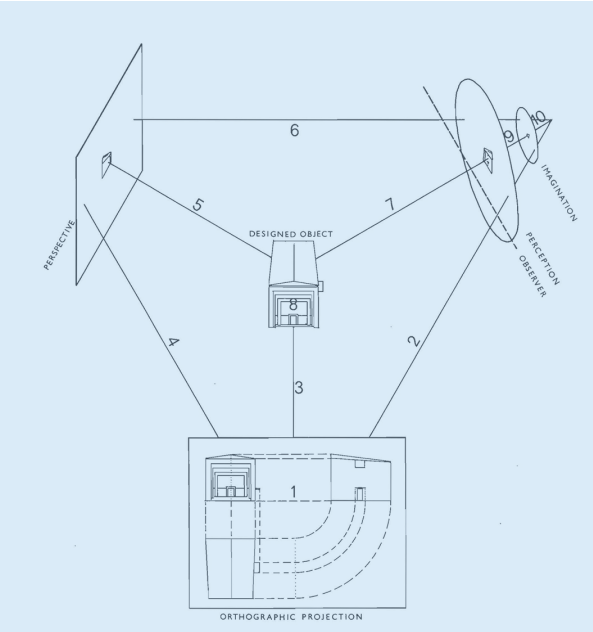
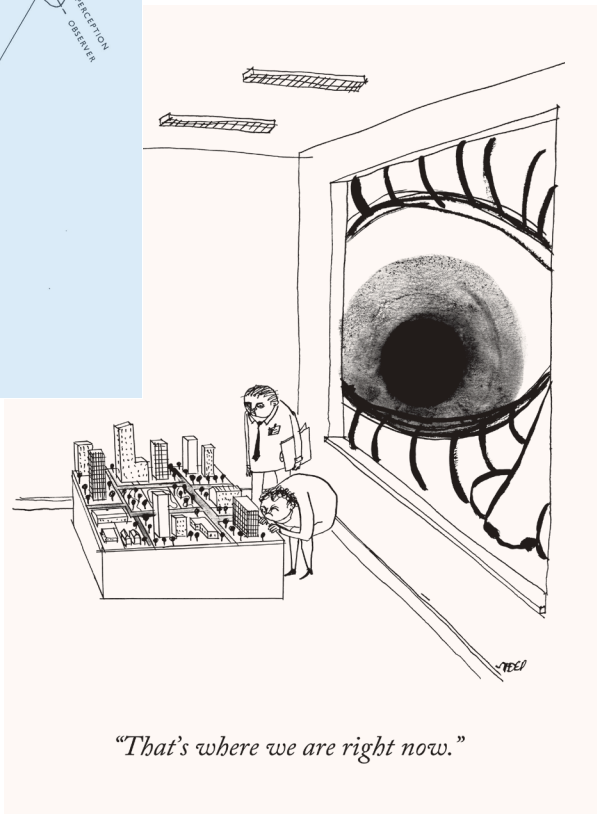
Thesis: *Representation shapes Reality*
Aneesh Nandi, April 2021





"That's where we are right now."

Architectural History thesis
AR2A011, 2020/21 Q3
Guide: Catja Edens

Colophon

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Contents

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To Czaee Malpani, thank you for instilling and encouraging my fascination for viewing the architectural drawing through a theoretical lens.

Abstract

Representation shapes Reality

The paper reflects on the relationship between drawing and architecture in six parts. It first gives an overview of the history of drawing – which is seen to be closely linked to the history of the architecture profession as we know it today. The overview establishes a historical trajectory and identifies patterns in the use of certain *types* and *modes* of drawing. These *types* and *modes* are then analysed in further detail. This part is bookended by an overview of the way architectural historians and theorists have examined the role of the drawing. With this background information at hand, the paper studies the work of contemporary architects to examine the hypothesis that the way the architect *draws* influences the built outcome significantly. In conclusion, the paper argues that the use of a certain *mode* of drawing or the *layers* of information depicted in them drastically affects the object being designed, as opposed to the conventional understanding of its role as a passive, transparent medium.

Keywords: Architecture, Design process, Drawing, Representation

Part one: Introduction

i. Research theme

> *"I was soon struck by (what seemed at the time) the peculiar disadvantage under which architects labour: never working directly with the object of their thought, always working at it through some intervening medium, almost always the drawing; while painters and sculptors, who might spend some time on preliminary sketches and maquettes, all ended up working on the thing itself which, naturally, absorbed most of their attention and effort..." (Evans, 1997)*

The quote outlines how drawings serve as an *intervening medium* in the production of architecture, and the 'peculiar disadvantage' architects have in the production of architecture: having to always rely on representations of the 'object of thought'. In the conventional, essentialist notion (Gomez, 2005) of architectural production; this 'object of thought' is an entity that exists purely in the architect's imagination, independent of the mode of creating the work: the drawings/ representations are *neutral, objective* tools that create 'transparent descriptions of buildings' (Bafna, 2008).

The paper aims to counters this notion: the title R*epresentation shapes Reality* is indicative of the hypothesis that the way the architect *draws* influences the built outcome significantly. Rephrased, the paper argues that the use of a certain *mode* of drawing or the *layers* of information depicted in them drastically affects the object being designed, as opposed to the conventional understanding of its role as a passive, transparent medium. The paper intends to make this explicit by showing how the choice of drawing might sway the design process in one way or another in the case studies.

It is important to note that the drawing is only one of the ways an architect produces architecture, and that the process encompasses many other methods of study and analysis: for instance, model-making. While they all operate in parallel/ simultaneously and exert influence on each other, the paper makes a conscious decision to focus only on drawings as the primary means of design investigation.

The paper thus digs deeper into the relationship between drawing and architecture in six parts. It first gives an overview of the history of drawing – which is seen to be closely linked to the history of the architecture profession as we know it today. The overview establishes a historical trajectory and identifies patterns in the use of certain *types* and *modes* of drawing. These *types* and *modes* are then analysed in further detail. This part is bookended by an overview of the way architectural historians and theorists have examined the role of the drawing, culminating in a *theoretical framework* for this paper. With this background information at hand, the paper studies the work of contemporary architects to examine the hypothesis, leading to the findings and conclusion.

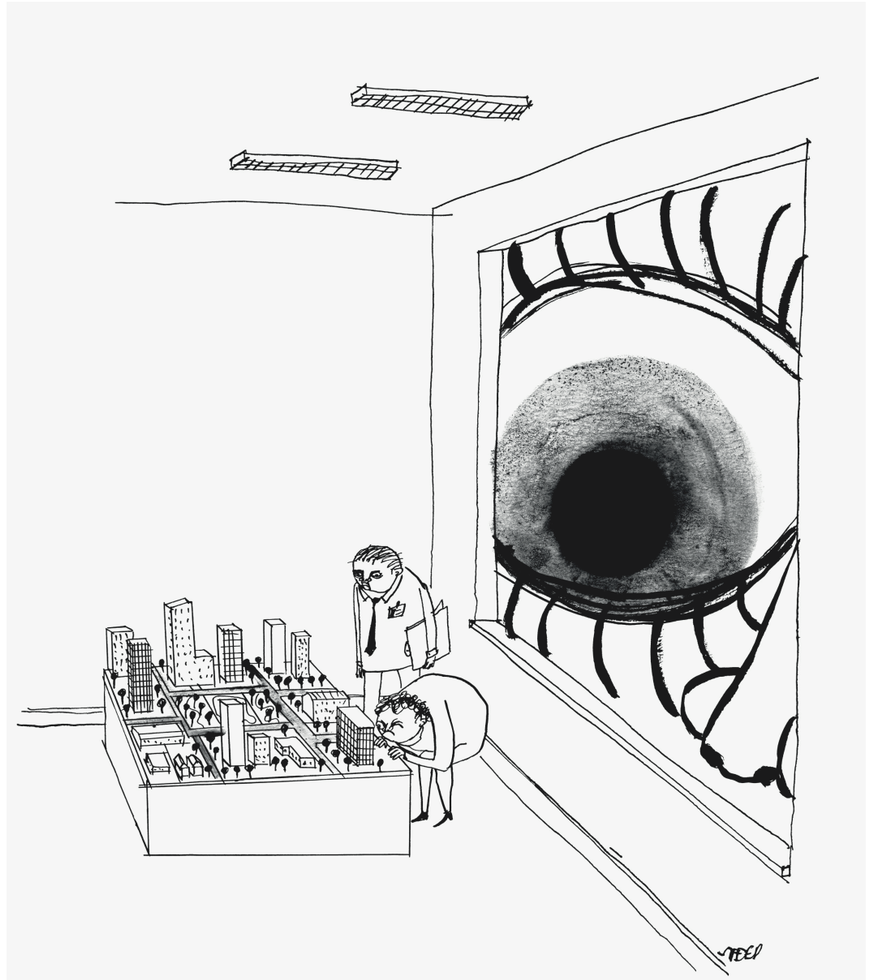


Figure 1.001 – Cartoon, Edward Steed (2014) • Source: The New Yorker

ii. Definitions

> *"The vocabulary with which architecture is discussed is notoriously protean. Words change their meaning between, and sometimes within, contexts, and arguments can seem to gyrate around semantic inconsistencies." (Unwin, 2007)*

To address the issue highlighted in the quote, this sub-part deals with defining some terms and explaining how they will be used in the paper.

Architecture is a term which encompasses the act of designing as well as the eventual built object. This paper will highlight the distinction between these stages by using temporal qualifiers: such as architectural design *process* for the former definition, or *eventual* architecture, buildings, built object etc. for the latter.

Representation, similarly, has multiple meanings: within the architectural design process, it is a working medium for the author – the architect (Bafna, 2008) as well as a means of communication with others (Unwin, 2007). This can be drawings, models, texts, images etc. Here, these representations point to an object that does not yet 'exist' in reality. At the conclusion of the design, representation would refer to entities that depict the built work – like photographs, as-built drawings etc.

As a subset of representation, *drawings* are two-dimensional abstractions of the object being designed, and as such can be seen as a noun (drawing an artefact in itself) or a verb (the drawing as an arena of the architect's engagement). The latter, and its place within the architectural design process, is the focus of the paper – more than the independent analysis of the former. However, the use of this term would necessarily encompass both definitions, as the case studies are analysed through the drawings already produced; and the 'performative interchange' (Unwin, 2007) at play during the design process would largely be extrapolated from this base and supported by the architects' writing.

Simulation as opposed to *representation* is also an important distinction made by David Scheer when talking about BIM models. (Scheer, 2014) A simulation is semantically implied to be as 'real' as the building it simulates, thus fundamentally changing the way the designer interacts with the object being designed.

Types of drawing vs. *Modes* of drawing. In the paper, *types* of drawing refer to a grouping based on shared characteristics. *Modes* on the other hand will refer to the way in which the drawing is prepared – the geometrical convention employed: orthographic, perspectival, axonometric.

Layers of information refers to the elements depicted in the drawings – and a distinction is made between the *standard* architectural layers (walls, columns, openings etc.) of each mode and their modified versions; which may show more or lesser information depending on the authors' intent. A layer may be seen as a grouping of similar elements depicting a certain phenomenon or condition.

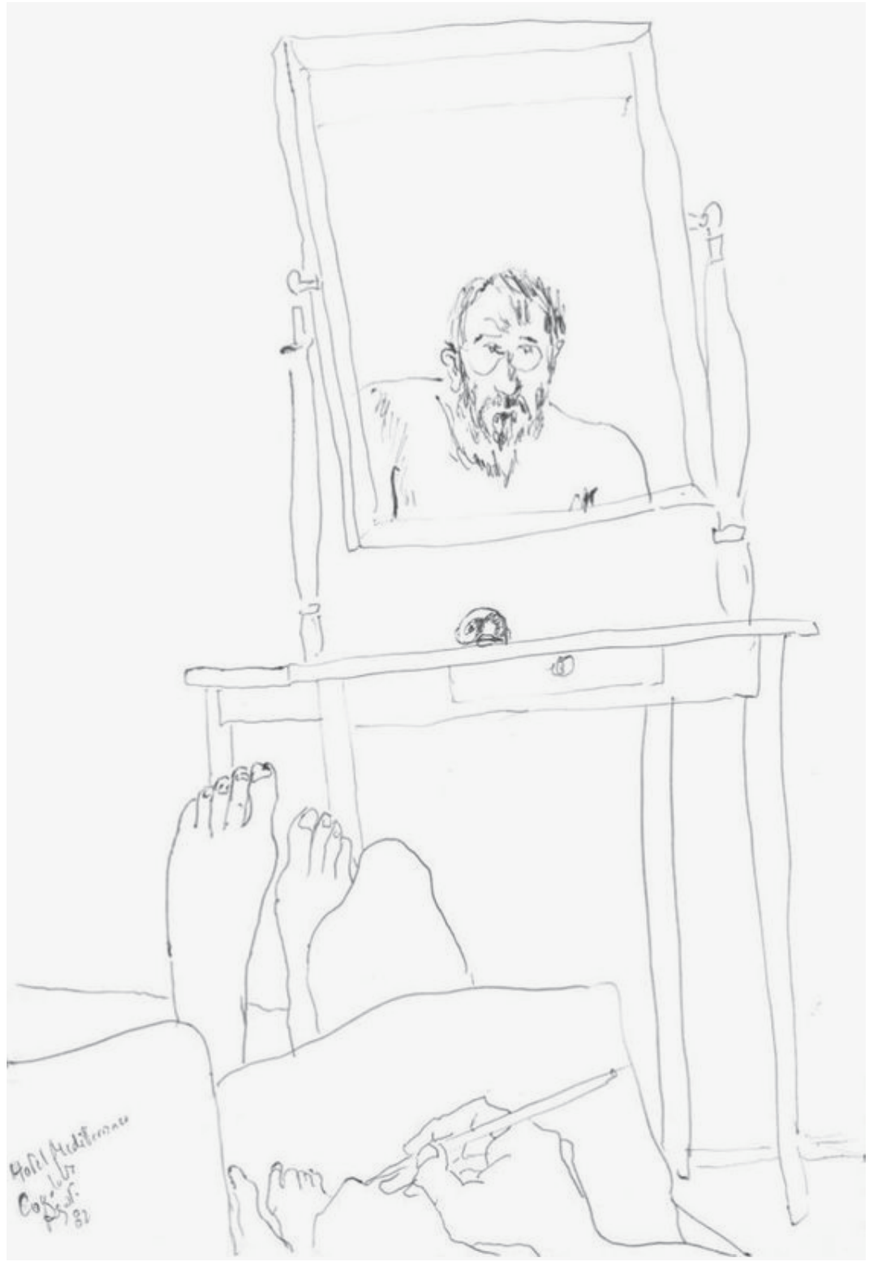


Figure 1.002 – Self portrait (1982) • Source: Alvaro Siza

Part two: Brief history of drawing

"... rather than a universal and transhistorical attribute of architectural practice, the use of drawing in architecture ... is relatively recent and historically situated. ... [The role of drawing in contemporary architecture] is not a function of some inevitable process of architectural thought or action [but rather] the result of choices architects made at a particular time in their history". (Robbins, 1997)

The use of architectural drawings can be summarised in five broad historical periods. In this part, we will briefly cover each, bringing up a few examples that show the manner in which they were employed. This quick overview establishes a historical trajectory and identifies patterns in the use of certain *types* and *modes* of architectural drawing.

i. Pre-historic period; upto 1st century AD
Drawings as construction aid

In the first broad swath of history, the architect acts as the master-builder on the construction site, supervising the creation of buildings themselves. Preparation of drawings in this time was surely present, but they were merely perfunctory, secondary to verbal and physical forms of instruction. This period lasts from the earliest civilizations to the 'ancient' civilizations of Greece and Rome. (Robbins, 1997)

The earliest evidence of the use of drawing for construction is from the Epipaleolitic era at Eynan (12-10,000BC in present-day Israel). The presence of strong geometrical organisation in the structures' regularly-spaced radial plans (fig. 2.001, 2.002) suggests the use of techniques such as a compass arm; used to draw a *plan* directly on the ground. (Haklay & Gopher, 2015)

The oldest known map (fig. 2.003, 2.004) was found at Çatalhüyük (6,000BC, present-day Turkey) and is assumed to represent the settlement against a backdrop of its hilly terrain. The purpose and very nature of this drawing is contested. (Edney, 2017) If it indeed is a *plan* of the settlement, it could conjecturally indicate the use of drawing as reference for construction activity. The archaeologist presents a documentation drawing of the town to highlight the similarity. (fig. 2.005) (Mellaart, 1967)

Another example is the Greek Didyma temple (3rd century BC, present-day Turkey) which has drawings inscribed at the very site, on the various walls of the complex. (fig. 2.006) This shows the use of the drawings as a means of testing out forms and proportions for the overall *plan* as well as the temple's columns *elevation* and *details*. (Haselberger, 1985) It also highlights the presence of the supervising architect/ designer on site.

ii. Ancient period; 1st to the 12th century
Developing parallel uses of drawing

In the second period the drawing, while still primarily being a construction aid and tying the designer/ architect to the site, develops other dimensions that allow it to transcend its role. This period stretches from the Roman civilization to the Middle ages. (Gomez, 2005)

To illustrate its primary role, Edward Robbins (1997), referencing Lon Shelby (1977) describes how drawings were used by the medieval master masons for construction – but

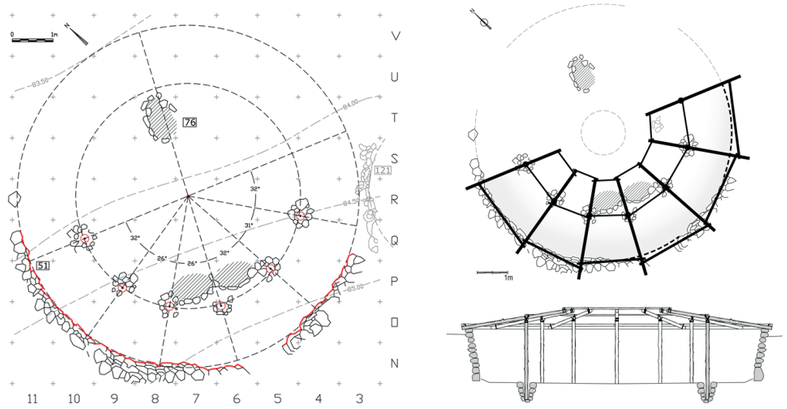
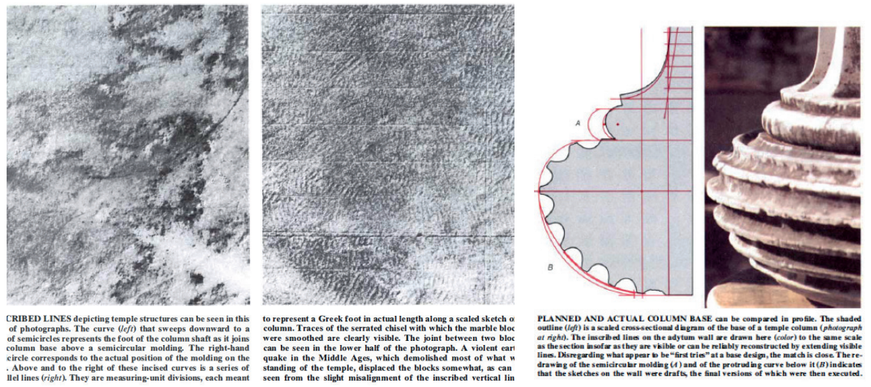


Figure 2.001, 2.002 – Geometric analysis of archaeological remains (left) and an impression of structures (right) at Eynan • Source: Haklay & Gopher, 2015

Figure 2.003, 2.004, 2.005 – Çatalhüyük drawing fragment (left) and its impression (top right) compared to settlement plan (bottom right) • Source: Edney, 2017



CRIBED LINES depicting temple structures can be seen in this of photographs. The curve (*left*) that sweeps downward to a of semicircles represents the foot of the column shaft as it joins column base above a semicircular molding. The right-hand circle corresponds to the actual position of the molding on the . Above and to the right of these incised curves is a series of llel lines (*right*). They are measuring-unit divisions, each meant

to represent a Greek foot in actual length along a scaled sketch o column. Traces of the serrated chisel with which the marble bloc were smoothed are clearly visible. The joint between two bloc can be seen in the lower half of the photograph. A violent ear quake in the Middle Ages, which demolished most of what w standing of the temple, displaced the blocks somewhat, as can seen from the slight misalignment of the inscribed vertical lin

PLANNED AND ACTUAL COLUMN BASE can be compared in profile. The shaded outline (*left*) is a scaled cross-sectional diagram of the base of a temple column (*photograph at right*). The inscribed lines on the adytum wall are drawn here (*color*) to the same scale as the section insofar as they are visible or can be reliably reconstructed by extending visible lines. Disregarding what appear to be "first tries" at a base design, the match is close. The re-drawing of the semicircular molding (*A*) and of the protruding curve below it (*B*) indicates that the sketches on the wall were drafts, the final versions of which were then executed.

