The Volumetric Diagram – Genealogy of a Drawing Type

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Biography

Tommy Kaj Lindgren is an architect (SAFA), and Lecturer in Urban Design, at the Department of Architecture, in the School of Arts, Design and Architecture at Aalto University. In his research, Lindgren is focused on the position of drawings as mediating tools in architectural production and reproduction. While working as an architect and teacher, he also contributes to ongoing discussions on the urban environment, its form and formation, through critiques and reviews.

Abstract

The architectural drawing is integral to the way we envision, construct and understand our environment. Interpreted as mediators, the situated nature of architectural drawings can be defined, and their effects identified. This text is an exploration in three parts of the drawing type that I call the 'Volumetric Diagram'—in the first part, the general nature of architectural drawings is described and examples highlighting the constructed nature of different drawing types are presented; all drawing types are claimed to be in a state of flux and the mechanisms of change are examined – the durability of types being a

function of their connectivity. In the second part, the Volumetric Diagram is described as a distinct contemporary drawing type, its 'pre-history' is traced from axonometric representations and diagrams, and its emergence is outlined by examining the genealogy of the type. The qualities of the Volumetric Diagram are described and elaborated based on this analysis. In the last part the previously explored aspects of architectural drawings in general, and the Volumetric Diagram in particular, are juxtaposed with architectural approaches and theoretical concepts, in order to highlight the position of the Volumetric Diagram in relation to them.

Keywords

Drawing type, Architectural drawing, Axonometric, Genealogy, Actor-network theory

Introduction

The Volumetric Diagram has had a central role in several architectural projects of relevance and visibility in the last decades. The drawing type is a relatively new tool for design and presentation, and it has not been situated, temporally or in relation to architectural discourse, even though discussions concerning 'the diagram' have held a prominent position in theoretical writings. The goal of this essay is to propose a constructivist reading of architectural drawings and drawing types as mediators—actors in networks—with explicitly stated functions and implicit effects, utilizing the concepts and framework delineated by Latour (2007); to consider the dynamics of their change; to trace the genealogy of the Volumetric Diagram; to discuss the implicit effects of the Volumetric Diagram in relation to approaches to architecture and to

establish a plane of discourse, where the focus can be directed at what drawing types are and what they allow as tools, instead of analysing them as visual data within a framework of 'sites and modalities' (Rose, 2016).

I The Architectural Drawing

> I suggest that it is the absolute and calculative precision of modern measure—together with its claims of objectivity, rationality, and universality (claims that lend assurance to the production of empirical knowledge)—that underlies the current aporia, an aporia of aimless precision and entropic blandness that is made only more confusing, ironically, by virtue of the creativity and freedom it affords. (Corner & MacLean, 1996, p. 25)

Corner's incantation of the power of measuring can be understood as a rendition of the twin potentials of architectural drawing—at once descriptive and projective. The use of drawing in architecture is manifold—instead of just the blueprint, the architectural drawing encompasses an array of tools. The notations made of existing conditions—legal boundaries, topography, differences between material conditions on and below the surface, approximations of the built and the natural fabric—produce the site for architecture. Initial outlining of the spatial qualities of a program produces visual concepts with dimensions and qualities—artefacts for discussion within the studio. Measured drawings produce tests—the drawing as a proof of concept—that develop the project from concept to a level of resolution that allows for comprehensive evaluation—from costing to approval. Construction drawings take a step back from the resolved image and deconstruct the project into documents geared towards the production of its constituent parts—the most variant of all architectural drawings, construction drawings combine methods of exact representation with references to building codes and standards, material specifications and implicit assumptions of craft methods. During construction, the drawings

do not stay inert, registering unforeseen changes on the construction site—from revelations unearthed during the building of foundations, to changes in the components of the finishes—susceptible to everything from international trade wars to private changes of heart. Once the building stops and the project is completed, the drawings of representation vary from the carefully curated images used to fix the project in time, to analytical drawings of its performance and use. The building is finally treated as a 'ground' for new projects—minute and / or complete transformations—and architectural drawings are again used to trace the contours of the different aspects of the built, producing and preparing a new 'site' for interventions.

