Diagrams and Abstractions: Machines and Desires

Diagramming has become a favored practice among many contemporary critical practitioners. Often referred to as "abstract machines", diagrams characteristically focus one's attention to a limited, abstracted palette of ideas, and allow for design generation without the burdens of formalist thinking and its implications. This reductive process of the diagram mirrors that of the machine. If diagrams are conceived of as machines then it is important to ask who or what they serve, how they go about this service and the resultant effects on human perceptions and space creation. This paper provides a definition for the diagram, explaining how they operate within an emerging digital design realm, and elucidates as to their future role within a computational design context.

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Human cultural evolution watches mathematics replace mythology as the root of our primary mechanisms of environmental control. Our narrative traditions seem somehow linked to our corporeality, whereas our mathematics aligns with our intellect. Our technologies advance toward abstraction and the ubiquitous; everywhere and nowhere simultaneously. The contemporary acceleration of the diagram as a design tool is an extension of these larger cultural trends. Our computational tools attempt to replicate the brain at work as the diagram maintains a mathematical logic that bridges human and machine. Whether this bridge is connecting us to an organism distinct from our humanity, or simply one that allows the augmentation of one part of that humanity, we may never realize.

As all of these mechanisms of control seem to sprout from a core of evolving human desire, the endgame seems to be the continual reduction of all complex phenomena into a diagrammatic nature that fits a mathematical model. Within architecture, these reductive diagrams, adhering to the language of our computational tools, and so able to cross all cultural and disciplinary bounds, become generative mechanisms that operate within a complex network of program parameters. In "Diagrams, Instructions for Use" Giovanni Corbellini claims that "the diagram, by reducing and connecting, puts itself forward as a generative system, capable of producing the new and relating to it. In this sense, the diagram plays a greater part in the organization processes than in the prefiguration of objects."[1] This shift from object to process epitomizes larger cultural trends that seem to be replacing the concrete with the abstract. Design mentalities that

were once dominated by a concern with static objects and their relations, now shifts to a concern for relations between a multiplicity of processes and flows. Through this process the architect becomes a manager of these information fields and the discipline of architecture becomes a rapidly morphing phenomenon in this exchange, informed and altered regularly by other disciplinary realms; with potentially radical effects for the architect's role.

TENDENCIES TOWARD ABSTRACTION

Abstraction constitutes a removal, and can be defined as "thought apart from concrete reality", or as expressing a quality "apart from any specific object or instance."[2] The notion of drawing away from, stealing, or "omitting from consideration" are also characteristics of abstraction.[3] Human intellectual evolution and technological development has advanced toward abstraction. A tool is an abstraction in that it uses the human body or natural environment as a model and draws away a portion of that model, projecting it into a new material reality. These tools are then often further abstracted in that their development often tends toward a removal of a corporeal understanding of cause and effect for those who use them. This holds true with the bulk of human invention. When one considers the evolution of weaponry the trend toward abstraction is clear; first the hand, then the rock, then the knife, the spear, the bow and arrow, the cannon, and finally the missile. Each generation of weaponry further removes the human being from a corporeal understanding of cause and effect. In addition, each new generation of weaponry is more effective with respect to its intended application. Human cultural registers have also evolved toward abstraction; from inscriptions on buildings, to books, to digital media. This evolution of cultural registers shares the trends cited with respect to weaponry in that they advance toward abstraction and increase their effectiveness with each new generation. Through miniaturization of the micro chip and ubiquitous computing, our computational tools are also marching toward further abstraction. Even today, the effects of these computing technologies often seem absent of a cause.

DEFINING DIAGRAM

Diagrams are forms of abstraction, and fit within the above narrative of human technological development. The evolution of human corporeal and intellectual realities has resulted in machines that are an abstraction, and some might say an exaggeration, of those realities. Diagrams exist within the same language of these machines, engaging in thought apart from concrete reality, reducing complex processes or objects for clarity and future production. Clearly defining the term diagram will help contextualize its relationship to emerging computational tools, allowing a clearer understanding of our machines and our desires.

It is likely that some form of diagramming existed even in early human history. The growth of the human brain and consequently its capacity for abstract thought likely made diagramming possible. The first diagrams would have been extractions of natural phenomena translated through some medium that had the capacity to leave a visual trace. Of course, if we were to broaden our ideas about what constitutes a diagram beyond simply this two-dimensional visual mapping, then the rudimentary character of diagramming is the act of removing portions of phenomena in order to better focus on or understand other portions; a reduction of complex ideas into simple terms.[4] In other words, diagrams are reductions that help organize relations.[5] In this way much of human thought and language is "diagrammatic." The act of defining is in many ways

an act of diagramming; and to expect clear definition and clear distinction is to have a sensibility toward the diagram. Diagrams are not a singular entity with a fixed purpose. It would be impossible to describe the diagram as a phenomenon that exists in only one state, apart from its situational context. Being that they are reductive, diagrams are abstractions of ideas; meaning they are the result of an exclusion of some information in the service of the clarity of other privileged information. In this way it is possible to think or act "diagrammatically" without offering any physical artifact for one's visual consumption.