Figure 2.006 – Photographs, drawings, and text explaining the presence of in-situ drawings at the Didyma temple • Source: Haselberger, 1985

Figure 2.007, 2.008 – A piece of the stone carving (left) and an impression of the original Forma Urbis Romae drawing (right) • Source: Aureli, 2017

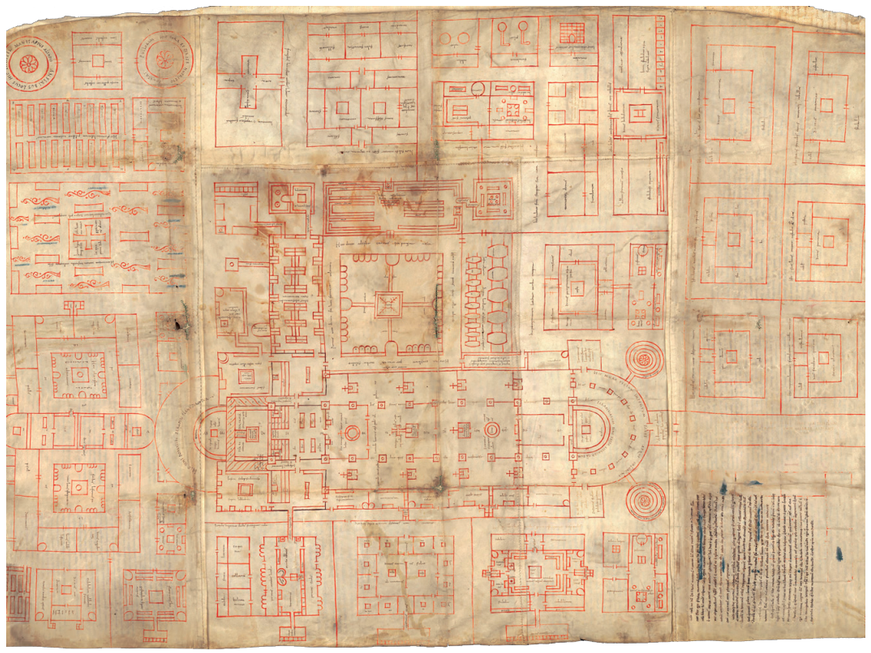


Figure 2.009 – Plan drawing of St. Gall monastery, annotated with explanatory notes and diagrams • Source: Aureli, 2017

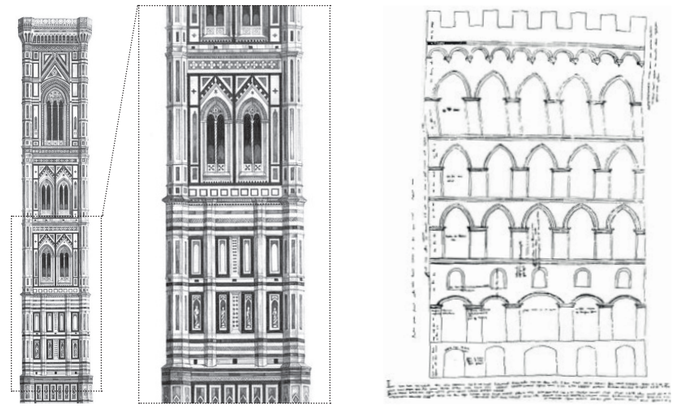


Figure 2.010, 2.011 – 14th Century: Campanile elevation (left) • Source: Evans, 1997 and Sansedoni elevation (right) • Source: Robbins, 1997

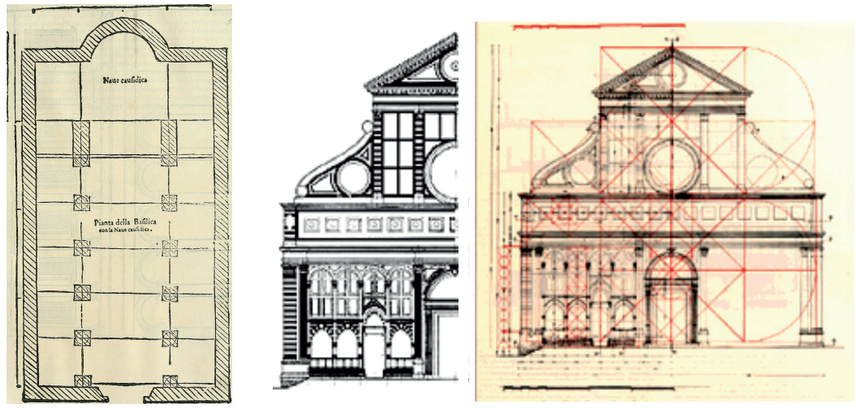


Figure 2.012, 2.013 – 15th Century: Basilica plan (left) • Source: Alberti, 1485 S. Maria Novella elevation and geometric study (right) • Source: Borsi, 1989

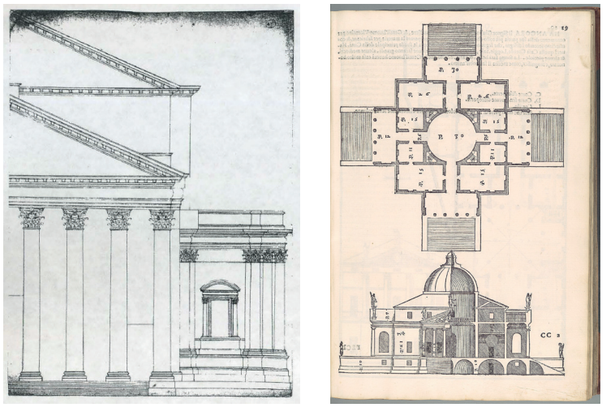


Figure 2.014, 2.015 – 16th Century: Villa Bologna elevation (left) • Source: Evans, 1997 and Villa Rotunda plan and section (right) • Source: Palladio, 1570

they could not rely on them alone as an adequate form of instruction, necessitating their presence on-site.

The development of new dimensions and roles for the drawing are visible in two examples, one from ancient Rome and the other from Switzerland. In the former, the 3rd century AD Forma Urbis Romae (fig. 2.007, 2.008) maps the urban *plan* of Rome for the city's public registry, performing the role of a cadastral survey – gaining power to both depict and control architecture by demarcating public and private spaces. (Aureli, 2017).

The second example is the Monastery of St. Gall, (fig. 2.009) which apart from depicting the built form's *plan* is also used to organise the functional aspects of the monks' daily lives. While the reason for its preparation is a matter of debate among historians (whether it was an actual project or a hypothetical exercise), it is remarkably detailed: extensive written descriptions include proposed circulation paths and building uses (Aureli, 2017).

iii. Pre-modern period; 12th to the 18th century
Drawing as means of instruction, discourse, dissemination

The third period starts from the late 13-14th century renaissance to the Industrial age of the 19th century. This period sees the development of drawing as a tool not just for construction and instruction, but for discourse and dissemination – with an obvious link to the development of the printing press. (Robbins, 1997) The architects' desire to portray designing and drawing as an intellectual equal to the noble arts of painting, writing, and mathematics (Carpo, 2013) led to the distancing of the architect from the site via the use of drawings. Being able to distance themselves allowed the architects to take on multiple projects at a time and explore design ideas without necessarily testing them on site first. (Robbins, 1997). This also created a social hierarchy – with the architect as the sole author of the building, disregarding the effort engaged in the actual construction activity. Mario Carpo uses Leon Battista Alberti as a key protagonist of this shift:

> *"In Alberti's theory of design, the architect's drawing is the original act of creation; the physical building that may follow is only a copy, devoid of any intellectual added value." (Carpo, 2013)*

Consequently, drawings underwent a significant development during this period: *parallel* and *perspective projection* (Filippo Brunelleschi et al.) first appeared in paintings and were then slowly co-opted for architecture. Analytical *sections, elevations* were all renaissance inventions which enabled the accurate representation of objects in two dimensions. These were used to not only build architecture, but to also document existing historical buildings. (Carpo, 2013) Examples of the use of drawing in this period, in chronological order, are the 14th century Campanile *perspectival elevation* (fig. 2.010) and the *Sansedoni elevation* (fig. 2.011); 15th century *plan* of a basilica from Leon Battista Alberti's treatise 'De re aedificatoria' (fig. 2.012) and his S. Maria Novella *elevation* (fig. 2.013); and 16th century Bologna façade *elevation* (fig. 2.014) and villa *plan* and *elevational-section* (fig. 2.015) by Andrea Palladio.

In these representative set of drawings, one sees how the development of geometric techniques (Guarino Guarini et al.) from the 14th century resulted in dynamic use of different *modes* of drawing, from the basic *plan* to the sketch *elevation*, the detailed *façade study* to the *elevational-section*. Geometry was used as a guiding principle shaping the

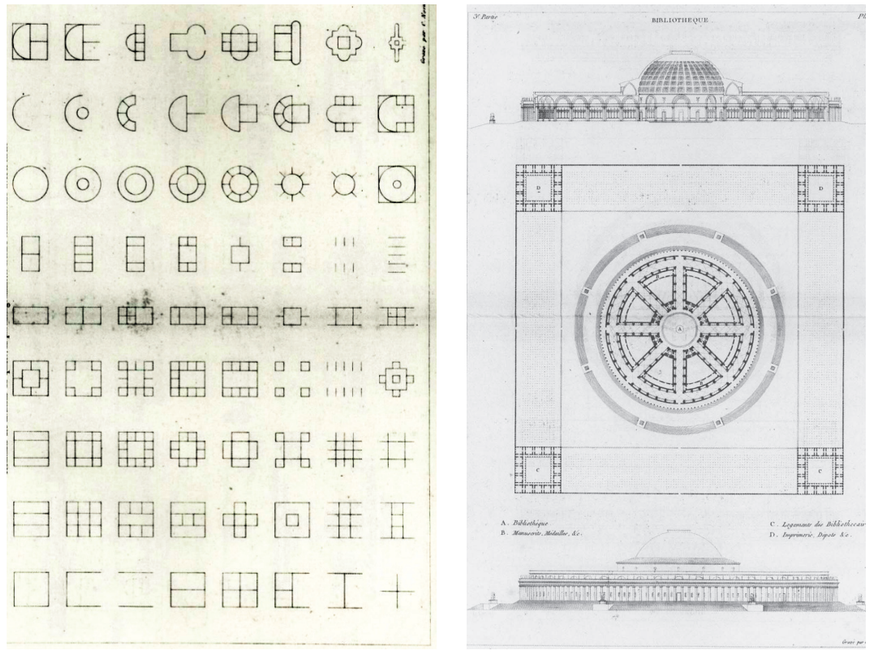


Figure 2.016, 2.017 – 18th Century: Precis des lecons by J. Durand (1799-1813) showing typical plans (left) and example of a typology in use (right) • Source: Brawne, 2003

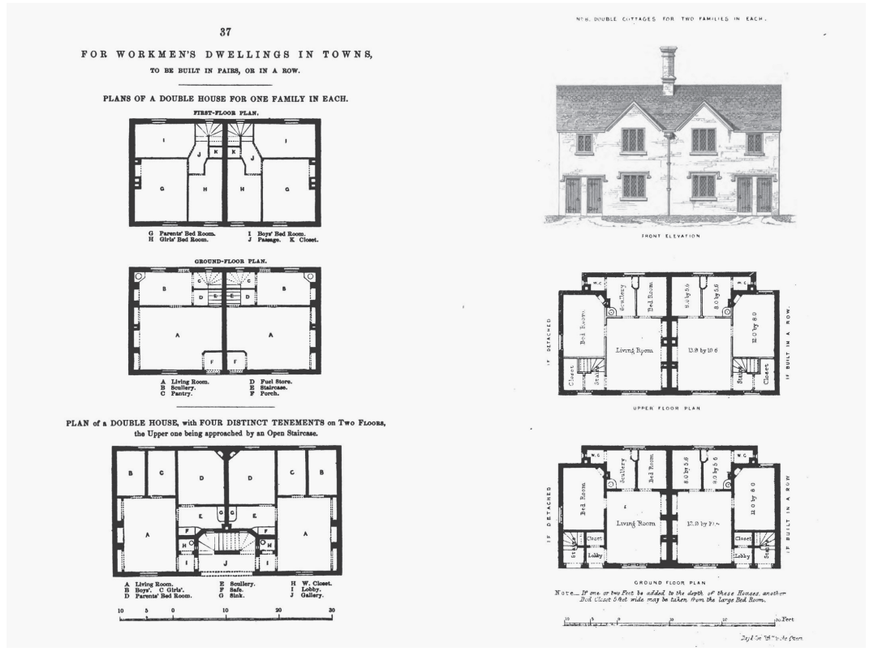


Figure 2.018 – 19th Century: plans and elevations for proposed workers' housing, Henry Roberts (1850) • Source: Aureli, 2017

design, with the use of ideal forms/ shapes, operations like *symmetry* and *mirroring*, and consistent *proportions*. (Evans, 1995) This is clearly visible in Andrea Palladio's plans (fig. 2.015) and how Leon Battista Alberti uses harmonic proportions for his elevations. (fig. 2.013) (Borsi, 1989)

These four canonical *modes*: *plans, sections, elevations, perspectives* – have remained largely unchanged since then. Thus, in this period the profession of architecture established itself as an entity distinct from the construction activity and simultaneously 'above' it. It developed and expanded drawing techniques to stratify this shift. By the 16th century, the profession of architecture begins to resemble its contemporary counterpart. In the 17, 18, and 19th century, we see the development also of parallel uses for drawings, such as for teaching architecture, like Precis des lecons by Jean-Nicolas Louis Durand, fig. 2.016, 2.017 (Gomez, 1982); as well as to encourage political and social discourse, like Henry Roberts' pamphlet titled On the Dwelling of the Labouring Classes. fig. 2.018. (Aureli, 2017)

iv. Modern period; 19th to late 20th century (1970s)
Drawing as status-quo

The fourth period is the 20th century till the digital age (1980s), which sees the use of drawings grow and become the driving force behind architectural production, as well as its educational or cultural dissemination. This is linked to the development of instruments and related conventions (like the practice of hand drafting), which refined the canonical *modes* we have already discussed (*plan, section, elevation, perspective*). In addition, *axonometric* drawings, which were developed in the industrial age to accurately depict technical objects in the early 19th century, was added to the architect's toolkit in this period – via the Bauhaus and by its earliest proponents, Theo van Doesburg. (Krikke, 2000)

Unlike the previous periods of history, there is an overwhelming range of architects, styles, movements, and drawings to choose from. Very broadly, this period covers the rise of modernism, and its dissolution into the post-modernism and other varied movements in the latter half of the century (Jencks, 1977). While the underlying theories and concepts varied, the way the architectural work was represented remained consistent – the same four *modes* of drawings are used, albeit in different compositions. The assessment of the drawing as a driving force of design (which is the focus of this paper) comes at play at this stage, with enough historical evidence to base claims on.