Drawing histories

> The close resemblance between wall surface and paper surface has never been entirely overcome in architecture, any more than the geometrical equivalence of plan and floor. It is far too convenient. (Evans, 2000, p. 116)

Different uses call for different types of architectural drawings—maps, site plans, elevations, sections, etc.—and even though the inertia of convention is strong, grounded often in law, building codes (the need for appropriate drawing types for proving compliance, etc.) and educational models (for example the serial and analytical use of plan, elevation and section in Durand's *Précis* and *Recueil*, putting their stamp on the École des Beaux Arts in the 18th and 19th centuries, as analysed by Lee (2016))—there is no causality between the results that are sought after, and the type of drawing that has to be deployed. Drawing types are not 'transparent', but historically constructed and situated entities—often reliant on representational convenience. Consider for example the discrepancy between the descriptive poverty of a site map drawing, and the dense—often heterogeneous—urban environment that it is summoned to represent.

The artificiality of drawing types can be easiest exemplified with types and situations that are foreign to us in contemporary use, like the 'developed surface interior' drawings of late 18th

century Britain analysed by Evans (1997), the 13th century representations of architecture and machines in Villard de Honnecourt's Portfolio, as analysed by Scolari (2012) or the diminished role of documentation compared to the concepts of faith and collaboration in the design and building of the great European Gothic Cathedrals, discussed by Scalbert (2018). Instead of hard 'facts' we see that with drawing types, we are dealing with artefacts of more, or often less, solidity.

The dynamics of this change can not be reduced to an idea of 'progress'—continuous refinement and optimisation, as this would not account for the appearance of novel types, or the sudden collapse and disappearance of some forms of visual representation. A theory of causality between drawing types and new processes of construction or forms of media could be proposed, but it would run the risk of a passive idealism, with each new conceptual or technological innovation having an 'ideal' mode of representation.

And more importantly, the nature of the rich variety observable in drawing and presentation types would go unexplained. A rewarding model is treating drawings as embedded in networks as defined by Latour (2007), participants in actor-networks, on the same plane as all the other associated participants in envisioning and producing our environment. The Actor-Network Theory (ANT) also provides a useful concept pair in 'intermediaries' and 'mediators' (Latour, 2007)—where 'intermediary' stands for the ideal of total transparency, of a participant not really participating in the process, but just passing on information between the actual actors, and 'mediator' means a participant that takes part in forming the message while passing it on. The concept of the intermediary belongs to hierarchical models of thought, to the foregrounding of the 'human' author at the expense of the 'non-human'; while the concept of all participants as mediators represents the ANT model and gives a framework for us to understand the architectural drawing as an actor in its context.

Drawing essence

> This is why any social production having some marked characteristics, be it an industrial good, a verse, a formula, a political idea, which has appeared one day somewhere in the corner of a brain, dreams like Alexander of conquering the world, tries to multiply itself by the thousands and millions of copies in every place where there exists human beings and will never stop … (Gabriel Tarde, as cited in Latour, 2007, p. 15)

We have examples of forms of architectural representation, that have defined moments of emergence and disappearance. And we have drawing types, like the plan, the elevation and the section, that although we know them to be constructs, seem to have staying power. If drawing types are without any essence, what keeps them from falling apart?

The drawing types that are tenacious, have durability through the density of their network of connections. Through replication, a type creates reach and stability, but the nature of the connections is crucial for their persistence. We can consider the BIM (Building Information Modelling) 'drawing' type—the models that are used for design, evaluation, assessment and managing of complex projects. The models have generated a seemingly durable location in the networks of production of built environments—as tools for design and representation, they act as mediators that condition the practices of the design studios as well as the sites of production and construction. The reach of the type is considerable, as it is deployed globally and its qualities and processes are codified in standards – but the width of the 'network' the type casts does not necessarily correlate with endurance, as most of its connections are tightly coupled with technical interfaces. A scenario, where the integration of 'smart' technologies in construction materials and elements, and the use of AI in managing coordination between the design branches could easily be envisioned—resulting in the relocation of the 'tasks' that the BIM

model had been the nexus of—thus resulting in its obsolescence as no more than a historical artefact, and removing (or relocating) the effects the type has had on design as a mediator.