Diagrams of course offer more than merely an abridged representation of a complex reality. Deleuze suggests that we are beyond a simple defining of diagrams as a mode of representation and need to consider them as maps; a "cartography that is coexistensive with the whole social field."[6] Giovanni Corbellini in "Diagrams, Instructions for Use" cites synthesis as "one of the primary functions of the diagram," describing it as a tool that compresses the process of design.[7] One might exchange Corbellini's term "compression" with the word simplification; as every diagramming process denotes a removal of some content. For Corbellini, it is the diagram's ability to compress or simplify, both as a generative and representational tool, which makes it such an appropriate device in a design environment radically affected by an increased complexity of programmatic criteria. Because the diagram has a mathematical basis and reductive tendencies, it embodies machine logic. Gilles Deleuze refers to the diagram appropriately as an "abstract machine," and Corbellini follows by referring to diagrams as "true machines for thinking."[8,9] Sanford Kwinter shares Deleuze and Corbellini's view when he describes objects as a "composition of forces" arriving via a "compositional event" that is a formulation of the diagram as a dynamic "engine of novelty."[10] For Kwinter, the diagram has the capacity to both uncover and generate novel qualities of objects, or object "events" themselves, by decoding the underlying object forces and reusing them as a generative mechanism.[11] In this way, diagrams become instruments that hold process as paramount and reduce form to a temporary reality; a static picture of an evolutionary unfolding. This description of the nature of diagrams and their implied processes fits nicely within the general tendencies of human evolution mentioned above. That is, the diagram now becomes a tool by which all that is qualitative is translated into a quantitative description through the machinery of diagramming. To the extent that the diagram adheres to a mathematical logic it becomes a universal and generative device.

The aforementioned author's characterization of diagrams as machines is apt considering the relationship of the diagram to the modes and methods of both industrial production and the language of computational tools. The basis for the diagram as abstract machine, if we are to accept the diagram as such, is mathematics, and the generative nature of diagrams relies on this mathematical foundation. So the relationship of diagrams to machines, beyond the Deleuzian example, is one of compatible coexistence and evolution from the same desire for environmental control.

ADVANCING MACHINE ABSTRACTIONS

The compatible coexistence between diagrams and machines provokes questions about the evolution of machines themselves. In Digital Age: the Fourth Machine Age Nigel Whiteley defines five eras of machines; three of these have come and gone, we exist in the fourth, and are close to entering the fifth. The First Machine Age, described in detail by Reyner Banham, Whiteley and others, embodies the

"reduction of machines to human scale."[12] This is epitomized by the vacuum cleaner and typewriter, among other household devices. This era helped transform human relations with machines and radically altered our social and aesthetic sensibilities. In the Second Machine Age domestic electronics, such as the television, became more available and pervasive. Whiteley points out that, during this age, a "society based on scarcity and need was being superseded by one encouraging abundance and desire."[13] Technology became so pervasive during this time period that in essence it was becoming transparent. The Third Machine Age was an era that moved consumers "out of the house and away from their consumer goodies", signaling a shift from "things, to situations and events."[14] Personal stereos, the "walk-man", the camcorder, and the digital camera among other things personify this Third Machine Age. According to Whiteley we currently exist in the Fourth Machine Age which is characterized by the idea of "inter"; meaning interrelations, interconnectivity, and interaction. The technological products of the Fourth Machine Age are a further extension of the previous age's devices of intellectual mobility and act to "re-socialize" us through machines. Our iPad's and smart phones are prime examples of the devices of the Fourth Machine Age. In the Fifth Machine Age human beings integrate with machines. Instead of being intellectual subordinates, our machines become embedded within our bodies, creating seamlessness with respect to how we now engage with a machine dominant environment.[15] One can imagine an environment which adjusts to your every need according to your "connectivity" and desire. We see evidence in our current age with possible tendencies of the machine ages to follow. For instance, when we combine the tendencies of labor replacement and intellectual and social transference of the above discussed machine ages we perceive evolutions toward generative machines; machines that gain some level of creativity, machines that become companions to their design host, or machines that become designers through a larger social design host. Diagrams, because they are machines, and because they rely on a connection to mathematical, quantitative content, become convenient translational devices for this task.