Two examples highlight this – both are historically key figures, chosen for their immediate recognizability and association with their particular movements. First is Le Corbusier, who famously proclaimed that the plan is the generator of design in his book 'Vers une architecture' (Corbusier, 1931) and Aldo Rossi, whose drawings were identified by Charles Jencks as being a part of the postmodern movement. (Jencks, 1977)

The former uses *plans* (fig.2.019)*, sections* and *elevations* (fig.2.020) to convey the scheme, in a format that is all but ubiquitous today. In the architect's writings, one observes that the *plan* takes the centre stage, being the 'primary' drawing which shapes the design – the placing of masses and elements like columns, ramps, staircases etc. The *elevation* and *section* are used to fine-tune the effect of the plan and are thus essentially secondary. In contrast, Aldo Rossi uses a combination of an *elevation* and *plan* almost parallelly, as seen in the *siteplan* composition (fig. 2.021) where the two *modes* blend into one. In the place of the precise modernist *siteplan*, the *perspective* is used to give an overview of the project. (fig. 2.022)

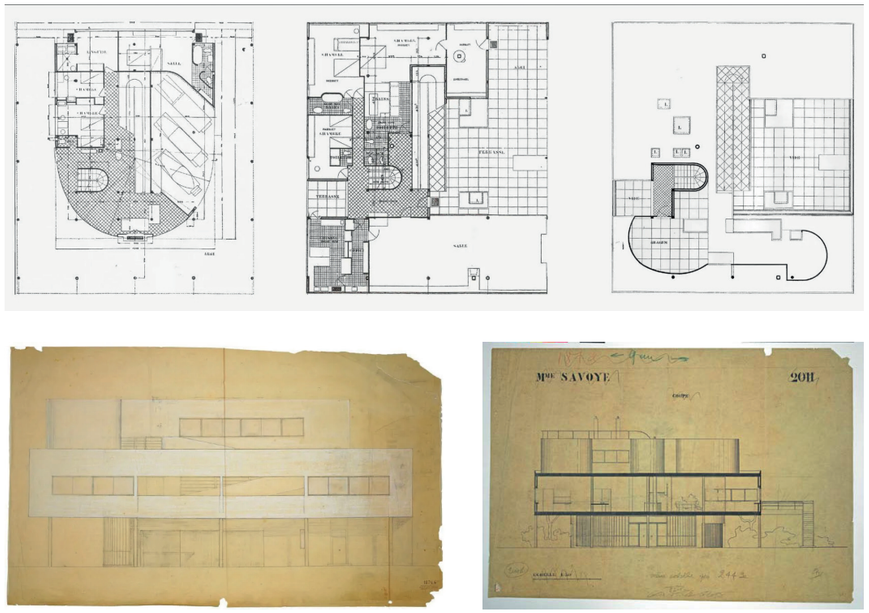


Figure 2.019, 2.020 – Plans, (top) sections and elevations (bottom) of Villa Savoye, Le Corbusier (1928) • Source: Fondation Le Corbusier, Paris

Figure 2.021, 2.022 – Site plan and elevation (top) and perspective view (bottom) of Modena cemetery, Aldo Rossi (1979) • Source: Fondazione Aldo Rossi

v. Contemporary period; late 20th century onwards (1970-2020s)
Emergent possibilities for drawing

The modern era sees the architect as a professional (and architecture as profession) reach their contemporary status. The drawing is at the centre as the means of communication and instruction, and work as a *"universal currency of architectural discourse and social exchange"* (Robbins, 1997). Looking back, the evolving role of the drawing is seen as symbiotically linked to this growth; marking the conclusion of the trajectory set forth by the Renaissance architects.

The contemporary period beings with the advent of digitalization. While architects were slow on the uptake, the use of software to draw became common in the 1990s in North America and Europe. The presence of CAD (computer aided drafting) allowed the profession to produce more work in less time, increasing the efficiency of a practice that had essentially remained the same for a few centuries. However, while replacing hand-drafting, CAD did not actually change the relationship of the drawing to the architecture, it used the *"same representational conventions as its forbears"*. (Scheer, 2014)

Thus we see the act of drawing remain the same, up until the development of BIM (Building information modelling) in the 21st century. This enabled the architect to directly manipulate the architectural object as a detailed three-dimensional *simulation*, foregoing the need to depend on two-dimensional drawings to represent them. This, to an extent, was also possible before with the use of models – digital or physical. However, the distinction here is that these models are prepared in parallel to conventionally drafted drawings, and could not function independently unlike BIM.

This shift from 'representation' to 'simulation' is significant, as it changes the essence of the drawing. David Scheer argues that this tool is more than being just 'another pencil': but rather is fundamentally different. (Scheer, 2014) As defined in part one, a *simulation* is assumed to be closer to the object of analysis than a representation: almost a proxy of the object. This enables the architect to no longer deal with an abstracted reality but with simulated reality: to test the designed object's behaviour in almost as if it were real-time (eg. testing structural limits of a building in an earthquake zone or looking at its climatic impact). The development of BIM is closely linked to advancement in technology.

Drawings from this period will be analysed in later parts of the paper. The contemporary architects analysed as case studies (part five) are chosen specifically to highlight the massive shifts in technology mentioned here.

Figure 2.023 – Pre digital revolution: Louis Kahn in his studio circa 1961 • Source: Louis I. Kahn Collection/ University of Pennsylvania

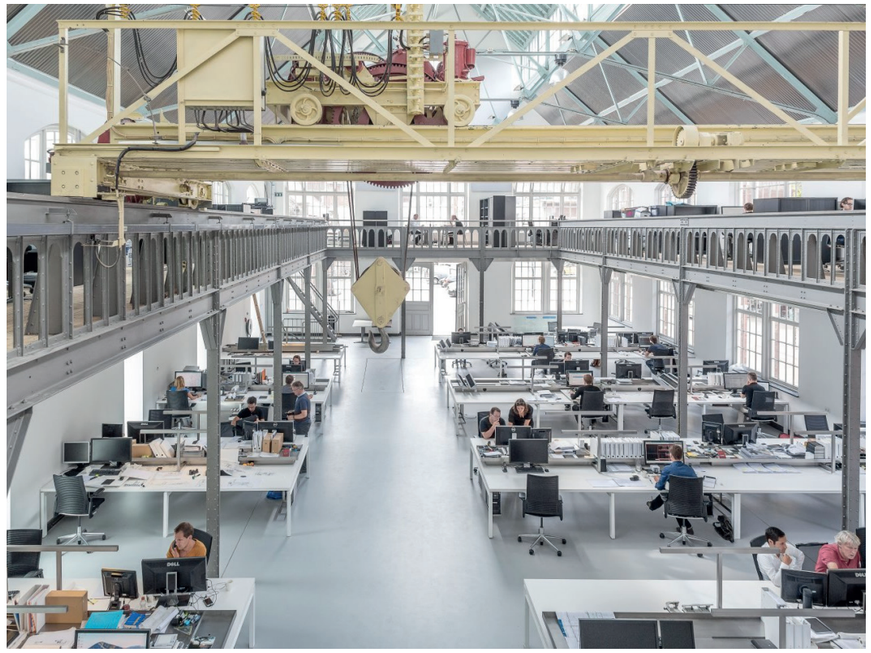


Figure 2.024 – Post digital revolution: Cepezed office, Delft circa 2015 • Source: Cepezed

Part three: Understanding drawings

As seen in the last part, certain canonical *modes* of drawing recur in history, which forms the basis of this paper's investigation. However, before delving into the *modes*, the first sub-part will describe a broader categorization that has been around since the Renaissance: that of the *type* of drawing (Carpo, 2013). Here, *type* refers to the function of the drawing; either being 'notational' or 'depictive'. Mario Carpo, an eminent architectural historian and critic, describes the former as *"technical instructions that are sent to the builders and which must convey the author's idea of the building without any gap, uncertainty or ambiguity"* and the latter as *"... drawings which distort angles and measurements, cheat the eye, and where anything goes so long as the drawing may please its viewers"*. This distinction persists to this date, with tender/ construction documents on one side for the construction team (fig. 3.001) and renderings/ views on the other for clients and laypersons. (fig. 3.002) (Carpo, 2013) As a starting point, this distinction is useful for this paper – it sets out the two key historic roles of the drawing; that of being a set of instructions vs. a representation of reality.

i. Types of drawings

Notational drawings: Standard representation of architectonic elements are termed as 'notational' representation by Sonit Bafna (2008) The history of the drawing as a tool of communication and instruction for construction activity necessitated the use of geometrical abstraction such as *orthographic* projections, to create measurable and quantifiable representations. These drawings are meant to be interpreted 'without ambiguity' (fig. 3.001) – and is gauged by its legibility and understandability, as well as its efficiency in 'translating' the design to the construction site. (Robbins, 1997) This developed its own set of standards and conventions over time, as the historical overview shows.

Depictive drawing: In contrast, these drawings forgo abstraction as much as possible in their mission to depict architectural objects as the eye may perceive them in reality. Thus, *perspectives* (fig. 3.002) and other means of depicting three dimensional objects two dimensionally are used for this purpose – culminating in 'photorealistic' views generated by software in the digital era. (fig. 3.003) These views, true to their name, are often *"... virtually indistinguishable from photographs"* (Carpo, 2013) and create very specific images to convey the architectural quality of the space. There is also a parallel movement championing less exact imagery: the 'post-digital drawing' which covers a wide ambit of styles ranging from illustration to collages (Ghosh, 2018). This is seen in the work of Fala Atelier and Tatiana Bilbao Estudio, who use illustrations and collages exclusively to portray their architectural proposals. (fig. 3.004, 3.005) In contrast to the 'photorealistic' views, the post-digital drawing attempts to reduce or control the amount of information contained in the drawings to increase its communicative power. While this seems counter-intuitive, Sonit Bafna writes about how drawings that contain less information can be more effective or influential than drawings that do – bringing up the example of Mies van der Rohe's brick country house, which is a key moment in modernist history. (Bafna, 2008) This introduces the idea that the *layers* of information contained within the drawing influences the way it is read and acted upon; and is closely linked with the drawing's very nature.

Beyond the duality of notational and depictive: While discussing the notational and depictive drawings independently is important; it, in a way, looks at architectural drawings as an outsider, focussing only on the kinds of 'deliverables' the architect produces. In contrast, looking at drawings that are produced not for construction or for depiction, but for the steps leading up to it – for designing, or for communicating with other architects –

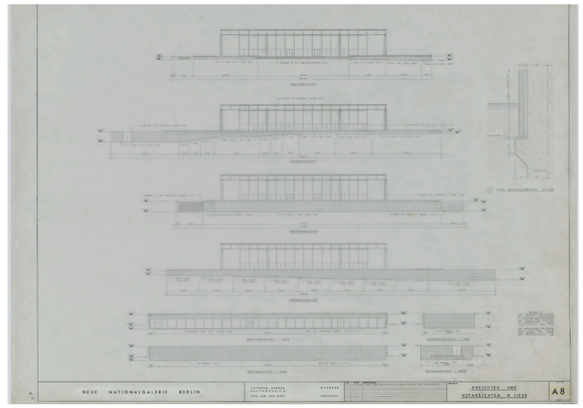


Figure 3.001 – Berlin New National Gallery Elevations, Ludwig Mies van der Rohe (1965) • Source: MoMA, New York

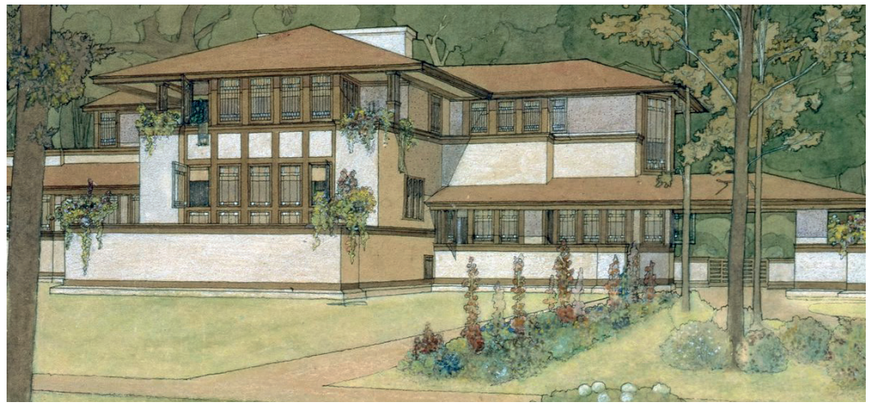


Figure 3.002 – Ward W. Willits house watercolour rendering, Marion Mahony Griffin (1902) • Source: Frank Lloyd Wright Foundation/Frank Lloyd Wright Trust

Figure 3.003 – Gapahook house computer rendering, Mir. (2007) • Source: Snøhetta , Norway

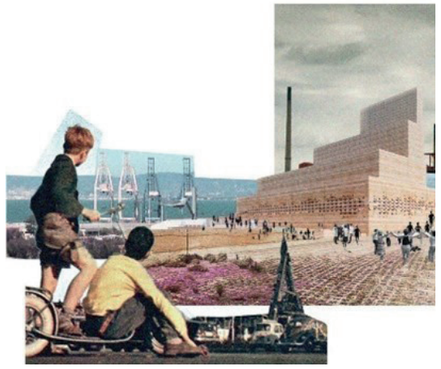



Figure 3.004, 3.005 – (left) Apartment on Rua do Paraiso, Fala Atelier (2017) • Source: Fala Atelier
(right) Hunters Point Master Plan, Tatiana Bilbao (2016) • Source: Tatiana Bilbao Estudio

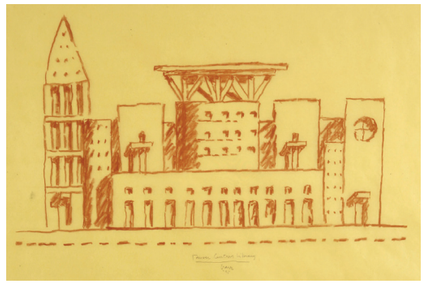
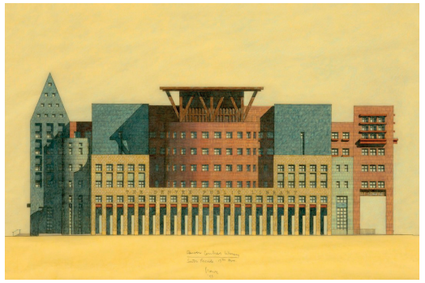



Figure 3.006 – Comparison between process and final presentation drawings:
Denver Library, Michael Graves (1995) • Source: Michael Graves Studio

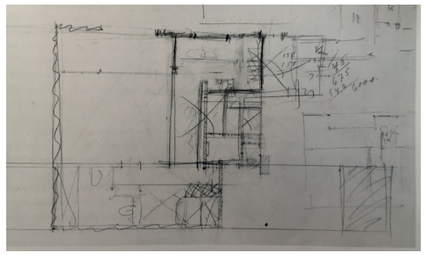
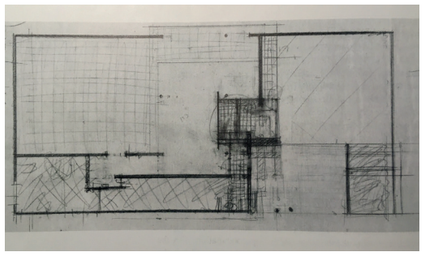
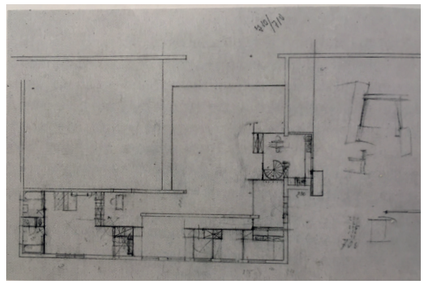
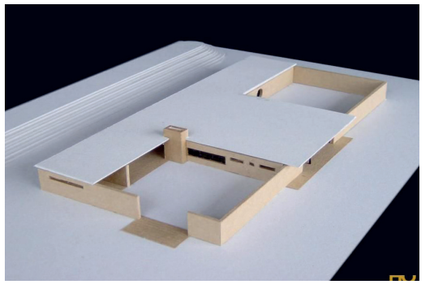





Figure 3.007, 3.008 – Plan studies Lange house, Mies van der Rohe (1935) • Source: MoMA, New York
(bottom right) Model • Source: Història en Obres, Barcelona

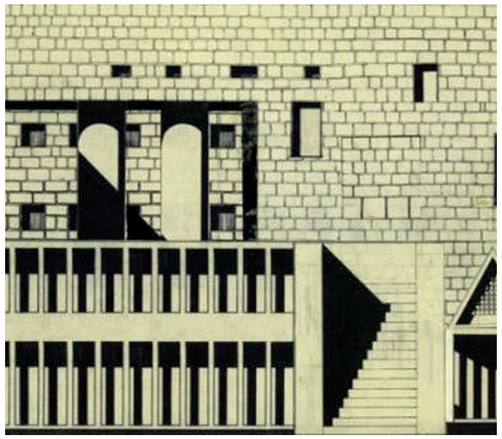
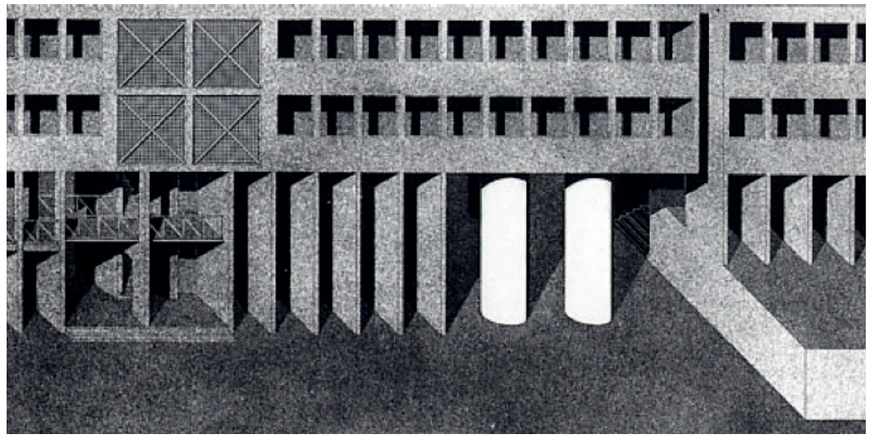




Figure 3.009, 3.010, 3.011 – (left, right, bottom) Elevation studies Gallatrasse
quarter, Aldo Rossi (1972) • Source: Fondazione Aldo Rossi

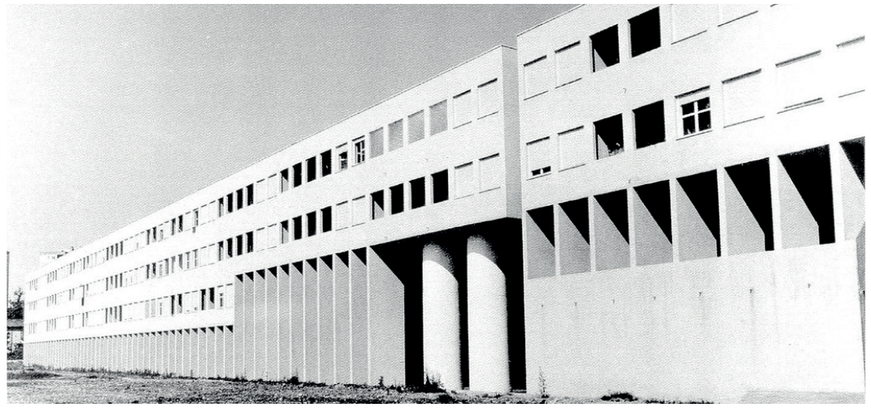


Figure 3.012 – Gallatrasse quarter, Aldo Rossi (1972) • Source: Carlo Aymonino

subverts this duality and treats it more as a spectrum of possibilities.

