DISTRIBUTE AND MARKET

Innovation generation within firms, *Chain - link model*, Kline and Rosenberg (1986)

FIG.1. Schematic of Kline and Rosenberg

In furthering this line of enquiry, when surveyed, industry noted that as little as 5% of traditional base line research was useful to them, reinforcing the argument that research that is most impactful, is that which is bound up directly *within* the processes of innovation, rather than the delivery of information into an innovation context.

Innovation is understood quiet differently within architecture which is typically articulated within design as formal novelty. This compares to the understanding of innovation in other contexts and the well established language of innovation systems tied to research and knowledge economies and suggests innovation in architecture could be expanded to include such areas as managerial innovation marketing processes and so on, core to innovation in a broader business development contexts.

Yet as is recognized in the chain link model above, the actual processes and terms of reference are not that far apart. In recognizing this distinction, design research has an enormous potential to contribute to a broader innovation agenda, but only if it is able to activate meaningful information flows between internal and external research contexts, and situate design within innovation as a process, rather than as formally

driven and external to it. There is no doubt of the spatial dimension and consequence of national research agendas that architects are well trained for, however architecture certainly and design more generally remains fixated on formal novelty and will therefore remain relatively marginal to most innovation and research and development situations as long as this is the case.

In architecture, not all design work is research, in the same way that not all design can be called innovative. A case for the contribution and innovation of the work needs to be clearly articulated if it is to be considered research on the first hand, and innovative on the second. In this context, it becomes important then to consider how the nature of innovation as a critical goal of design research is distinct from more traditional forms of research where documentation and critical interpretation dominate, yet still contribute to new knowledge. Equally, with contemporary design research in architecture becoming more broadly accepted as a form of research, the tendency from within the discipline will increasingly be to engage broader research cultures and contexts. For this reason, it is imperative that we begin to understand and bridge the vocabularies of innovation contexts within and external to architecture, as sites where design research is aimed.

The diagram as a continuously evolving form of visual work, as distinct to drawing, has the potential to organize spatial and architectural thinking in such as way as to both incorporate larger fields of abstract (non-formal) information flows, and equally act as a form of design research work in its own right, in such a way as to offer significant advantage to any innovation agenda. The Australian National Innovation report of 2013 notes that those businesses that are considered innovative are generally 78% more likely to report increases in profitability. Additionally, those that are innovative and collaborate with research contexts and disciplines beyond their own are reported as being 242% more likely to report increases in productivity, demonstrating again the need for excellent communications beyond disciplinary specialisations.

In Kwinters' reckoning, it is also significant that the diagram operates at the margins of quantitative data, and allows a visual and no less informatic space of qualitative information and even intuition to be considered. In innovation terms, these are the conditions for step change innovation rather than the incremental innovation.

"Our lives and our world have been desiccated by numbers and so the mysteries of the qualitative world are necessarily beginning to recapture attention. ... This is no doubt why the diagram issue is becoming important again: it represents a fresh

approach to knowledge."[18]

In as much as one accepts the neo-vitalist or emergent version of the world in becoming, the diagram as abstract machine insists on the necessity to continually evolve/organize matter toward form. Yet the diagram while a visual form of work, is not formal, sitting between the active forces on matter and organizing these flows and relations, even while performing as a feedback loop from matter back into the diagram itself in a continual evolution of relational information.

The issue with the role of the diagram as it is typically understood in architecture however is the legacy of the formal diagram and its misunderstanding. This type of diagram is situated with a discourse on representation and is distinct in its goal to produce form as used by Eisenman and Rowe etc. (Eisenman 1998; Rowe 1947), where a formal intrinsic operative procedure is paramount. The role of the diagram to produce form is not the same as the role of the diagram to produce *difference* (information). The qualities of the diagram then that are significant to innovation are its capacity to continuously act in time and bridge disciplinary internal and external information, and thus not tied to the production of form per se. To *build* the diagram as happened in the early 90's in architecture, is not externally useful to a design research agenda as it situates the research ambition back within the normative processes of the discipline and should at this point be considered representational rather than diagrammatic. The diagram in Kwinters "bio-logic" analogy operates as the genotype to which there are numerous phenotypical expressions. In a post cybernetic stance, the diagram as abstract machine produces information (difference) that is *in-formal*, ie not of form, but which produces formal effects.

The EAAE Research Charter (2012), reinforces the unfortunate siloing of the terms of architectural research. Architectural research in this context is defined as an "original investigation undertaken in order to generate knowledge, insights and understanding based on competences, methods and tools proper to the discipline of architecture. It has its own particular knowledge base, mode, scope, tactics and strategies." The critical phrase here is "proper to the discipline of architecture" seemingly aborting cross disciplinary advantage at a foundational level. More positively research by design is defined as "any kind of inquiry in which (…) the architectural design process forms the pathway through which new insights, knowledge, practices or products come into being. It generates critical inquiry through design work." Recognizing a broad mandate for architecture design research consistent with innovation contexts

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[18] Kwinter, S. 1998, 'The Hammer and the Song', *OASE*, no. 48, p. 42

discussed earlier.

Innovation therefore is the expression (application) of difference, i.e. new information (knowledge). and while the diagram operates spatio-temprally, the register of this form of work of the architectural diagram must not be limited to the production of form per se, but extended to new organizational systems, management processes, economic, social and technical innovation equally which are recognized in the EAAE definition of research by design above. Recalling architectures' inability however to "to deal with the real yet intangible", if architecture is capable of more fully activating this form of the diagram, not only in embracing its informatics foundation, but equally flowing information back through the diagram to the discipline, design research in turn becomes capable of engaging in more universally adopted system of innovation, and thus extending the agency and capacity of design research into new territories.

Why would this linking of the diagram to innovation be of significance at this point? Why the diagram now? While much work has been done to interrogate the diagram, the more elusive question of what work does the diagram do, to whom does it communicate and what type of information does it both carry and generate, remain relatively unexplored areas. Also, architecture as a discipline has a very tightly defended and specific disciplinary vocabulary that as often as not, impedes innovation through its incapacity to engage information spaces outside of itself. Further work on developing the diagram as outlined here will help to overcome these barriers.

As an abstract and highly idiosyncratic but non-representational form of notation, the diagram uniquely situates innovation within visual processes of enquiry common to architecture. The diagram in this sense can be understood to constitute its own form of design research, emerging in the nineties as a consequence of the incapacity of traditional drawing techniques to address new arenas of enquiry, levels of multi-disciplinary complexity and speculation within the architectural design process. As the significance of design research becomes increasingly recognized however, the need to bridge from the interior to the exterior of architectural design research will only become more pressing.

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