Whether we agree or disagree with the delineation of machine eras presented by Banham, Whiteley and others, a brief outline of technology indicates some particular trends which are certainly worth examining if we are to speculate on evolving conditions in our own disciplines. Based on the outline given above a few telling trends are evident. First, there perhaps needs to be a distinction made between tools that serve as a replacement of our physical labor and those that serve as mechanisms of human intellectual transference. There will always be a need to labor, and currently we have a litany of tools that serve as that labor's companion. In many respects our first and second machines were those that replaced components of human physical labor: the vacuum cleaner, the dishwasher, the washer and dryer among other things. These machines are certainly still undergoing refinements today and play a large role in our contemporary lives. In replacing many components of physical labor these machines are a form of abstraction, in that they remove a portion of the human physical effort necessary to achieve the resultant outcome; a divorce from a full understanding of cause and effect. So the rise of the first and second machine age consists of a rise of abstraction and, through our engagement with its tools, becomes a cause to further abstraction.

As the world of machines evolves however, there seems to be a trend from technologies that translate human labor into devices that translate the human creative intellect. Instead of replacing physical labor, these machines are transferring human ideas and social interaction through new media. The Walk-man or

Game Boy for instance, are early examples that allowed one to transport creative environments. The iPad and the smart phone are tools that allow the transference of human social intellectual environments. If an abstraction is something apart from concrete reality, and the extent of the separation from concrete reality is perceived as tantamount to the extent of the abstraction, then the difference between human physical labor and intellectual labor consequently becomes a difference in levels of abstraction. In other words, the evolution of tools that replace labor toward tools that transfer social and intellectual realms is itself an evolution toward abstraction. Attempts at easing human labor and at transferring or expanding the human intellect are not new even to the scientific revolution or the industrial age. Even the most rudimentary human tools were attempts to alleviate the burdens of labor. Consequently, they were also abstractions from the natural environment. Human beings have been at work transferring their knowledge for tens of thousands of years, always selecting the most enduring medium possible for this effort. The question isn't whether we do this, and increasingly the question isn't even why we do this, the question is about the end game of our pursuits and how they will affect life within our discipline. Diagrams do not come without their dangers.

DANGERS OF DIAGRAMS

The potential danger of diagrams is well established in the article "Hidden Lines: Gender, Race, and the Body in Graphic Standards." In this article Lance Hosey examines the evolution of the dimensioning of the human body, from 1932 to 2000, in the influential design guidebook Graphic Standards. As a whole, this article points out the flaw in any act of diagramming, abstracting, and quantifying; that it has to rely on removal of content to be useful and that that removal is bound to result in a privileging of a particular world view. Diana Agrest, cited within the article, warns that this privileging of world view should be seen as an exclusion or repression. For Hosey, the book's standardization of the human body, and its content generally, reflected "implicit beliefs of architecture and the larger community."[16] The attempts to dimensionally standardize the body were part of a tradition that went at least as far back as the French Enlightenment.[17] This parallels the accounting of David Kubrin's article, "Dead on Arrival: the Fate of Nature in the Scientific Revolution," wherein he describes a societal view characterized by a belief in a living, "knowing" nature, as evolving fairly rapidly into a belief in nature as a "resource", there for humanity's consumption.[18] This represented a shift in thought from "nature to science and faith to reason", and a "shift in metaphor from the divine body, an abstract, sacred vessel, to the mechanical body, a real organism appearing in an environment."[19] In other words, at its root this represents a shift from qualitative to quantitative thinking. In this quantification of the human figure "bodies are constructed as abstractions" and "idiosyncrasies are ignored in favor of generalizations."[20] This is in fact the very danger of the diagram itself, that any system of representation is an abstraction that privileges particular information. In the case of Graphic Standards the human body was seen as white European male and consequently the dimensioning of the built environment came to privilege that diagrammed type. Even with our best intentions and careful examination of inclusions and exclusions in a singular diagram, its crafting is going to privilege a quantitative sensibility and therefore leave out that which is difficult to measure but might previously have been intuited by the designer. Through this process we risk sacrificing intuitions and qualitative understandings of our environment for that which can be calculated and measured.