In (fig. 3.006), Michael Graves uses a juxtaposed 'process' and 'final' *elevation* drawing to simultaneously highlight the contrast and similarity between the two. Here, the drawings are both notational and depictive to varying degrees; with the use of material and light/shadow rendering overlaid on an *orthographic mode*.

In these paragraphs, we see a loose co-relation between *types* and *modes*: while the two-dimensional *orthographic* drawings (*plan, section, elevation*) lend themselves to notational purposes, the three-dimensional *perspective* and *axonometric* are better suited for depiction. However, there are many examples of notational *perspectives* and depictive *elevations*. Thus, the notational or depictive capacity of the architectural drawing ought to be seen as a trait distinct from the *mode* it operates through, and pertains more to the *layers* of information it contains. This is further expanded in sub-part three, after going over the *modes* of drawing.

ii. Modes of drawing

This sub-part gives a brief overview of the canonical *modes* of drawings: *plan, section, elevation*, *axonometric* and *perspective* via showing an example of its use by prominent architects of the modern and contemporary period.

Plan is a horizontal cut through a building, showing its internal arrangement. In (fig. 3.007) Mies van der Rohe uses the *plans* to resolve the location of the programmatic components of the house, drawing in more detail at every step. The eventual building (fig. 3.008) is a direct extrusion of the *plan*; its rectilinear masses and walls all rising to the same height. *Sections* and *elevations* of this project would not be able to do justice/ convey the same amount of information as the *plan*. (Fraser & Henmi, 1994) Similar to the example of Le Corbusier's work shown earlier, the *plan* is the primary drawing that dictates the terms for the other modes. (fig. 2.019, 2.020)

Elevation is a projection of the building's surfaces, typically exterior but could also refer to the interior. In (fig. 3.009, 3.010, 3.011) Rossi explores the formal characteristics of this housing block in a series of abstract *elevations* which assess the porosity and height of the volume, as well as the alignment of the column and window grids. (fig. 3.012) (Rossi, 1976) In this project, the *elevation* may be considered atleast as important as the *plan;* allowed some degree of flexibility for the façade to be designed independently. For many post-modernist architects, the *elevation* and the references it made to either the context or other signifiers was a critical component of the work. Rossi for instance uses forms from the city in his projects, to create a coherent sense of identity for the scheme.

Section is a vertical cut through the building, revealing the conditions of the enclosure. In (fig. 3.013) Louis Kahn uses this *mode* to investigate various strategies for daylighting and structure for an art museum, going through multiple sketch iterations before settling on a vaulted section. (fig. 3.014, 3.015) (Iype, 2020) The eventual building is essentially a repeated array of this design solution. (fig. 3.016, 3.017)

Perspective developed as a means of representing reality in painting and is thus the most 'life-like' of the *modes* discussed here. It is a geometric projection of three dimensional space, and is thus dependant on the position of the viewer respective to the object. In (fig. 3.018, 3.019) Eric Mendelsohn uses perspective to study the building's impact on the street, drawing it almost from a human eye-level view. (Fraser & Henmi, 1994) The faithful transformation from sketch to building (fig. 3.020) underlines its most compelling strength: to be able to approximate visual perception.

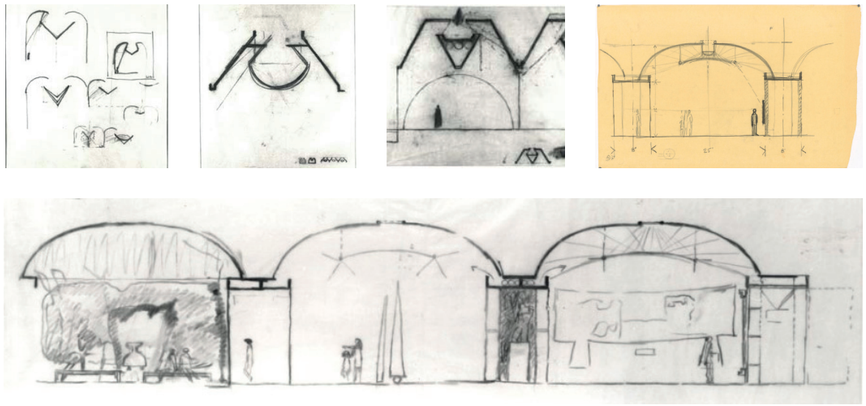


Figure 3.013, 3.014 – (top, bottom) Roof section studies, Kimbell Art museum, Louis Kahn (1972) • Source: Louis I. Kahn Collection/ University of Pennsylvania

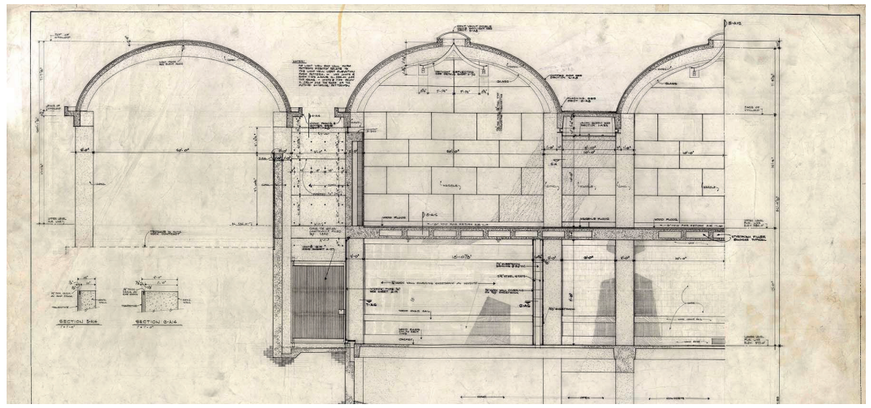


Figure 3.015 – Building section, Kimbell Art museum, Louis Kahn (1972) • Source: Louis I. Kahn Collection/ University of Pennsylvania

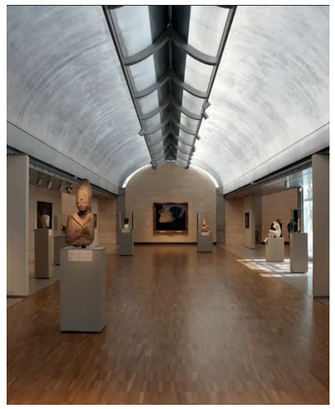


Figure 3.016, 3.017 – (left, right) Interior and exterior, Kimbell Art museum, Louis Kahn (1972) • Source: Kimbell museum

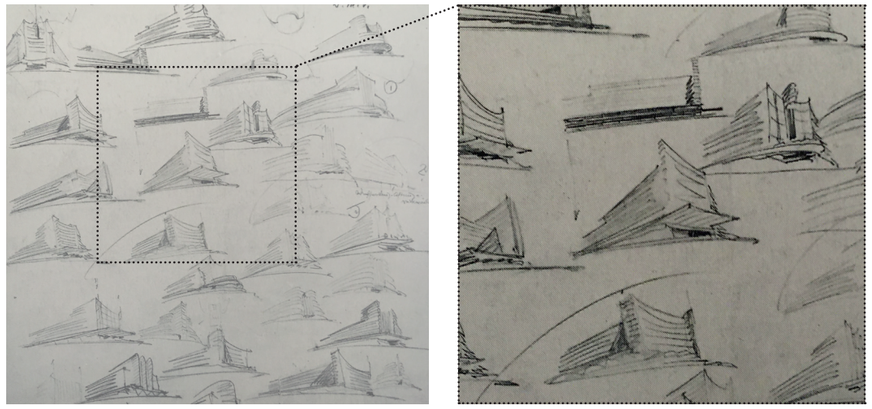


Figure 3.018 – Perspective sketches, Eric Medelsohn • Source:
Fraser & Henmi, 1994

Figure 3.019 – Sketch, Leningrad textile factory, Eric Mendelsohn (1925) • Source:
Kunstbibliotek, Staatliche Museen zu Berlin/Dietmar Katz

Figure 3.020 – Leningrad textile factory, Eric Mendelsohn (1925) • Source:
Wikipedia Commons

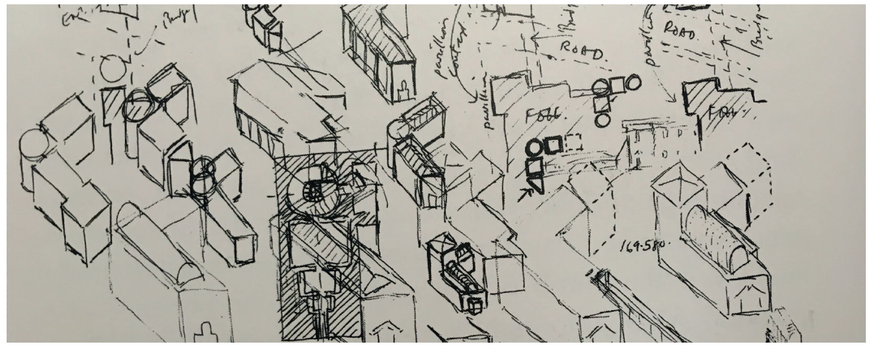


Figure 3.021 – Axonometric sketches, James Stirling • Source:
Fraser & Henmi, 1994

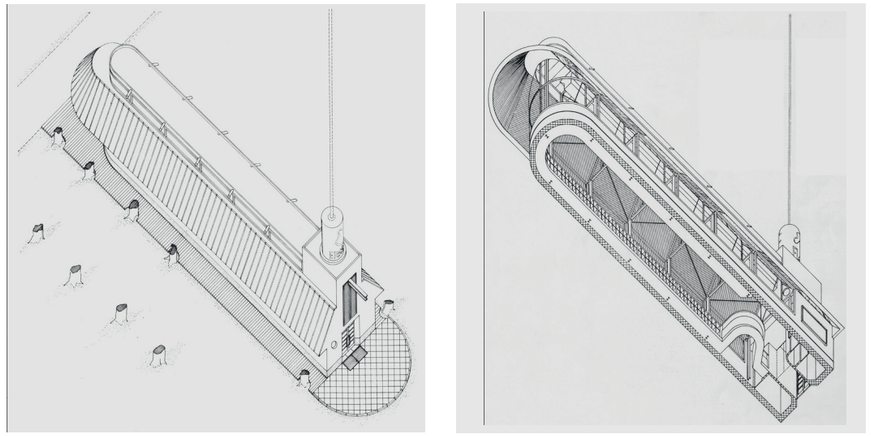


Figure 3.022 – Axonometric drawings, Electra bookstore, James Stirling (1991) •
Source: James Stirling, Michael Wilford, and Associates

Figure 3.023 – Electra bookstore, James Stirling (1991) • Source: Dida Biggi

Axonometric is a parallel projection of the object's three axes, enabling the generation of a scalar, measurable image of a three-dimensional entity. In (fig. 3.021) James Stirling uses this *mode* to investigate the spatial and volumetric implications of a proposal for a museum; taking advantage of the *mode's* ability to produce an *"accurate understanding of the building"* (Stirling, 1991). He uses the *mode* to create top-down and bottom-up views, (fig. 3.022) which despite being from 'unnatural' angles (compared to a perspective) allows the viewer to grasp the various elements at play in both the interior and exterior of the building (fig. 3.023); folding together *plans, sections, elevations* in a complex whole.

Combined: To accurately extrapolate three-dimensional space from the orthographic drawings, one needs to view several drawings simultaneously. In (fig. 3.024) the plan, section, and elevation study of a house (fig. 3.025) are juxtaposed, and the adjacency allows the designer to depict various interrelated conditions. (Fraser & Henmi, 1994)

Three-dimensional *modes* can also be combined with two dimensions: examples of drawings by Steven Holl (fig. 3.026) and Paul Rudolph (fig. 3.027) show how complex spatial configurations can be explained via the cut-away three dimensional view.

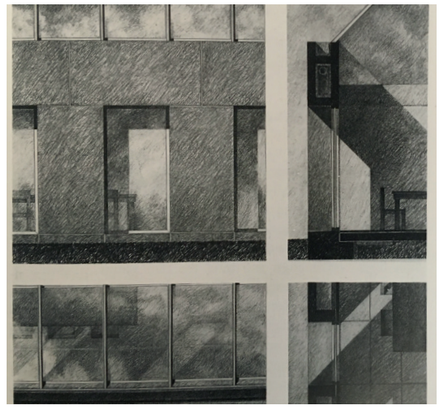
iii. Drawing as 'working medium'

In the examples shown to describe the various *modes,* the 'preparatory' drawings (Graves, 2012) used in the design process help organise disparate ideas and coalesce these ideas into architecture in a non-linear process. The act of drawing is the vehicle of the design process, propelling it forward. Thus the architectural drawing is not simply a mode of presentation, but rather a 'working medium'. (Bafna, 2008) This term is central to the paper's argument.

As we have seen in the examples, the choice of a certain *mode* as 'working medium' affects the way the object being designed may be manipulated. For instance, a sketch *perspective* or *elevation* could be grappling with the object's height, massing and volume, while plans enable the manipulation of the spaces' length and width, relative positions of enclosures and openings, and scale of elements. A distinction may be made between the way two and three-dimensional *modes* – the former is often assessed as a two dimensional composition, with reference/ control lines and geometric rules (like Alberti in fig. 2.013) and the latter as a sculptural volume (like James Stirling in fig. 3.021)

Similarly, the *type* of drawing as 'working medium' examines and manipulates the built object in different ways: a process drawing may be more notational when attempting to organise the materials and structure (like Louis Kahn in fig. 3.014); or more depictive when trying to decipher the spatial quality (like Eric Mendelsohn in fig. 3.018). Apart from the standard notational architectural elements of walls, columns, openings etc.; various layers of information such as furniture and fittings, material texture and patterns, light/ shadow, landscape may be shown based on what the drawing's intention is.

A built work can thus be seen as an amalgamation of multiple such design strategies; with certain drawing *modes* and *types* more dominant than others, as a direct consequence of being a more-used 'working medium'. The hierarchy is apparent in the work of some architects. For example, Glen Murcutt's use of detailed notational *sections* (fig. 3.028) makes his work read as "*... protrusions of a sectional solution"* (El Croquis 163/164, 2012). (fig. 3.029) Sections are also the protagonist of 'Manual of Section', a book that collects and categorizes buildings that it contends had been predominantly designed in section. (Lewis, Tsurumaki, & Lewis, 2016)



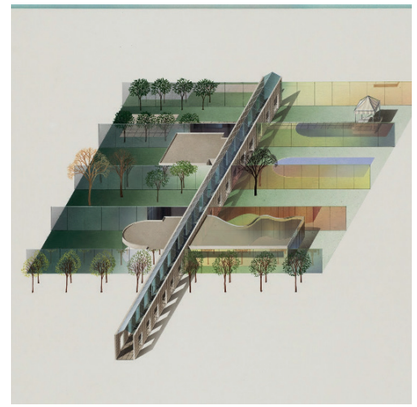
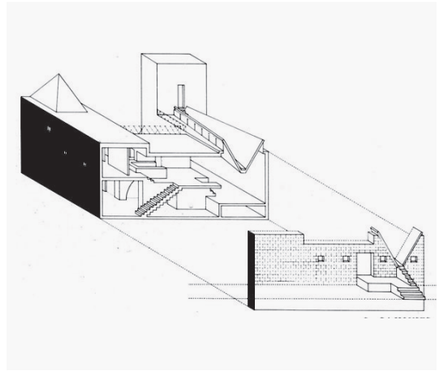


Figure 3.024, 3.025 – (left) Combined drawing, Long house, Cesar Pelli (1976) • Source: Fraser & Henmi, 1994
(right) Axonometric view • Source: MoMA New York



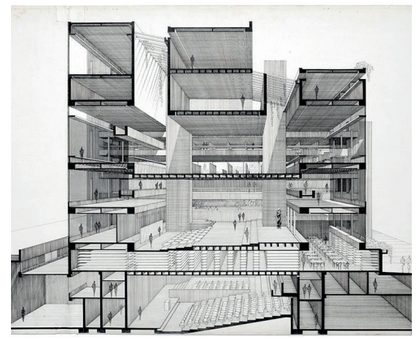
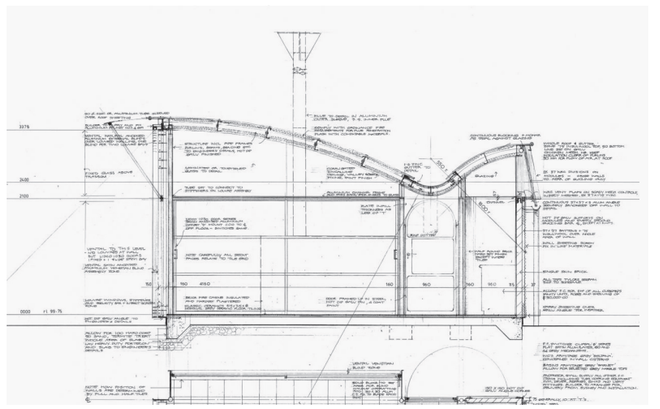


Figure 3.026, 3.027 – (left) Axonometric section, Metz house, Steven Holl (1980) • Source: Steven Holl Architects
(right) Perspective section, Yale architecture building, Paul Rudolph (1963) • Source: Paul Rudolph Foundation



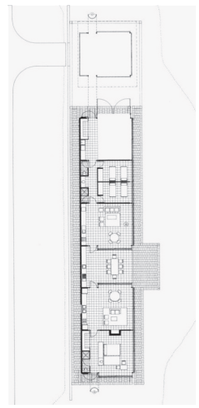


Figure 3.028, 3.029 – (left) Detailed section and (right) plan, Magney House, Glen Murcutt (1984) • Source: wikiarquitectura

Part four: Theoretical framework

This part is an extension of the previous one; a continuation of the investigation into drawing. Various writers articulate aspects of the architectural representation, creating a broad framework for continuing with the paper's analysis of built work through drawings. While most exist within the domain of architecture as practitioners, theorists, teachers and researchers, they also bring perspectives from the domains of art, history and anthropology.

Robin Evans was an architect, teacher, and historian. In his writing, he focussed on the role of geometrical representation and the evolution of drawing techniques parallel with developments in fields like mathematics, science, art and history.

Edward Robbins is an anthropologist focused on studying and writing about the system of architectural education and practice. His book 'Why architects draw' is central to the paper, and looks at the social uses of drawing in historic and contemporary times.

Michael Brawne was an architect, critic and educator. His book 'Architectural Thought: the design process and the expectant eye' (released posthumously) makes observations on the role of drawing and thinking based on a lifetime's worth of practice and education.