The drawing types that continuously find locations in the evolving networks of the production and reproduction of the built environment endure, while the ones losing contacts become obsolete.

II The Volumetric Diagram

'Volumetric diagram' can be used loosely as a colloquial term, usually denoting a schematic volumetric or axonometric drawing, with some general diagrammatic properties (properties describing something other than the presentation of the volume itself, like e.g. use). In this text, the drawing type is more tightly defined, as a volumetric or axonometric drawing, which answers through formal transformation to a force or forces outside the presentation of the volume itself. This type has as its significant attribute at least one dimension that is variable, i.e. a proportion that can alter in order to accommodate a chosen force. The type has first appeared in architectural representations just before the turn of the millennium, evolving into a stable form during the first decade of 2000. Through a prodigious proliferation, today the drawing type can be found used with varied levels of rigour everywhere, from student projects to representations used in the media as shorthand for explaining the intentions of architects—an inexact but telling metric is the inclusion of numerous examples of the drawing type in the DOM publishers popular '*Manuals*' series (Pyo, 2015).

Pre-Histories

> The constructive diagram can describe the context, and it can describe the form. It offers us a way of probing the context, and a way of searching for form. Because it manages to do both simultaneously, it offers us a bridge between requirements and

> form, and therefore is a most important tool in the process of design. (Alexander, 1964, p. 92)

Several earlier examples of similar drawing types can be found, notably in the work of the New York Five, all partial to axonometric representations (Peter Eisenman, Michael Graves, Charles Gwathmey, John Hejduk and Richard Meier)—especially in the work of Peter Eisenman. His utilization of the axonometric drawing as the main tool for design for his influential 'House'-projects (from the late 60's to the mid 70's) is notable, as well as his use of the axonometric as a basis for extensive formal analyses, in his dissertation of 1963 (Eisenman, 2018) and later in his analysis of Terragni (Eisenman, 2003)—originally published in 1994 – and of 'ten canonical buildings' (Eisenman, 2008b). Eisenman has also theorized the diagram in architecture and its nature "as an explanatory or analytical device and as a generative device" (Eisenman, 2008a, p. 94).

Eisenman's use of the axonometric and the diagram in analysis and design is formal and hermetic—the descriptions of projects reference an 'inherent' logic of the forms, the bodies and voids represented 'reacting' to each other and pre-established systems, like grids and directions 'found' on site. Eisenman's position regarding the axonometric diagram is summed up well with his assertion, that Terragni's work is concerned with the "syntactics of architectural language", the "conceptual relationships that underlie … formal arrangements" and "deep structure" (Somol, 1999, p. 15)—here one could be forgiven in reading this as a confession of Eisenman's own priorities and preferences. Despite the considerable similarities in appearance of Eisenman's work and the Volumetric Diagram, Eisenman's preoccupations are in line with the 'critical project'—constructing foundations for an autonomous architecture, while the Volumetric Diagram features prominently in the discourse around 'post-criticality'—as a visual tool helping "To 'solve', not to 'problematize'" as the 'post-critical' approach is succinctly summed up by the historian Ole Fischer (2012).