Sanford Kwinter describes the diagram as a "synthetic explanatory device that opens up a space through which a perceptible reality may be related to the formal system that organizes it."[21] Through this mode of operation our evolving perception of reality becomes fundamentally linked to the chosen organizing system, in this case the diagram. Being that diagrams are first and foremost a reductive instrument that translates, through simplification of an otherwise complex reality, it stands to reason that this reformulation of reality is both more simplistic and based on the underlying mathematical realities of this instrument of translation. Though Kwinter argues that the diagram should not be understood as a device that reduces complex reality into simpler forms, diagrams as representations of reality are difficult to conceive of as anything but. In fact, the success or failure of the diagram as a representative or generative instrument seems to be linked to its ability to include or exclude specific information.

PLEASURES OF DIAGRAMS

Pleasure and danger, of course, are not opposite ends of a continuum and in many cases are absolutely conjoined. So examining the pleasures of diagrams is not to suggest lack of vulnerability, but instead indicates a gratification or indulgence despite, or because of, being vulnerable. In "The Diagrams of Matter," Robert Somol writes that designing is that which "makes it possible for an accident to occur."[22] The accidents in the case of the generative diagram arise from a simultaneity of relationships that emerge from seemingly divergent disciplines allowed to coexist within a shared computational language. This coexistence establishes new formal and spatial derivations that potentially arise from content areas that architecture has neglected or simply not known how to incorporate in the past. Because it is based on the universal logic of mathematics, the diagram has the power to seamlessly cross disciplinary fields. By simplifying what otherwise would be a complex array of multi-disciplinary ideas, the diagram has the power to generate unexpected and innovative results.[23] In addition, the fact that these relationships have been translated into a computational language means an exaggeration of the iterative possibilities of the design process within the machine. In this scenario the machine takes over much of the current role of the architect and human designers become managers of networks, choreographers, conductors, and directors. Diagrammatic catalogues of spatial types along with post occupancy data are continually updated and used as filters during this iterative process. Formal registers that map qualities of brand relate the iterated data to solutions that best fit particular clients. Other filters that allude to material, structure, code and building performance help these new managers surf the complex network of formal and spatial possibilities.

If we think in terms of Kwinter's characterization of an object as an accumulation of forces that can be diagrammed, then architects will begin to find pleasures in mapping and decoding the underlying forces that created the event that became the object. The decoding of a multitude of objects filters itself generatively as an encoding of a novel object. Though in "The Hammer and the Song" Sanford Kwinter warns against conceiving of the diagram as a fixed template rather than a flow, the future that diagrams allude to is one in which their geometry is attached to effect, thus becoming a mathematical template of performance.[24] This template is morphologically based on continually adjusted programmatic understandings and criteria such that it is only static at the moment that it is plucked for use. This method of using the diagram is not opposed to the idea of flow but asserts that the diagram itself becomes, at times, the "compositional event"

discussed above that Kwinter relates to objects. In other words, in order to be useful, it seems that the diagram has to become a template, just not one so rigidly fixed that it denies new knowledge about the spaces it's attempting to describe.

CONCLUSION

Human technological evolution trends toward abstraction and diagrams are part of this abstract, reductive conceptualization of our complex natural world. The diagram replaces concrete realities with abstract reductions that help to clarify a particular set of ideas. This process of reduction is vital to the diagram's ability to simplify spatial ideas that may otherwise be clouded by an attention to unnecessary detail too early in the process of design. That which is readily quantifiable is also likely able to be diagrammed, whereas that which is qualitative has to be forced into a quantitative model to be so. Ironically, this elimination of content is both the strength and the weakness of the diagram. Because diagrams are based on mathematical models, and because their effectiveness requires them to be reductive, they become value laden machines. This tendency of the mathematical or quantitative in diagramming aligns itself perfectly to its emerging relationship with digital machines in that they share a similar language.

The increased role of the diagram in critical design practice and its relationship to digital machines is born from the need to control an increasing amount and complexity of environmental information; information whose specific design outcomes are ever more critical due to limited budgets and the needs of exactitude in building performance. The evolution of diagramming is not a distinct phenomenon, apart from the emergence and evolution of computational tools. The increased value we place on diagramming as a process is cast from the same mold as the computer. The evolution of that mold is toward generative diagramming that arises from consistently catalogued types measured against human emotion, experience, and building performance issues. Eventually the complexities in design practice will mean a conversion to a more pronounced use of computational machines and the processes those machines imply. This will mean a shift from our conceptions of "architect" from one who "designs formally balanced structures" to someone who "designs the design."[25] In other words, next generation architects are design cartographers, mapping programmatic relationships, processes, and desires. The mapping of these processes and continual assessment of their effects establishes new roles for architecture and architects. We become form givers through the aggregation of a complex network of forces mapped within our computational environments. Instead of applying form or shape to suit the program parameters, forms emerge from without instead of within. This process allows us to quickly and iteratively measure the needs of the program and our desires.

ENDNOTES

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