Mario Carpo is an architectural historian and critic. He has written widely on the role of drawings in historical and contemporary digital contexts, and provides insight into the changing dynamics that come with it.

Iain Fraser and Rod Henmi are architects and educators. In 'An analysis of drawing', they outline a guide to understanding and using different kinds of drawings, and illustrate how these choices impact the architectural ideas.

Alberto Perez-Gomez is an architectural historian and theorist. Amongst other things, he is interested in exploring fundamental questions concerning the practice of architecture, and thus focuses on the drawing in a few texts.

Sonit Bafna is an architect and academic. He has written multiple papers on how drawings are read visually and spatially simultaneously, using them to analyse the work of architects like Mies van der Rohe.

Paolo Belardi is an architect and educator. In his book titled 'Why architects still draw', he makes the case for the architectural drawing as a way of thinking, forming an interface between the work and the idea.

i. Drawings as 'working medium' continued

Whether referred to as a 'working medium' (Bafna, 2008); 'mediating artefact' (Gomez, 2005); or a 'multivariate tool' (Fraser & Henmi, 1994) – the notion that drawings take up a privileged position within the process of architectural production as the primary zone of the designer's efforts is a recurring theme.

Paolo Belardi describes the role of early, conceptual architectural sketches as a 'moment of invention' creating containers of possibilities, analogous to DNA to any living object, or a seed to a tree; and not a passive act of transferring thought to paper. (Belardi, 2014) Similarly, Robin Evans compares relationship between drawing and building to the act of translation (ie. between languages). (Evans, 1997) *Translation* semantically implies that the interchange between architect's drawing and the built object is a two-way street, instead of being a one-directional 'output' of ideas.

In his book 'Projective cast', Robin Evans diagrammatically illustrates this interchange (fig. 4.001). The diagram is organised as two arrested images, with the third being an explanation of how they both work. Here, the architect's attention is focussed on the two kinds of 'arrested image's – the orthographic and perspectival projection; which in turn

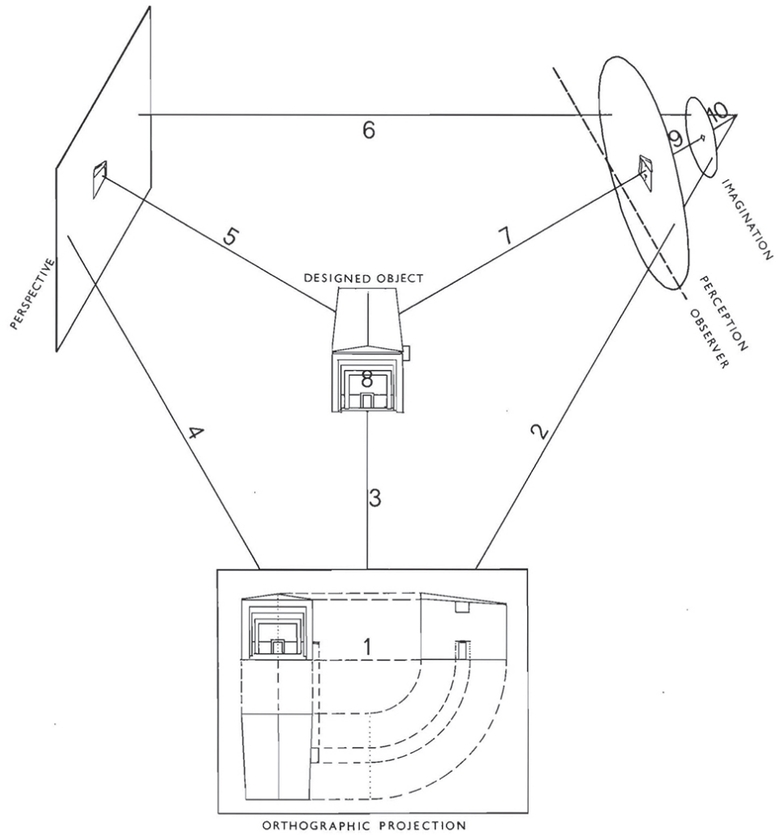


Figure 4.001 – The Arrested Image • Source: Evans, 1995

refers to a designed object (lines 3, 5, 7). Each image is parsed through a layer of visual perception, and the observer's imagination (lines 9, 10). The diagram implies that each image is complete in itself, and its relationship to the other can bypass acknowledging the complete designed object (lines 2, 4, 6). In doing so, it creates an almost independent domain of investigation. In principle, this diagram could be expanded to include various other *modes* of arrested images and still make sense.

Each such image would then act as distinct 'arenas' (Unwin, 2007) or 'vantage points' (Robbins, 1997) to view the designed object from. The independence between these points coupled with the idea of the drawing as a 'working medium' implies that each vantage point is also a tool to manipulate and examine the architectural design in unique ways. Rephrased, each drawing is a means of visualizing and manipulating the designed object.

ii. Drawings as visual medium

Architectural thought is 'primarily non-verbal' (Brawne, 2013) and relies on the use of visuals: and experienced through the human eye. There is, thus, a 'visual quality' to architectural thought (Bafna, 2008). Understanding how this works necessitates a brief overview of perception and engagement with visual media.

On one hand, the fact that architects are trained to 'read' drawings in architecture school and do so throughout their professional lives (Robbins, 1997) creates a form of tacit knowledge, a 'tutored' or 'expectant eye' that knows what to look for in them. (Brawne, 2003) On the other, the fact that drawings have the ability to be comprehended outside the domain of architecture implies the presence of more fundamental characteristics that go beyond domain-specific training. This is not the case for sheet music or computer code, for instance, which can be read only by people who have the training to do so.

These fundamental characteristics are a consequence of drawing's historical adjacency with art: the act of depiction and representation. Simultaneously, it calls for a 'perceptual engagement' which Bafna describes as an act that *"... involves our perception of the depicting entity as much as what is depicted within it"* (Bafna, 2008). Here, perception involves parsing the entities within the drawing beyond the visible – for instance, invoking Gestalt logic when reading a *plan*; treating it as an abstract composition of shapes and forms. Unlike a *perspective* that is closer to depiction/ pictorial representation, a *plan* uses perceptual engagement to bypass the fact that it is a 'confusing and perverse convention' that cannot be experienced in reality. (Brawne, 2003)

This 'unnaturalness' of a floor *plan* is evident in unique, uncommon situations which confront it with real-life human occupation. In (fig. 4.002, 4.003), we see how the *plan* is utilised to represent imaginary space: in the former, it is used to placate future residents of social housing units, allowing them to visualise life in these minimal and compact dwellings. In the latter, it is used as a minimal movie set that draws on theatre traditions, emphasising the actors' performances over the imagined setting.

> *"... Recognition of the drawing's power as a medium turns out, unexpectedly, to be recognition of the drawing's distinctness from and unlikeness to the thing that is represented, rather than its likeness to it, which is neither as paradoxical nor as dissociative as it may seem." (Evans, 1997)*

Figure 4.002 – 25 sqm social housing units • Source: Shelter Associates, Sangli

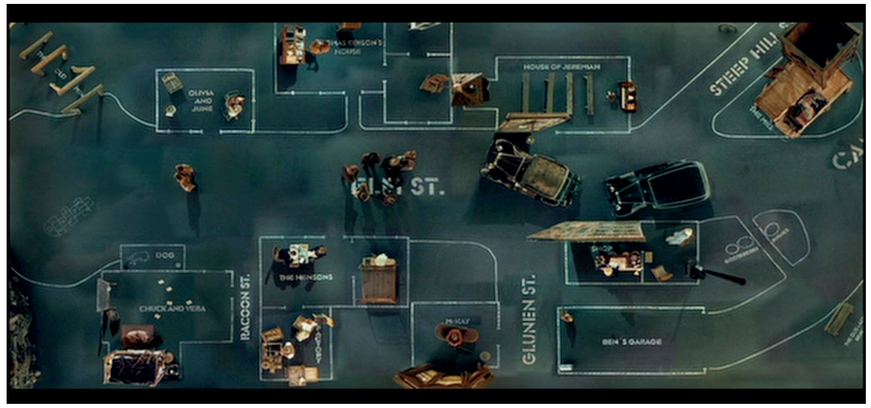


Figure 4.003 – Dogville set • Source: Lars Von Trier

iii. Drawings as discourse

The historical overview in part one gave an indication of how the architectural drawing transformed into a cultural and social construct over time. Drawings act as the de-facto means of exchange within the industry; and architecture is primarily disseminated through drawings paired with photographs or depictive views if it is unbuilt.

> *"Whole reputations, architectural competitions, and architectural evaluations are based on nothing but drawings. ... Indeed, many architectural historians and critics argue that the real architectural worth of a building is better viewed from the vantage of the drawing than from that of the building itself. The latter, they argue, often compromises the purity of the architectural concept." (Robbins, 1997)*

With the dominance of the visual over the experiential, the image and drawing-heavy discourse becomes a means of substitution; taking over the building it represents and forming an essentialist impression or 'image' of the structure. This act is reductive by nature, but more effective than just having photographs/ renders. These go on to influence and shape the way other architects draw and think, creating a feedback loop.

A plethora of architectural magazines and journals, monographs and websites create a wide range of inspirations and references which vary wildly in terms of (say) building program and budget; but these disparate projects all follow the same set of conventions in their drawn representation. This results in broad trends over time, like how the *perspective* view lost favour to the *axonometric* during the modernist period, which was seen as a more democratic and neutral way of representing the work. (Fraser & Henmi, 1994)

At the same time, the drawings and images in this context do more than just explain the scheme: they have a power of their own; and act as representative of not just the architecture but their author-architect and how they wish to be portrayed. (Robbins, 1997). This aspect of self-identity is explored by Alejandro Zaera-Polo & Guillermo Fernandez Abascal in 'Architecture's political compass' (fig. 4.004). 'Populists', for example, are chosen based on *"media-friendly, diagrammatic approach to architectural form"* (Zaera-Polo & Abascal, 2016); showing a clear link between representation and identity.

Figure 4.004 – Architecture's political compass • Source: Zaera-Polo & Abascal, 2016

Part five: Case studies

i. Methodology

The case studies will analyse projects by two leading contemporary architects from different parts of the world with their own distinctive traditions and developments: RCR (Spain) and SANAA (Japan). Both are winners of the Pritzker prize (2017 and 2010 respectively). Both firms were established around 1990s and gained prominence in the last 20 years. These firms have a wide and mature body of work; and monographic sources of original drawings/ images of their work. Both practices have been extensively published by the magazine El Croquis, which will be used as the primary source for this paper. Multiple issues of this publication cover the 18 year period between 1998 and 2017 for both practices, defining the time range. (fig. 5.001)

These firms take a wide range of positions and attitudes towards drawings; each has a distinct way of employing it as a device to create and disseminate their work. The paper analyses the practices' architectural projects via the three canonical modes of drawn architectural representation: the *plan, section, and elevation*. By condensing a project into a series of drawings, one can objectively link design ideas/ decisions to the *modes* and *types* of drawing used to create it. Apart from the standard/ notational depictions of architectural elements, the analysis focuses on the ways the drawings have been adapted/ personalized by the architect – for instance, by highlighting a certain *layer* of information that adds another dimension to the drawing.

Parallely, the paper looks at the effects of digitization of the architectural practice through four chronologically distributed projects from each studio. As mentioned earlier in the historical overview, this time period is backgrounded by massive shifts in technology.

ii. El Croquis

Within the cacophony of architectural publications and periodicals, *El Croquis* stands out as a unique, consistent body of work. It was established in 1982 by directors/ editors Fernando Marquez Cecilia and Richard Levene. In 2014, the publication was awarded a RIBA fellowship for the high standard they set in architectural journalism. (Pitcher, 2014) Publishing 5-6 issues a year, the publication compiles both established and emerging practices all around the world.

Each issue is structured as a monograph; publishing issues completely dedicated to one architect. Over the years, this builds up to an ouevre of the architects' work. Each issue begins with the description of the architects' practice and team members, followed by an interview with sets an overarching narrative to their work. The projects are then displayed in chronological order. What sets El Croquis apart is the curatorial process – wherein the editors (working with a small team); apart from just selecting the firms to be published, are involved in everything from photographing the projects to selecting the drawings that are included, to the layout and typesetting of the magazine itself. (Levene, 2020) Both educated as architects, the editors bring their own capacity as designers to the fore and engage with the built object independent from the architects' influence. As a consequence, the issues feature recurring compositional details like of facade photos with construction details, *notational* plans and sections adjacent to mirrored photos of interior spaces.

Drawings take the centre stage in this publication – its name literally translates to 'the sketch'. The publication's insistence on only showing original drawings is useful for the paper, and is thus treated almost as an archive of the architects' process and presentation drawings – which is usually not something that is privy to people outside of the studio.

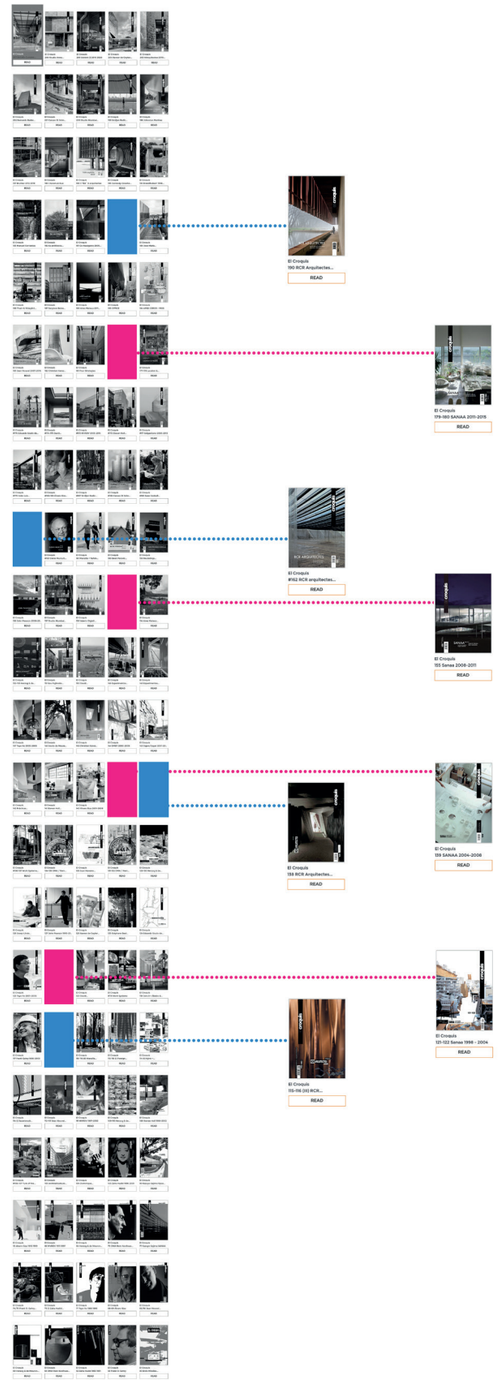


Figure 5.001 – El Croquis issues dedicated to RCR (blue) and SANAA (magenta) compared to past 110 issues • Source: El Croquis/ author

iii. RCR architects

RCR architects is composed of principals and co-founders Rafael Aranda, Carme Pigem and Ramon Vilalta. It was established in 1988 at Olot, Spain. The following paragraphs go through four projects of different type and scale, built in 2001, 2007, 2014 and 2015.

1. House for blacksmith and hairdresser (2001): In a suburban setting, this house in steel and white plaster stands out amongst its neighbours. (fig. 5.002, 5.003) Conceived as a simple volume with a panoramic 'eye' towards the landscape and sun, the process sketches (fig. 5.004) show how this mass is articulated to enhance this narrative. The block in *section* and *elevation* (fig. 5.006, 5.007) has two narrow extensions on either side, creating the framing 'eye'. Within the block, the central volume is left open on both floors (fig. 5.005) while the sides are occupied by program, drawn as a *perspective* sketch in the concept. These simple, symmetric operations in *section* and *plan* define the building.

The *elevational* articulation is evident in the manner in which the steel volume is set in from the edges and treated as an independent mass visually. Along with the mass, the surfaces and openings retain a strong compositional horizontality and symmetry, reflecting the plan. (fig. 5.006)

The *detailed section* resolves the material junction between the traditional masonry and concrete construction to the ornamental steel volume. (fig. 5.008) The triangular sections within the panoramic frames are hollow spaces concealing technical equipment. The selective use of *depictive* rendering, adding in colour and texture of steel, in this otherwise *notational* drawing makes the material relationships very apparent. Also noteworthy is the frame-by-frame study of the movement of a large vehicle, done to ensure it does not clash with the humble ceiling height, a check necessitated by the steep downwards ramp that would effectively increase the height of a long-wheelbase vehicle.

For this project, the building's massing and organisation is explored in *plan* and *section,* and articulated in *elevation*.

2. Horizon house/ Country house (2007): In a dramatic rural site marked by a steep embankment, the architects place a series of cuboidal corten steel volumes at the edge of this level difference to maximise the view to landscape. (fig. 5.009, 5.010) This is captured in the conceptual water colour sketches. (fig. 5.011) It shows the desire to treat the house as a series of volumes perpendicular to the edge in *plan*, with a sunken connector tying them together in *section*.

The drawing in (fig. 5.013) can be seen as a collage of the views out of the building overlaid on a conceptual *section*. It also depicts the underground parking and access; and the interconnecting passage. It uses a simplified solid line to indicate the building *section*, and by choosing to eliminate the *detail*; focuses on the design intention of these volumes acting as frames for the view. Similarly, the elevation drawings in (fig. 5.014) are not so much about the building as they are about the landscape that surround it. The *elevation* is overlaid on photographs of the site, with shadows added to show depth. These drawings are in line with the architect's intention for the structure to strike a 'balance' with nature.