Eisenman's 1963 dissertation (2018) purportedly countered a previous dissertation by Christopher Alexander (Somol, 1999), dealing with diagrammatic tools for generating form. On a conceptual level, the ideas linked with these 'diagrams', later presented in Alexander's *Notes on the Synthesis of Form* (1964) are closer to the definition of the Volumetric Diagram. The purpose of Alexander's work is to create a methodology for finding 'goodness of fit' (1964), and while the infrastructure of the method consists of the application of set theory, the results take the form of diagrams. These diagrams are fusions of 'requirements and form', as stated in the quotation above, and thus aim at generating the answer (form) by carefully crafting the question (requirements). Alexander later focused in his A *Pattern Language* on finding these diagrams in the existing environment, hence turning away from the creation of novel form—even though the ideas of evolution and the potentiality of the 'unique' are still seen as possibilities, the name of the overarching theory 'The Timeless Way of building' gives away the nature of the project (Alexander, Ishikawa, & Silverstein, 1977). Alexander's diagrams, whether constructed or 'found' have an aversion to the volumetric, and appear as figure-ground drawings, staying away from the realm of mass and void, so central to the operations of Eisenman.

History

> Even while he was still working in Koolhaas' office, Winy Maas' particular talent was for developing complex diagrams, instructions, cartoons and other commentaries on reality into design strategies. While others sceptically attempted to explain Koolhaas' associations as irony and fantasy, Maas busily set about transforming them, one might almost say magically, into a method for design. (Bosman, 2003, p. 91)

The appearance of the Volumetric Diagram is a Dutch affair, finding its resolution in Denmark. The drawing type in its mature, stable form is clearest in the work of the Danish Bjarke

Ingels Group (BIG), as evinced for example in the Fan Buildings project drawings of 2005, with variable dimensions answering to views (Ingels, 2010); the National Bank of Iceland project drawings of 2007, with variable dimensions answering to the urban context in relation to building heights and distorting the facades in order to create urban stages and control sunlight (Ingels, 2010); and the drawings of Via 57 West apartment building in New York of 2016, with variable dimensions transforming a tall perimeter block building volume in accordance with views and sunlight (BIG, 2020). Also, the company of Ingels's previous collaborator, Julian De Smedt, JDSA, uses the Volumetric Diagram almost exclusively in presenting the design processes and products of his practice (De Smedt, 2020).

If we consider the previously stated definition of the Volumetric Diagram—an axonometric drawing with one or several variable dimensions—we can start to trace its genealogy in reverse from the full-blown examples of BIG and JDSA. The type is found in the projects of PLOT, the company Ingels and De Smedt founded in Copenhagen in 2001 and disbanded in 2006. The earliest projects of PLOT (JDSA, 2020) feature diagrams depicting transformations on the plane of the plan or the section—sometimes both, like in the proposal for the Grand Egyptian Museum competition in 2002 – but not in a volumetric drawing, until the project for the Stockholm Contemporary Dance Theatre, in 2003, where an ambiguous stack of planes presented as an axonometric is transformed by bending, so it answers to the two vectors of entrance direction and sunlight. The competition proposal for the European Patent Office in 2004, where a circulation spiral generates the main form that is then pushed and pulled according to directions of sunlight, takes up the use of the Volumetric Diagram in a more ambitious scale and the REN and VEJLE Building projects from the same year shows how the drawing type is used as a facile generator of novel form—one of the inherent 'effects' produced by the use of the drawing type.

Ingels and De Smedt are both alumni of the Office for Metropolitan Architecture (OMA), the Rotterdam based office founded by Rem Koolhaas (with Madelon Vriesendorp, and Elia and

Zoe Zenghelis) in 1975. Working in the office in the late 90s they were likely also influenced by the publication of FARMAX in 1998, by the office MVRDV, founded by Winy Maas and Jacob van Rijs, also alumni of OMA, and Nathalie de Vries. *FARMAX* explores many of the issues that Koolhaas had been dealing with through projects and texts—the fate of the modern project, urbanism, the evolving role of the architect—but with a focus on statistics, ratios, regulations and 'datascapes' as generators of form, a different approach than the ironic detachment and theoretical sophistication typical for Koolhaas. "Form becomes the result of … a 'datascape' of the demands behind it." Maas states (MVRDV, Maas, Van Rijs and Koek, 1998, p. 103), preparing the ground for the Volumetric Diagram to emerge.

