IMAGE MANIPULATION: A POST-ORTHOGRAPHIC DESIGN MEDIUM

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ABSTRACT

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This thesis initially aims to reveal representational processes considered as "natural" to architecture. Based on the fact that architecture is reliant on its image, these processes are revisited in their technical terms in order to be able to "denaturalize" architectural design process. Particularly, the consideration of drawing and its technical qualities as inherent to architecture disguises the limitations they impose on the architectural work. Also, the institutionalization of drawing in the educational settings of architecture obscures the necessity to re-question these limitations. The thesis reasons these limitations through the linear rule of drawing and its reliance on bodily performance. Following John May's proposition that "Everything is Already an Image," image manipulation is explored as a "post-orthographic" design medium eliminating the fragmentation and mechanization of design process, which are the consequences of linearity and embodiment of drawing. The thesis also speculates on how imaging techniques render certain practices of contemporary architectural education redundant, incompatible, or even detrimental.

Keywords: Post-orthography, Embodiment of Representation, Imaging, Image Manipulation, Architectural Education

ÖZ

ORTOGRAFİ SONRASI TASARIM ORTAMI OLARAK GÖRSELLEME

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Bu çalışma mimarlığa içkin olduğu düşünülen temsil süreçlerini ortaya çıkarmayı amaçlar. Mimarlığın, kendi görseline bağlı olduğu düşünülerek, mimari tasarım surecini içkinleştirilmiş olgulardan arındırmak adına bu temsil süreçlerini teknik bağlamlarında tekrar sorgulamaya açar. Özellikle, çizim ve teknik niteliklerinin mimarlığa içkin olduğu varsayımı, çizimin mimarlık işlerine getirdiği kısıtlamaların görünürlüğünü azaltır. Ayrıca, çizimin eğitim ortamlarında kurumsallaştırılması, bu kısıtlamaların sorgulanması gerekliliğini de engeller. Çalışma bu kısıtlamaları çizimin doğrusal isleyişi ve bedenselliği aracılığıyla gerekçelendirir. John May'in "Everything is Already an Image" söylemi üzerinden, doğrusallığın ve bedenselliğin sonuçları olan tasarım sürecinin ayrışmasını ve mekanikleşmesini ortadan kaldıran, otografi sonrası bir tasarım ortamı olarak görsellemeyi inceler. Çalışma aynı zamanda görüntüleme tekniklerinin belirli güncel mimarlık eğitimi pratiklerini nasıl gereksiz, çelişkili ve hatta olumsuz kıldığını tartışır.

Anahtar Kelimeler: Ortografi Sonrası, Temsilin Bedenselliği, Görüntüleme, Görselleme, Mimarlık Eğitimi

To my family and to all the “others”

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CHAPTER 1

INTRODUCTION

Roland Barthes introduces the conception "naturalization" as the transformation of history into nature.[1] This is to say that naturalization masks historical phenomena as natural and inveterate. While talking on the perception of painting, Norman Bryson refers to naturalization as the state of unconsciousness and imperceptiveness of the essential content of the formation in question.[2] On account of Bryson, what is naturalized becomes apathetic, inactive, and well blended in its native settings.[3] The adjustment of naturalization into the appreciation of painting by Bryson provokes the idea of a quest for the naturalized occurrences in architectural representation.

In his seminal article "The Education of the Innocent Eye," Kazys Varnelis, for instance, says that definition of a design work with reference to its elemental parts like lines, planes, points, volumes etcetera and to their modifications like rotation, shear,

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[1] Roland Barthes and Richard Howard, *Mythologies* (New York, NY: The Noonday Press, 1991), 128. However, it should be noted that Barthes first refers to the term in both noun and verb forms (*naturalization*, *naturalisé* or *naturaliser*) in 1957 as the main principle of myths. The term "naturalization" is the literal translation of the French word *naturalisation* hence it does not denote a situation of inactivism, equilibration or counteraction. In addition, the terms, conceptualizations or scientific revelations included in the text do not follow a chronological order. Rather, they are approached by certain notions including "naturalization," "linearity," or "post-orthography." Ayşen Savaş shall be credited for these clarifying remarks.

[2] Norman Bryson, *Vision and Painting: The Logic of the Gaze* (New Haven, CT: Yale University Press, 1986), 69.