(Fig. 5.012) is a conceptual *plan* that draws attention to the way the artificial landscape intersects the site; what the architect calls a 'colonizing imprint'. This imprint is visually seen as a continuation of the building mass, following the rhythm of the program within. For instance, an orchard extends beyond the kitchen and dining room, directly linking the activity of cooking and eating with fresh fruit and vegetables. Similarly, the living room

Figure 5.002 – View from access road, House for blacksmith and hairdresser, RCR architects (2001) • Source: El Croquis

Figure 5.003 – View from landscaped park adjacent to site, House for blacksmith and hairdresser, RCR architects (2001) • Source: El Croquis

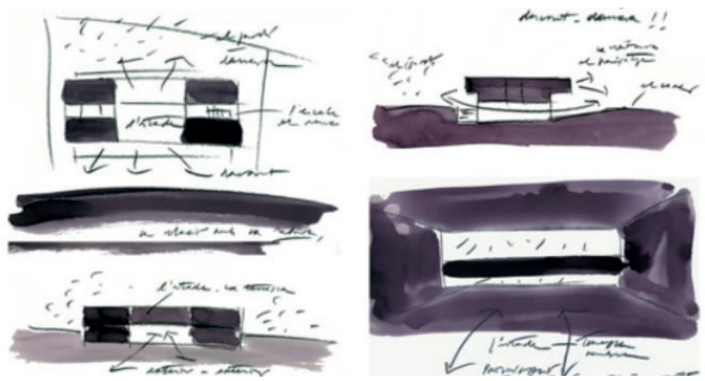
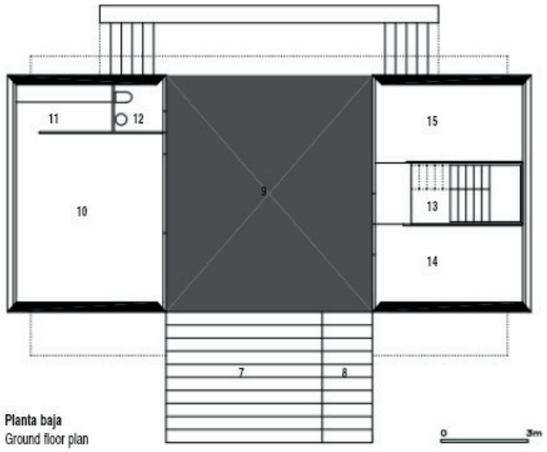


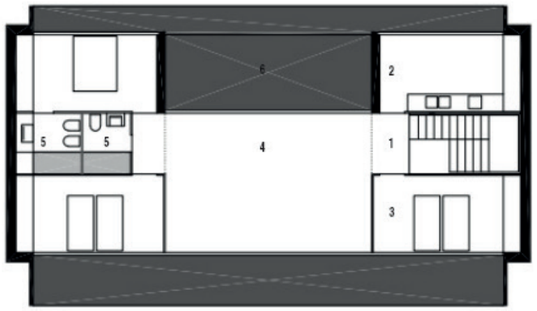
Figure 5.004 – Conceptual watercolour sketches, House for blacksmith and hairdresser, RCR architects (2001) • Source: El Croquis

1 Acceso a la planta inferior
2 Cocina
3 Habitación
4 Sala de estar-comedor
5 Servicio
6 Terraza
7 Acceso para vehículos
8 Acceso peatonal
9 Porche
10 Garaje
11 Sala de máquinas
12 Servicios
13 Vestíbulo de acceso a la vivienda
14 Peluquería
15 Almacén peluquería

1 Access to lower floor
2 Kitchen
3 Bedroom
4 Living-dining room
5 Bathroom
6 Terrace
7 Vehicular access
8 Pedestrian access
9 Porch
10 Garage
11 Mechanical room
12 Toilet
13 Hallway
14 Hairdressing salon
15 Hairdressing storage



Planta baja
Ground floor plan



Planta superior / Upper floor plan

Figure 5.005 – Floor plans, House for blacksmith and hairdresser, RCR architects (2001) • Source: El Croquis

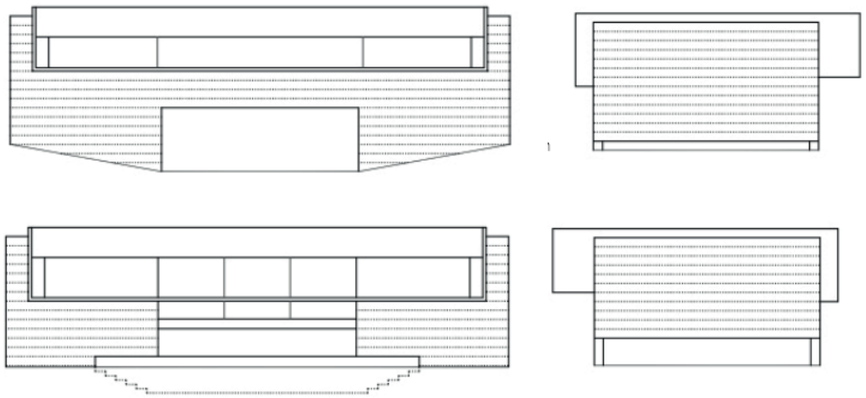


Figure 5.006 – Elevations, House for blacksmith and hairdresser, RCR architects (2001) • Source: El Croquis

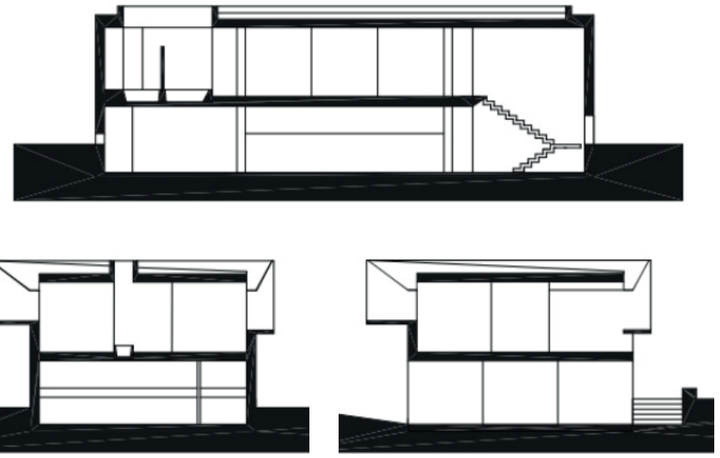
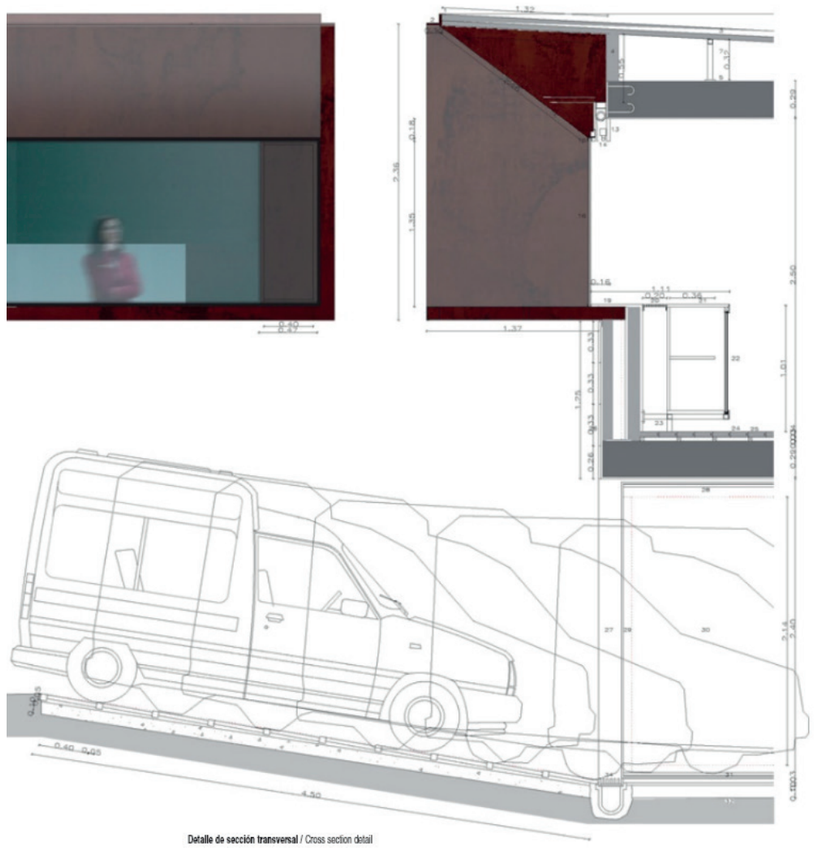


Figure 5.007 – Sections, House for blacksmith and hairdresser, RCR architects (2001) • Source: El Croquis



Detalle de sección transversal / Cross section detail

Figure 5.008 – Detail section, House for blacksmith and hairdresser, RCR architects (2001) • Source: El Croquis

Figure 5.009 – View from access road , Horizon house, RCR architects (2007) • Source: El Croquis

Figure 5.010 – View from valley , Horizon house, RCR architects (2007) • Source: El Croquis

Figure 5.011 – Conceptual watercolour sketches , Horizon house, RCR architects (2007) • Source: El Croquis

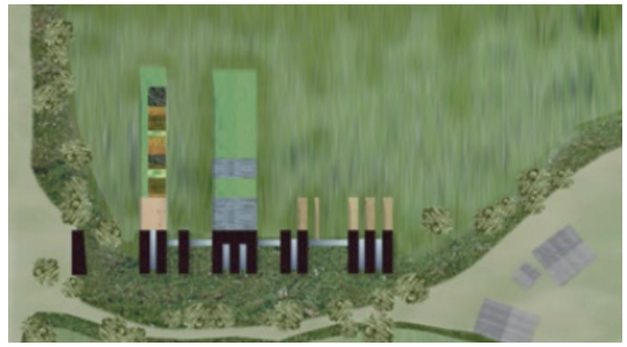


Figure 5.012 – Conceptual plan , Horizon house, RCR architects (2007) • Source: El Croquis

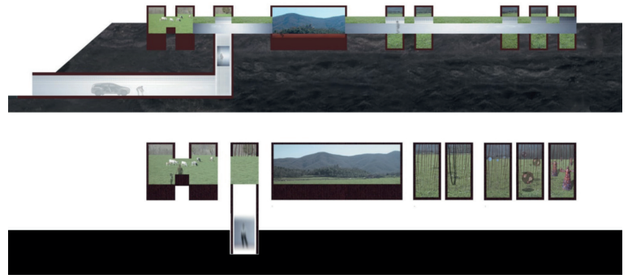


Figure 5.013 – Conceptual sections , Horizon house, RCR architects (2007) • Source: El Croquis

Figure 5.014 – Conceptual elevations , Horizon house, RCR architects (2007) • Source: El Croquis

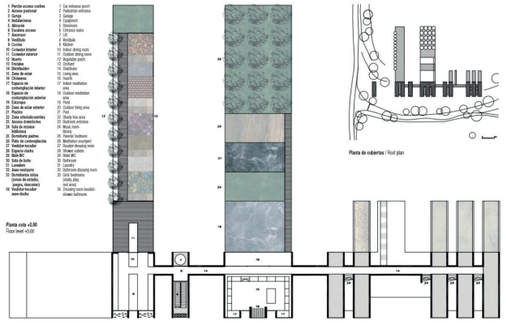


Figure 5.015 – Ground floor plan , Horizon house, RCR architects (2007) • Source: El Croquis

Figure 5.016 – Sections through program modules , Horizon house, RCR architects (2007) • Source: El Croquis

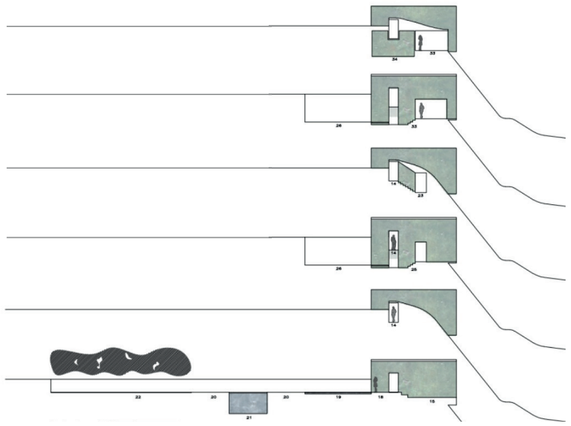


Figure 5.017 – Sections through passages, Horizon house, RCR architects (2007) • Source: El Croquis

Figure 5.018 – Valley facing view, Sun School, RCR architects (2014) • Source: El Croquis

Figure 5.019 – West facade facing access road, Sun School, RCR architects (2014) • Source: El Croquis

Figure 5.020 – Conceptual watercolour sketches, Sun School, RCR architects (2014) • Source: El Croquis

connects to a swimming pool and outdoor patio. The bedrooms extend into smaller, more intimate courtyards. This interrelationship is formalized in a *plan* (fig. 5.015) and *sections* (fig. 5.016) drawn up at key points.

For this project, the concept of embedding these volumes in the landscape is explored in *plan, section*, and *elevation*. The *elevation* establishes the intent to frame the views while simultaneously minimising the structure's impact on the landscape. The *plan* looks at how the program is spread over the volumes, and the impact it has on the site. The *section* examines the connections between the volumes (fig. 5.017) and the levels.

3. Sun School (2014): Set in a hilly terrain (fig. 5.018, 5.019), this project attempts to embed itself into the landscape. The conceptual sketch (fig. 5.020) shows how it uses the *plan* to first align the building to the site contours, and secondly to organise the program into strips along a central 'street', sitting on one level. (fig. 5.021) The *section* is used to submerge the building to have it read as a part of the hill; and to bring light into the sunken spaces. (fig. 5.023) The roofs and perimeter walls are designed to be occupied by landscape, while the rest of the building materially contrasts with the context. (fig. 5.022)

Here the *detail section (fig. 5.024, 5.025)* is the key drawing, which is almost extruded in *plan* across the length of the building. Critical junctions with the ground and ingress of light shapes the surface of the structure, qualities that are both represented in the drawing using value shading and notational hatching. This drawing also incorporates technical installations in various clever negative spaces.

4. Crematorium Hofheide (2015): In a plain rural setting, this pavilion is a space for reflection and consolation. (fig. 5.026) At a functional level, it uses the *plan* and *section* to create distinct zones within the structure: the 'main' functions are on the ground floor and the secondary spaces on the basement floor. In *plan*, both linear blocks are further broken into two parts based on a programmatic division. This is seen in (fig. 5.028, 5.029, 5.030) The *elevation* however creates a unified mass of steel screens shielding a circumambulatory verandah, making the structure read as one volume. (fig. 5.027)

The *section* (fig. 5.030, 5.031) is mainly used to sculpt the natural light entering the building. It treats light almost as a physical, tangible entity. With various intermediate slabs and baffles, it creates a complex section of low and high; bright and dark spaces. In the *detail sections (fig. 5.032, 5.033)* we see how the meditation room, reception and corridor are treated with a light funnel, an asymmetric baffle slab and a symmetric baffle slab respectively; and that creates spaces with completely different characters.

This is seen in the way the drawings are made: the sections feature depictive layers of materiality and texture, overlaid with light and shadow. These drawings would have likely been used to experiment with different ways of letting the light in, conjecturally supplemented by simulation software. The *plans* and *elevations* in contrast are much more *notational* and 'flat'.

In this project, the overarching theme has been the revelatory nature of the *section*: photos and other drawings would simply not be adequate to understand this building. The *plans* and *elevations* are intentionally subdued and simplified in keeping with the sombre nature of the program, but the *section* in contrast is very complex and intricate - working behind the scenes to create the atmosphere inside the building.

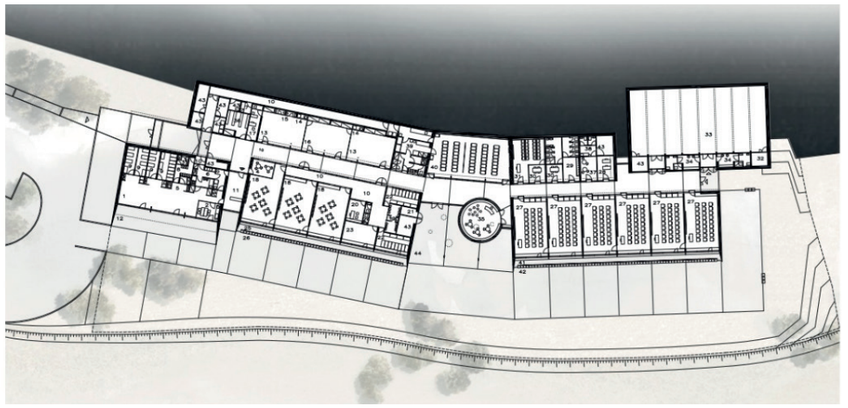


Figure 5.021 – Floorplan, Sun School, RCR architects (2014) • Source: El Croquis

Figure 5.022 – North elevation, Sun School, RCR architects (2014) • Source: El Croquis

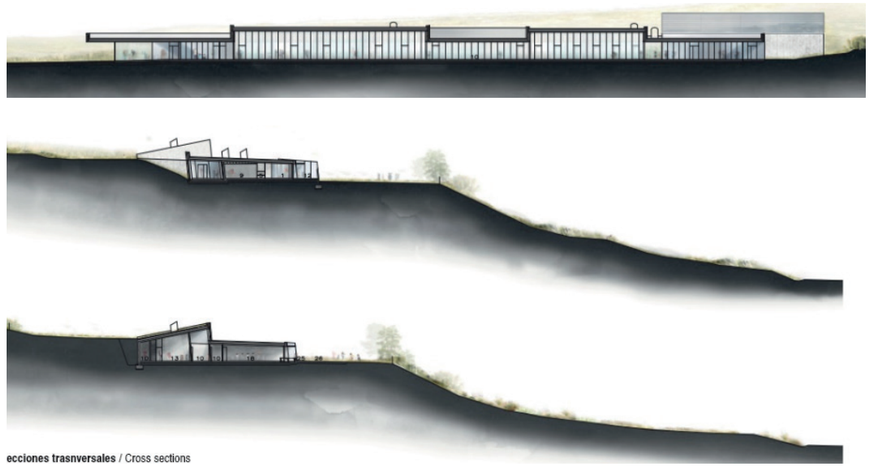
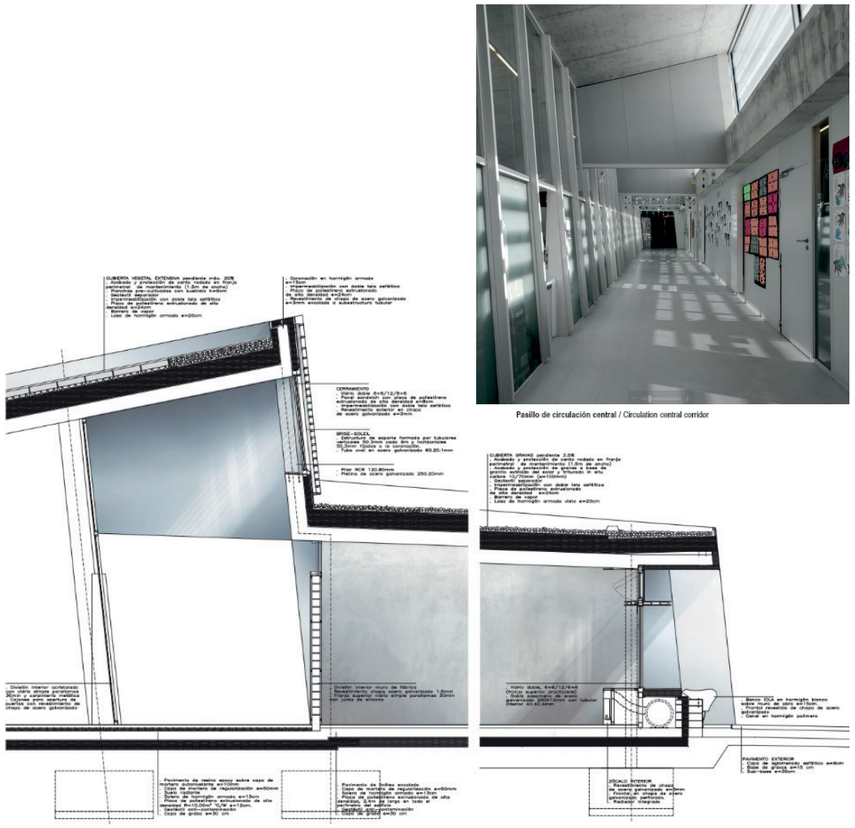