The studies featured in *FARMAX* explore different implications of datascapes—from density ratios to daylight regulations and their effects on block typologies, breaking down design into calculation and parameters. A number of speculative projects turn this procedure around and demonstrate the use of these parameters as design tools for reaching unconventional 'maximized' solutions, like the geometrically complex outlines of maximum zoning envelopes proposed for Bergen op Zoom and Amsterdam, carved by following rigorously the sightlines established for the protection of the character of historical environments (MVRDV, et al., 1998). The 'Noise scape' project from 1997 utilizes the variable conditions of sound on a site next to a highway in order to sculpt building forms according to the noise sensitivity of different functions, presented as crude axonometric renderings (MVRDV, et al., 1998). This is the ground zero of the Volumetric Diagram, combining a volumetric presentation of building form and a variable dimension used for transforming it.

Moving further back in time, we can find archaeological fragments of what will become the qualities of the Volumetric Diagram, in Koolhaas' 1978 book *Delirious New York*, with a paperback edition published in Europe and the US in 1994. Especially in the renderings of Hugh Ferriss of the maximum building envelopes allowed by the New York Zoning Law of

1916, Koolhaas sees the birth of a new architecture, forced into being by the absolute congestion of Manhattan, and the blind dynamic of regulation and maximum volume. Ferriss' charcoal drawings focus on planes and mass, eschewing the surfaces of 'items' of familiar styles, giving form to a novel architecture of fantastic slopes and peaks—all envisioned through an operation demonstrating how the legal regulatory envelope can be petrified into an 'automatic' architecture (Koolhaas, 1994).

Summation

With this sketch of a genealogy we can see a few of the crucial substrata that form the groundwork for the Volumetric Diagram, made of a diverse collection of connections, projects, publications, shared workspaces and the words of colleagues past and present. As a conclusion, some of the main qualities of the type can be summed up, elaborating the earlier compact formal definition.

The Volumetric Diagram is an image of a 'solution'—the 'requirements' and the 'form' are visible simultaneously. Here the use of the axonometric—the ability to represent the building, in isotropic space, instead of the conditioned space of the perspective—is essential for representing the forces altering the variable dimensions of the volume with exactitude. An Alexandrine diagram in three dimensions, looking like a drawing by Eisenman from the 70s.

The Volumetric Diagram presupposes a 'maximizing'—a drive for the most volume or mass. The volume to be transformed is often generated implicitly before the variable dimensions are introduced, by extruding the site to a theoretical maximum. This disposition can be traced via Maas and Koolhaas back to Ferriss' visions.

The Volumetric Diagram is disengaged from the questions of 'composition'—the drawing type is a generator of unconventional form through the use of datascapes, an antithetical process to considering architecture as a composition of discreet 'items', whether structural or superfi-

cial. This is clearest on a conceptual level in MVRDV's studies, and visually apparent in the drawings produced by PLOT, BIG and JDSA.

III Discussion on attitudes and aptitudes

> A diagrammatic practice (flowing around obstacles yet resisting nothing)—as opposed to the tectonic vision of architecture as the legible sign of construction… (Somol, 1999, p. 24)

The Volumetric Diagram has established a prominent position within the array of drawing types used for representing architectural design processes and final products, as the comprehensive use of the type by several global practices attests—it has reproduced itself and found important locations in the networks of architecture as a tool for conceptual thinking and popular representation. The character of tools as 'actors' and 'mediators'—entities that participate in the forming of their content instead of being mere 'intermediaries', passing on the intents of other actors with total transparency—compels us to consider the particular qualities of this specific tool. We recognize, that a tool does not 'determine' the action it is used for (Latour, 2007) or that "a technique of drawing does not compel designers to do this or that" (Evans, 1997, p. 200), but as tools create a framework of possibility for their users, we can now consider these 'affordances' regarding the Volumetric Diagram in relation to architectural discourse.

We can do this with another method of reversal—instead of considering the apparently inexhaustible 'formgiving' (also the title of an exhibition of BIG's projects at the Danish Architecture Center in 2019) made possible by the Volumetric Diagram, we can explore the approaches that it hinders or forbids. Especially by reflecting on the concepts of typology, tectonics and collaboration, we can start to outline this shadow image of the type in order to see clearly what it is and what it allows.

Against Typology

The production of UN Studio, founded in 1988 by Ben van Berkel and Caroline Bos is a good example of a practice engaged with the use of the diagram on a theoretical and practical level. The Volumetric Diagram as such does not play a role in their work, but their comments on the effects of diagram as a design instrument are informative: "A representational technique implies that we converge on reality from a conceptual position and in that way fix the relationship between idea and form, between content and structure. When form and content are superimposed in this way, a type emerges. This is the problem with an architecture that is based on a representational concept: it cannot escape existing typologies. An instrumentalising technique such as the diagram delays typological fixation" (Van Berkel and Bos, 2002, p. 105). One could argue that the diagram not only delays, but makes 'typological fixation' impossible—a typology is form, that has an embedded set of relationships that defines it—a superimposition of another set of relationships, like variable dimensions responsive to outside forces, creates a composite that cannot endure—the use of the Volumetric Diagram and typological design concepts are incompatible.

Against the Tectonic

The architectural historian Kenneth Frampton has explored the role of the tectonic as a bridge between what is seen as traditional and vernacular modes of building and modern architecture—the tectonic plays a central role in his definition of Critical Regionalism as a counterforce for the homogenization of architecture by the effects of modernity and globalization (Frampton, 1992). His contemplation of the tectonic in his Studies in Tectonic Culture (Frampton, 1994, pp. 375-376) sums up the role that the tectonic plays in architecture for him ("[o]ne may argue that the tectonic resists and has always resisted the fungibility of the world") and he ends his essay with the open question "... how to maintain the tectonic trajectory in the face of

a postindustrial civilization that seeks nothing less than the reduction of the entire world to one vast commodity". The tectonic is reliant on the possibility of composition, structural and otherwise, and we can see how the Volumetric Diagram, which embraces 'fungibility' or total elasticity as a core quality, is an unfit vehicle for tectonic considerations—the pre-eminence of formal freedom and novelty gives structural design the role of implementation after the fact. The Volumetric Diagram can be seen as the polar opposite of a tool for a regional tectonic.

Against Collaboration

The formal fluidity of the drawing type belies an exclusively rationalistic approach—the idea of design solutions found in datascapes or 'facts on the ground' draws its lineage straight through the modern project to the Bauhaus under Hannes Meyer and beyond. The problematic dynamic between the architect as the active expert and the users of the project as passive subjects, is clear once we ask the elementary questions 'who selects the data', 'who decides on what the relevant forces are' and 'who creates the order of priority between the selected variables'. On a deeper level, without a more profound role for the users in constructing the common project that architecture still often represents, the architect stays as the sole gatekeeper—relying on Science as described by Latour (2004, p. 249) "... in order to make public life impotent by bringing to bear on it the threat of salvation by an already unified nature..." In other words, there is no genuinely common project, if there is the possibility of the collaboration being short-circuited by the introduction of outside forces not agreed on or negotiated together.

In Conclusion

With this essay, a theoretical scheme for considering architectural drawing types as participating 'mediators' in the networks of architectural production, and a method for recognizing their ephemeral nature, has been proposed. With a genealogy of the Volumetric Diagram, the emergence and qualities of one type has been outlined and its implicit dispositions towards

methods of architectural production made apparent. By focusing on the drawing type as a tool, I have aimed at bypassing the black box of architectural authorial intentions—conscious or unconscious, declared or hidden. Through the choice of tools, architects convey the value framework in which they operate and the type of architecture that they advocate, more transparently than through rhetorical means, consisting only of words.

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