Figure 5.023 – Sections, Sun School, RCR architects (2014) • Source: El Croquis



Pasillo de circulación central / Circulation central corridor

Figure 5.024 – Detail Sections and photograph through internal street, Sun School, RCR architects (2014) • Source: El Croquis

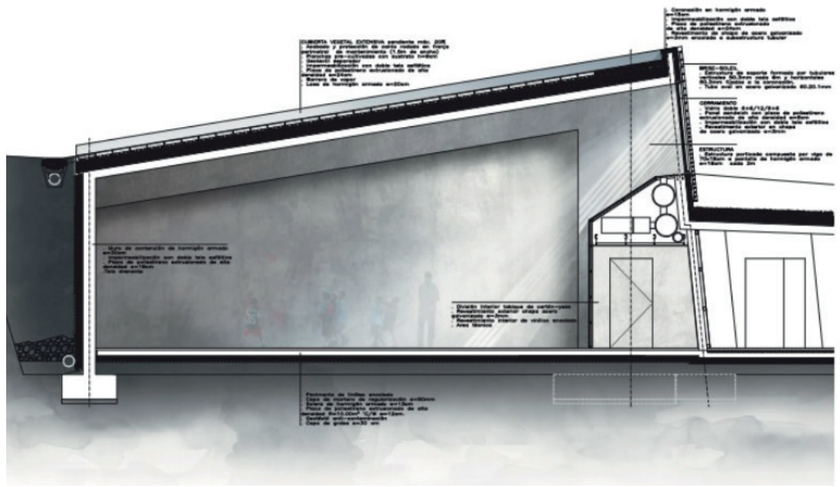


Figure 5.025 – Detail Section through classroom, Sun School, RCR architects (2014) • Source: El Croquis

Figure 5.026 – Hofheide crematorium, RCR architects (2015) • Source: El Croquis

Figure 5.027 – Steel skin, Hofheide crematorium, RCR architects (2015) • Source: El Croquis

Figure 5.028 – Conceptual sketch, Hofheide crematorium, RCR architects (2015) • Source: El Croquis

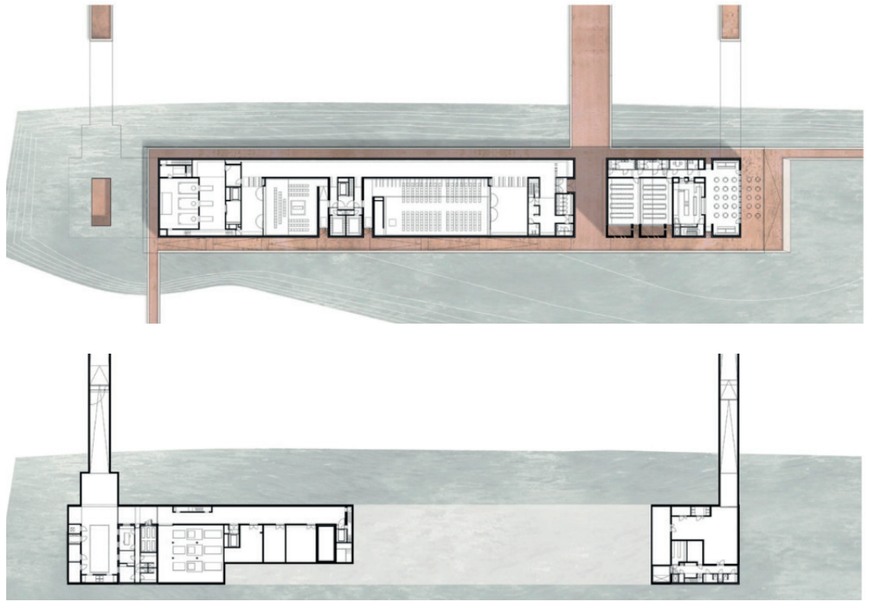


Figure 5.029 – Floor plans, Hofheide crematorium, RCR architects (2015) • Source: El Croquis

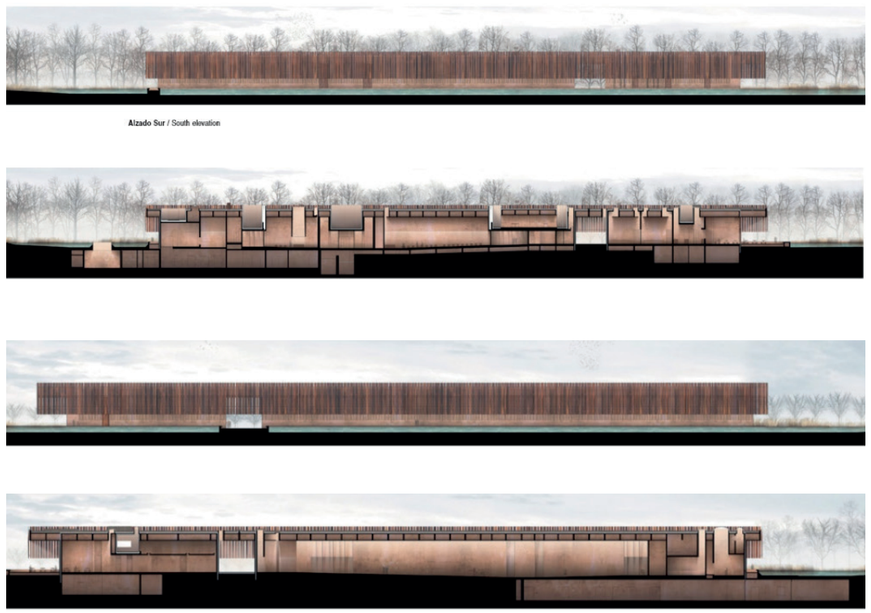


Figure 5.030 – Sections and elevations, Hofheide crematorium, RCR architects (2015) • Source: El Croquis

Figure 5.031 – Transverse sections, Hofheide crematorium, RCR architects (2015) • Source: El Croquis

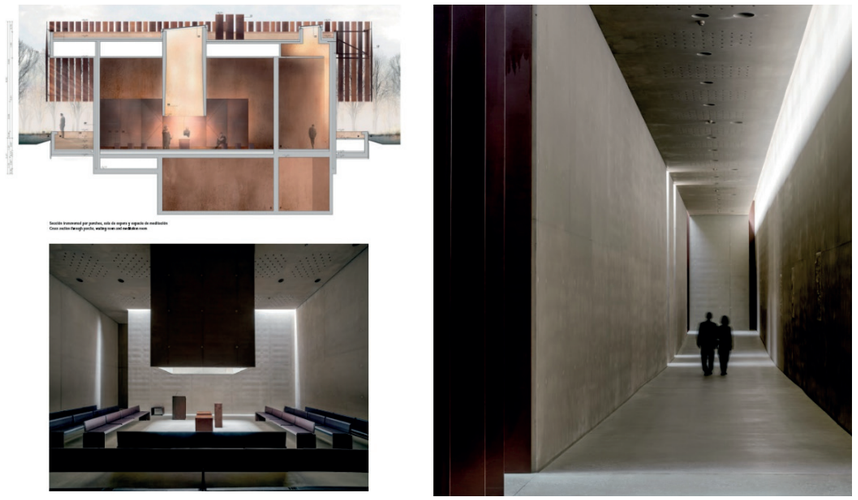


Figure 5.032 – Detail section and photograph, meditation room and lobby, Hofheide crematorium, RCR architects (2015) • Source: El Croquis

Figure 5.033 – Detail section and photograph, waiting room and verandah, Hofheide crematorium, RCR architects (2015) • Source: El Croquis

iv. SANAA

SANAA (Sejima and Nishizawa and Associates) is an architectural firm based in Tokyo, Japan. It was founded in 1995 by architects Kazuyo Sejima and Ryue Nishizawa, who also have their own independent practices (some of the projects shown here are from the latter). The following paragraphs go through four projects of different type and scale, built in 2001, 2005, 2011 and 2019.

1. Toledo Museum of art glass pavilion (2001): SANAA uses glass walls to define a museum dedicated to the exhibition and making of glass objects. The single-storey structure is flat apart from being punctuated by three small courtyards (fig. 5.034). The interior is characterised by double-layer curving glass, enabling strong cross-transparency. (fig. 5.035) The museum is developed almost entirely in *plan*. (fig. 5.036) The different programs are placed in a matrix, with the curving walls forming a diagonal link between spaces. As the *plan* is developed, the single-line partition between spaces becomes a double line; essentially creating a counter-intuitive unusable space between the functions. However, the architect uses the opportunity to treat each room as 'independent' in terms of HVAC requirements, effectively using the gap as a buffer. This is organisation is then simply extruded to one storey height. The final *plan* (fig. 5.037) is further articulated based on the permissible radius of curvature of glass (fig. 5.038). The few opaque blocks contain the structure and services.

The architects achieve their vision of this museum as 'interconnected bubbles' by choosing to engage in *plan*. *Elevations, sections*, and *details* are secondary to this primary objective. This clarity of vision is evident in the eventual building.

2. Moriyama house (2005): Ryue Nishizawa breaks down the scale of an urban residence into small volumes and scatters them across the site, such that each volume may function independently or as a whole. (fig. 5.039, 5.040, 5.041) Currently, some units are rented out while some are occupied by the owner's family. The connecting garden and terraces are designed as public space within the site. This is highlighted in his *parti* sketch.

The *plan, section,* and *elevational* resolution of each *cuboidal* unit is simultaneous, as each block is unique and functions depending on its adjacencies. This complex scheme appears as a densely packed composition in *plan*, (fig. 5.042) but has clear hierarchies in *elevation* - it is taller at the edges and shorter in the middle, creating an inward-facing block overall. (fig. 5.043) *Plans* and *sections* play an organisational role, stacking and creating connections between connected program rooms. The way the *plan* is drawn with furniture and landscape (fig. 5.044) is also interesting as it shows very specific conditions or the manner in which the spaces can be occupied; which is also a consequence of the compact size of the rooms. While usually rooms are designed with specific uses in mind, this project turns that logic on its head and instead organises furniture and program based on the exigencies of the *plan*.

This project uses the *plan, elevation* and *section* modes to propose a new way of living, and successfully manages to deconstruct a typical residence.

Figure 5.034 – Extruded single-storey structure, Toledo museum, SANAA (2001) • Source: El Croquis

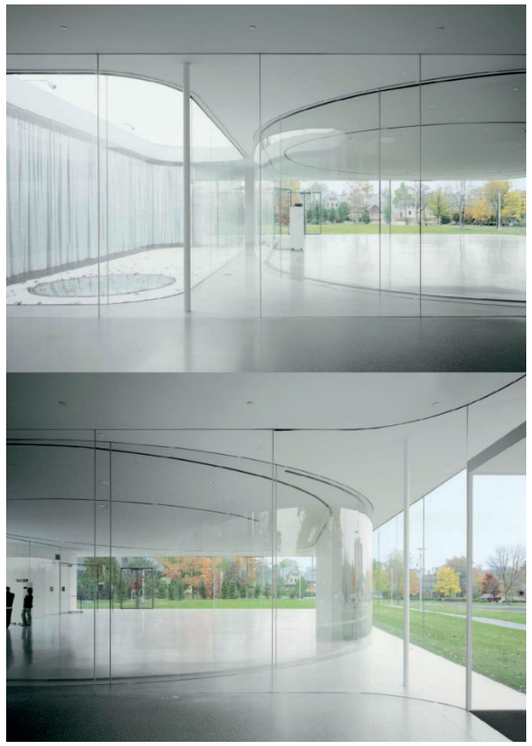
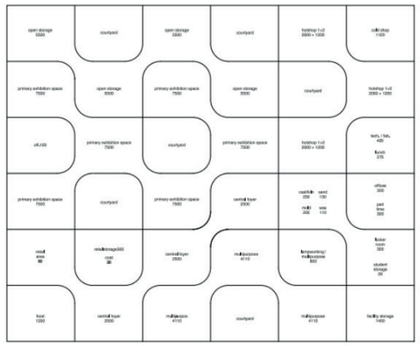
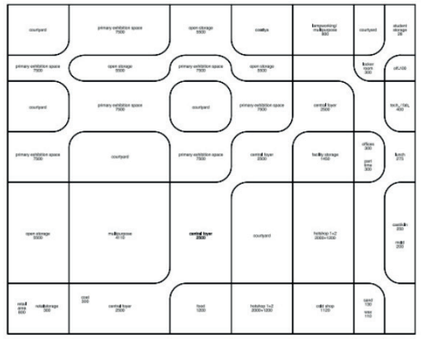


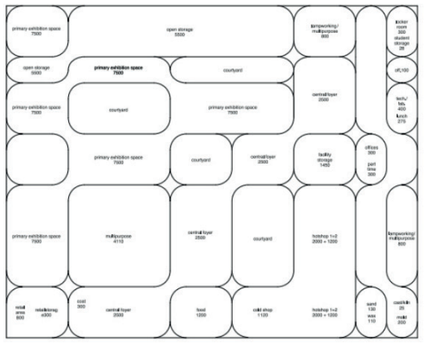
Figure 5.035 – Interior glass facade, Toledo museum, SANAA (2001) • Source: El Croquis



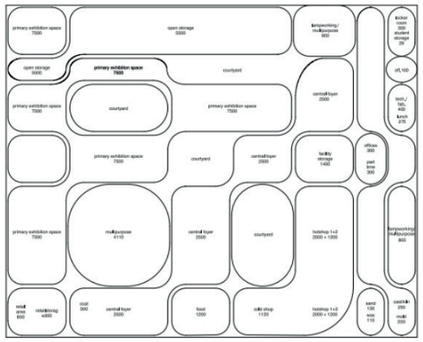
En el centro del parque proponemos una retícula modular. Las salas uniformes sobre retículas uniformes carecen de conexiones diagonales. Cuando esta relación resulta necesaria, se emplean las curvas para establecer una conexión en diagonal.
At the center of the park, we impose a modular grid. Uniform rooms on uniform grids do not have diagonal connections. Where this relationship proves necessary, curves are used to connect in the diagonal direction.



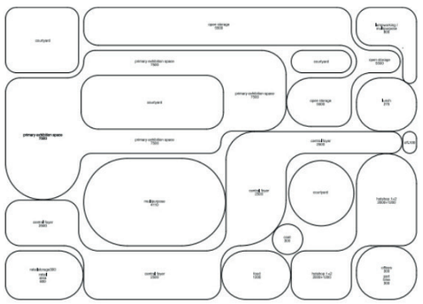
Para adaptarse al programa, la retícula uniforme se ajusta para transformarse en una retícula rectangular. Aquellos lugares en los que las salas rectangulares quedan conectadas por paredes curvas son buenos. Sin embargo, empezamos a pensar que una curva en una sola esquina de una sala es algo espacialmente desagradable.
To meet the program, the uniform grid is adjusted to become a rectangular grid. The places where rectangular rooms are connected by curved walls are good. However, we begin to think that a curve at just one corner of a room is spatially unpleasant.



Todas las salas tienen esquinas en curva, y no en ángulo. Creemos que las salas con esquinas en curva son más independientes
All rooms are made by curved corners, not angled corners. We find rooms with curved corners to be more independent.



Originalmente, un muro era compartido por dos salas. Los muros dobles hacen que cada sala sea independiente.
Originally, one wall was shared between two rooms. Double walls make each room independent.



El diseño esquemático nos condujo al proyecto actual. El espacio entre los muros es utilizado como zona de amortiguación
Schematic design directed us to the current scheme. The space between the walls is used as a buffer zone

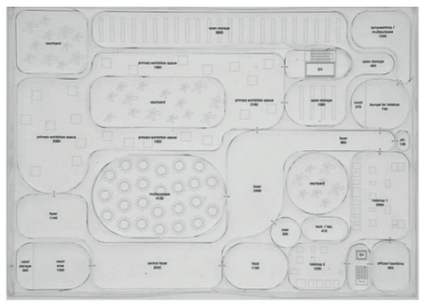


Figure 5.036 – Plan development, Toledo museum, SANAA (2001) • Source: El Croquis

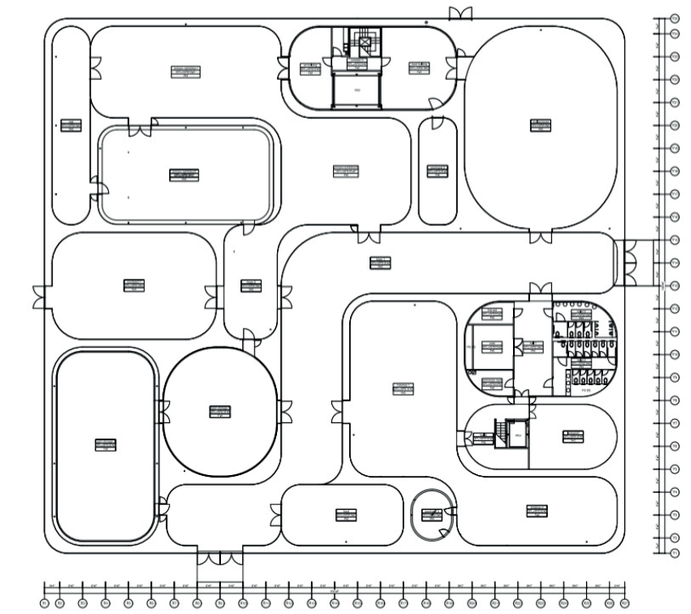
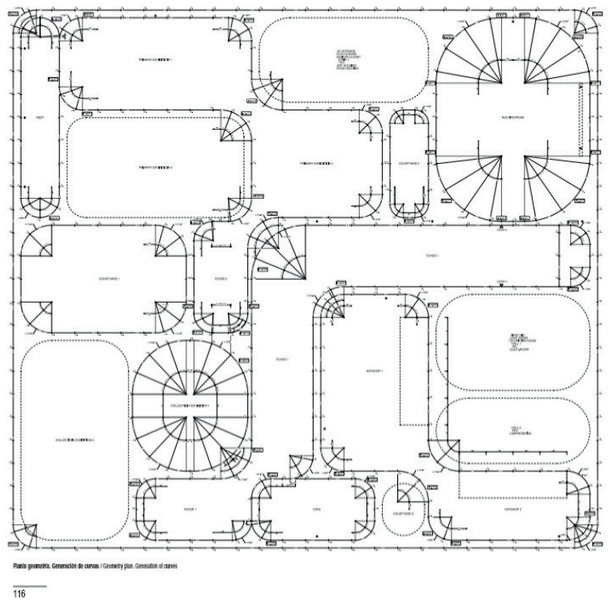


Figure 5.037 – Ground floor plan, Toledo museum, SANAA (2001) • Source: El Croquis



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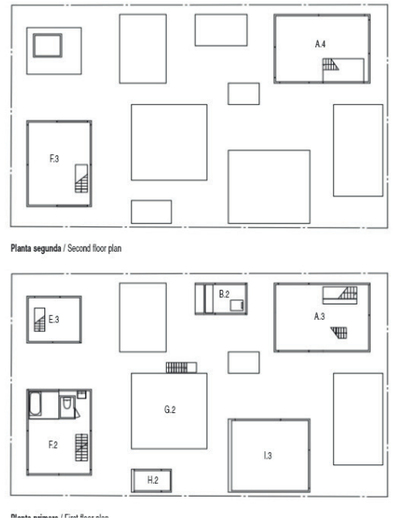


Figure 5.042 – Floor plans, Moriyama house, SANAA (2005) • Source: El Croquis

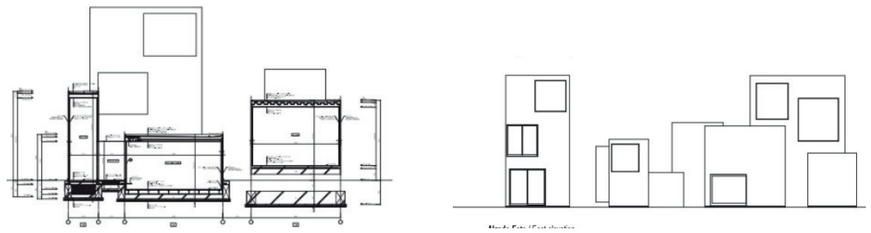


Figure 5.043 – Section and elevation, Moriyama house, SANAA (2005) • Source: El Croquis

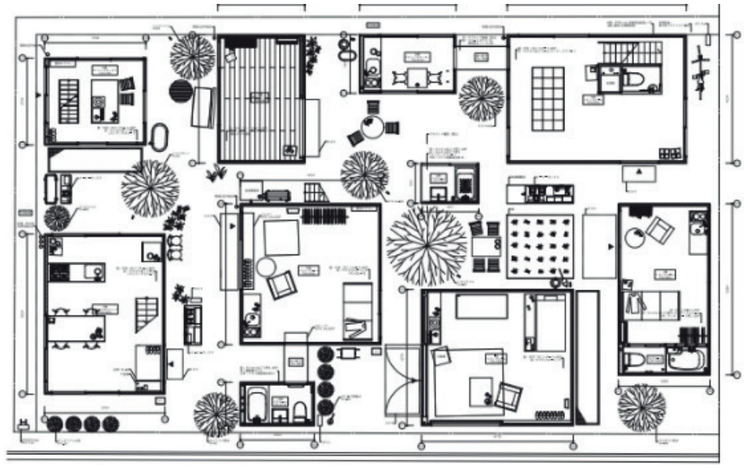


Figure 5.044 – Ground floor plan, Moriyama house, SANAA (2005) • Source: El Croquis

Figure 5.045 – Shibaura house, SANAA (2011) • Source: El Croquis

Figure 5.046 – Interior, Shibaura house, SANAA (2011) • Source: El Croquis

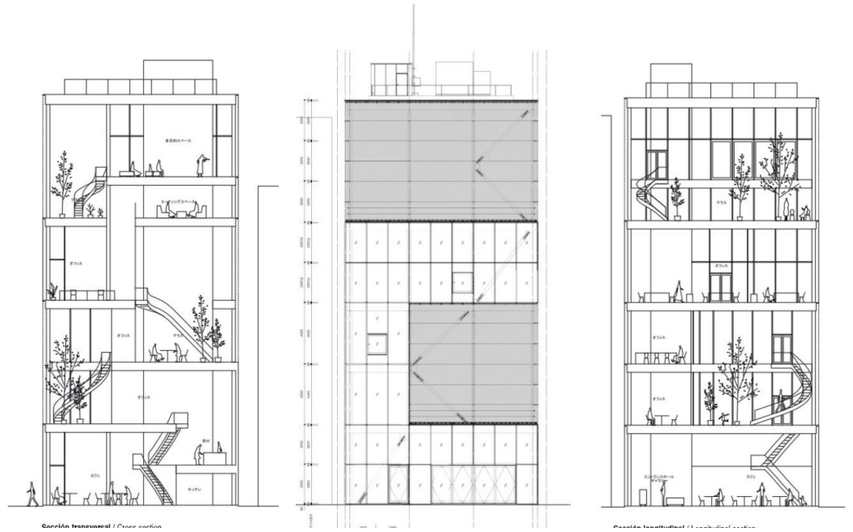


Figure 5.047 – Sections and elevation, Shibaura house, SANAA (2011) •
Source: El Croquis

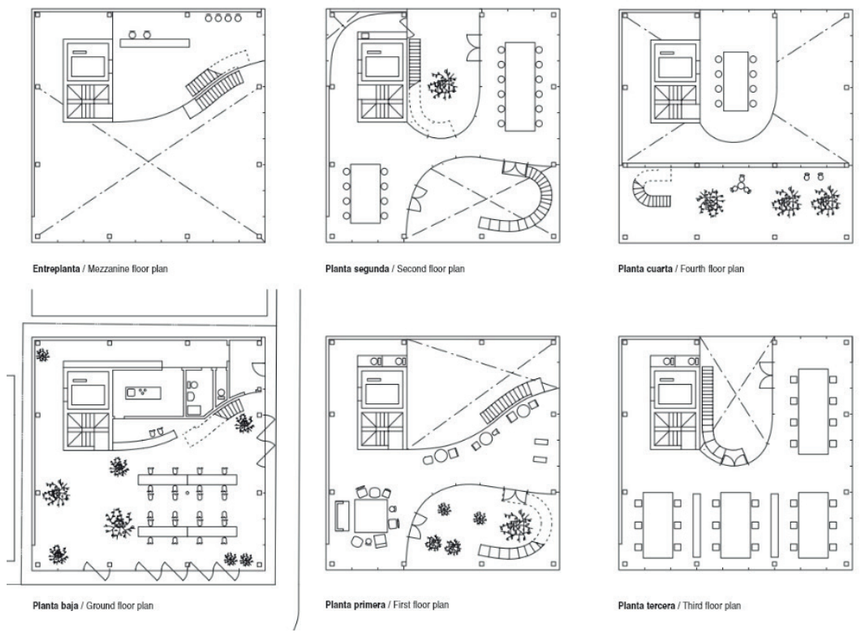


Figure 5.048 – Floor plans, Shibaura house, SANAA (2011) • Source: El Croquis

3. Shibaura house (2011): Kazuyo Sejima creates an office space with terrace spaces and internal courts. (fig. 5.045, 5.046) The relationship between the drawings used is quite direct, the *plans* are employed to create free-form shapes within the tower's outline, responding to the program and the overall massing (fig. 5.048); whereas the *section* is used to create voids and variety in floor-to-floor heights (fig. 5.047). While these are obviously simultaneous exercises that inform each other, there is evidence of independence as well: the curves in the floorplate, for example, relate purely to the act of moving and connection or are purely graphic, compositional tactics in *plan*. Accentuated by strategic staircases, these curves break the rectilinearity of the otherwise rigid building.

This building thus is an engagement of the *plan* and *section*. The *elevation* in this project plays a secondary role, as the surface is left mostly transparent and the prominent voids are governed by the other *modes*.

4. New Library, Japan Women's University (2019): Kazuyo Sejima creates a landmark library by effectively wrapping a ramp around a building, creating a continuous promenade through the structure, and creating an inviting, barrier-free environment from the street. (fig. 5.049, 5.050)

Designed in *plan* and *section*, the drawings indicate that the ramp defines the building's expression, except in situations where deliberate elements like vaulted roofs or circular cut-outs interrupt this condition. (fig. 5.051, 5.052) The structure's complexity stems from the geometric resolution of a simple diagram, with clashing slabs and walls due to the varying intermediate slab of the ramp. It employs various strategies to solve it in the *detailed section (fig. 5.053),* from the use of blind walls to glass to railings.

Figure 5.049 – New Library, SANAA (2019) • Source: El Croquis

Figure 5.050 – Interior, New Library, SANAA (2019) • Source: El Croquis

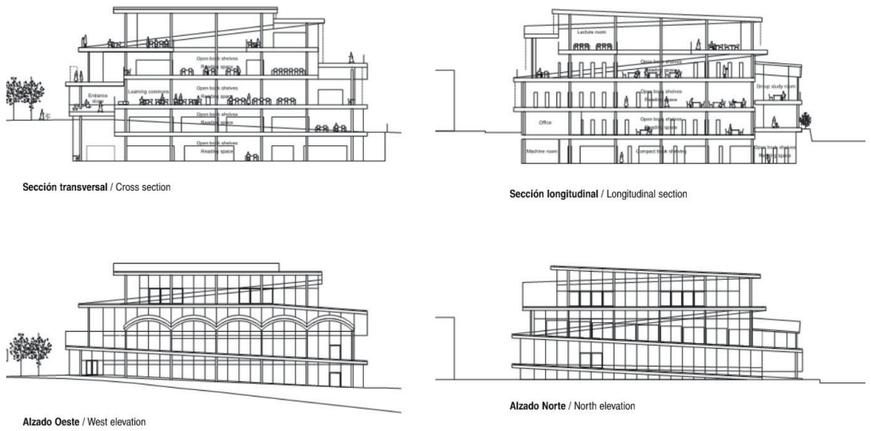


Figure 5.051 – Sections and elevations, New Library, SANAA (2019) • Source: El Croquis

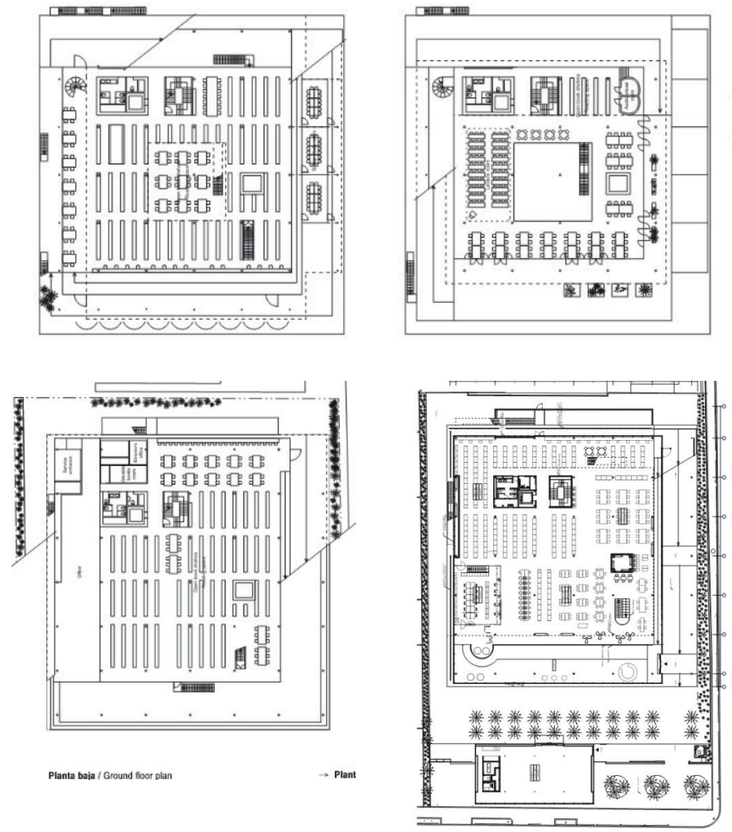
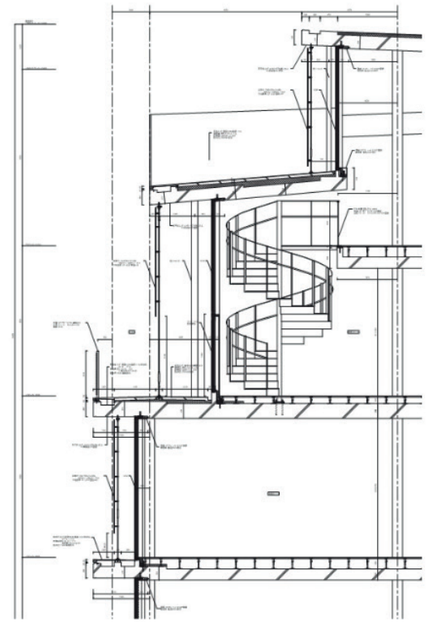


Figure 5.052 – Floorplans, New Library, SANAA (2019) • Source: El Croquis



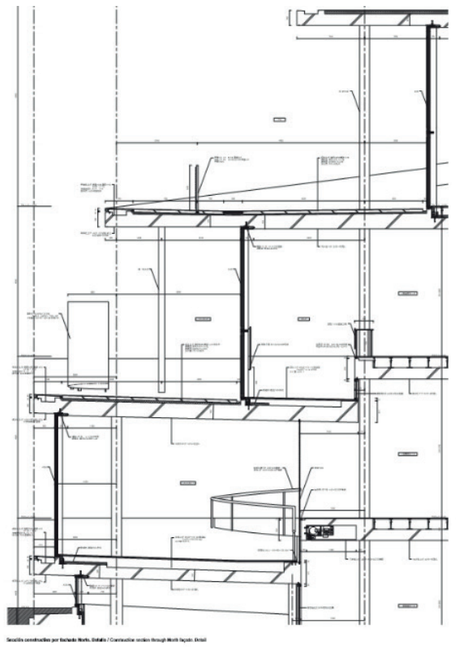


Figure 5.053 – Detailed sections, New Library, SANAA (2019) • Source: El Croquis

Part six: Conclusion

The case studies show that there is a relationship between the mode of the drawing used and its impact on the built outcome. The notion that drawing is a 'working medium' dovetails nicely with the observations from the case studies. While this might seem obvious or self-evident, or even tautological, the fact that the mode of drawing used is central to the way the architecture develops leads to the following possibilities:

The use of dominant drawing mode as a means of classification of buildings. Identifying 'plan-ar', 'section-al' or 'elevation-al' buildings could be helpful, but this seems to be too simplistic. Out of the case studies, only two (out of eight) were observed to have one dominant mode of design. The rest were hybrids of two or all three modes. (three out of eight each). Perhaps the criteria needs to use the kind of hybrid; implying listing all the modes that have played a critical part of the design. So a design might be Plan x Section x Axo (like James Stirling's Electra bookstore); or it could be just Plan x Section (like SANAA's Shibaura house).

It is important to note that this is evidently not a qualitative measure: single-mode architecture is not automatically worse that hybrid modes. For instance, there are only-plan buildings that are terrible (like any average nondescript office tower) but there are examples where the limited parameters result in powerful architecture (like Mies van der Rohe Barcelona Pavilion, or the SANAA Toledo museum)

Thinking about dominant design modes can have an advantage in two scenarios: *i. to study trends in history, or ii. to aid in changing one's design process.*

For the former, this paper already attempts to chart a rudimentary historic trend: that plans and elevations had always been the dominant modes till the invention of the section, perspective and later, axonometric. There is a loose correlation between the examples of modernist architects mentioned in this paper and the dominant use of plans and sections. With post-modernists, we see a shift towards elevation and perspective on one hand or axonometry on the other.

In the two contemporary examples studied, the precise and deliberate use of the section seems to be the common factor. These two architects restricted themselves to plans, sections and elevations (although the use of the physical or digital model needs to be acknowledged here). Perhaps this is the age of the Section? Undoubtedly, more research needs to be conducted to substantiate this claim.

Over the course of the last twenty years, the impact one observes in their work is the changing visual quality of the drawing itself: more detailed, more precise and containing more information. For example, RCR's Hofheide Crematorium has layers of light and shadow overlaid on material textures and colours, something that is easy to achieve with the bevy of softwares at hand today. Apart from the more pragmatic benefits like being able

to simulate structural loads or energy efficiency via a simulation; being able to visualize (and quantify) ephemeral phenomenon like light entering a building or the atmospheric quality etc. is fundamentally changing the way we design.

SANAA's large and complex New library (and other projects like the Grace farm) are only possible due to drafting and modelling technology that allows one to create free-form geometry. Mario Carpo links the harnessing of computational power to being able to model reality without having to simplify it. He highlights the contrast of the pre-BIM era to now by illustrating how the architecture then *"aimed at, and stood for, elegant smoothness, machine-made precision and calculus-based, spline driven continuous lines and surfaces"* as opposed to the present-day ability of design tools to *"... model the tremor of each trait of the hand, the wavering of the lilies in the field, or the passing of clouds in the sky, without converting these feeble and uncertain, fuzzy traces of chance and nature into the scripted rigour of geometrical objects."* (Carpo, 2013).

For using the 'dominant drawing mode' to change one's design process: architects and students of architecture are taught to design in very specific ways, and sometimes un-learning these ways is not a natural tendency. In my modernist, engineering-influenced architectural education for example, the plan was always king and everything else came second. Even in practice, the amount of time generally spent working on plans usually trumped other modes. In this context, perhaps acknowledging other ways - and *modes* - of working can be a useful exercise. Studying the work of architects through this lens would give an insight into the investigation carried out by the architect and in a way reverse-engineer the design process. And then by actively questioning the way one draws, one could see a change or atleast a shift to new ways of thinking and by extension, building.

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