[3] Bryson, 73.

compression, collision is an impulsive approach of the architects.[4] He further states that understanding of architecture through this spatial language is assumed to be "universal" and "timeless" in educational settings and was even codified as such in certain books including "Architecture: Form, Space, and Order" by Francis Ching.[5] However, this spatial language developed for the understanding of architecture is a construct by a particular coterie and historical framework - which misrepresents itself as natural – and is far from being "a universal truth."[6]

Varnelis seeks the traces of prevailing educational approaches in the mindset of Enlightenment through the novel *Émile* by Jean-Jacques Rousseaux, first published in 1762. The education of the protagonist of the novel involves in the experiential endeavors such as weaving in order to learn about fabrics rather than studying the facts regarding the fabrics.[7] As stated by Varnelis,[8] Rousseau's thoughts on education in *Émile* instigated Johann Heinrich Pestalozzi to develop a system of pedagogy for children which was, to Pestalozzi, based not upon concepts but rather upon such primary actions as "striking and carrying, thrusting and throwing, drawing and turning, encircling and swinging."[9] This suggests that student's bodily involvement with the subject matter to be learned was the initial concern in Pestalozzi's pedagogy. Pestalozzi argued that in order for a child to genuinely comprehend a real-life object,

[4] Kazys Varnelis, "The Education of the Innocent Eye," *Journal of Architectural Education* 51, no. 4 (1998): 212.

[5] Varnelis, 212.

[6] Varnelis, 212.

[7] Varnelis, 213.

[8] Varnelis, 213.

[9] Johann Heinrich Pestalozzi et al., *How Gertrude Teaches Her Children: An Attempt to Help Mothers to Teach Their Own Children and an Account of the Method*, Standard Teachers' Library (C.W. Bardeen, 1898), 177.

he or she should reproduce it by drawing.[10] For Pestalozzi, drawing would allow students to represent their observations through abstractions constituted of "an alphabet of geometric forms," including lines, shapes, and angles since he believed that geometric relations reveal the harmony of nature.[11] As explained by Zeynep Çelik Alexander, this drawing based pedagogical system to produce abstraction through bodily perception of the environment, developed by Pestalozzi and later advanced by his student Friedrich Froebel at the turn of the 19th century for the children at the early years of schooling, found its way into the drawing classes with various content appeared under the names of *Vorkurs, Vorlehre* or *Vorshule*, in higher-level educational institutions like the Debschitz School in Munich or Endell's Formschule in Berlin in 1902 and 1903, and later in the Bauhaus in 1919.[12] As Alexander also explains, having its roots in Pestalozzi's school, the idea of "nondiscursive and nonconceptual knowledge" produced through "body's experiential exchanges with the world" evolved into modern design education at the Bauhaus.[13] Since then, drawing as an embodied technique of representation forces itself into entirely different geographical, institutional, and technological contexts since it has long been naturalized in the educational settings of architecture, where this process of naturalization begins.

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[10] Varnelis adds, "Pestalozzi felt that teaching children words for things they had not yet seen would replace actual perceptions with conventional interpretations, filling children's minds with meaningless signifiers;" Varnelis, "The Education of the Innocent Eye," 213.

[11] Varnelis, 214.

[12] Alexander adds "*Kunstgewerbeschule der Mitteldeutschen Kunstgewerbevereins* in Frankfurt am Main under Ferdinand Luthmer, the *Staatliche Kunstgewerbeschule* in Hamburg under Richard Meyer, and the *Königliche Akademie für graphische Künste und Buchgewerbe zu Leipzig* under Max Seliger, among many others offered preliminary courses at the same time as the Bauhaus;" Zeynep Çelik Alexander, Kinaesthetic Knowing: Aesthetics, Epistemology, Modern Design (Chicago and London: The University of Chicago Press, 2017), 176.

[13] Alexander, 200.

Because architecture is reliant on its image (as explained by Robin Evans), this thesis initially considers it necessary to revisit the concept of representation in its technical terms in order to be able to denaturalize the architectural design process. Hence, following John May's axiom, "there are no pre-technical forms of thought," the following chapter "Representation as Design Media" acknowledges that the technicality of representation underlies this interdependency. Later in the second subchapter, on the ground of Mark Hewitt's statement that "thinking" is coupled with "seeing" and "drawing" during the act of designing, the interplay of these three activities is revisited in the context of initial design phases. With the aid of Gabriela Goldschmidt's reflections on the experiment by Esther Adi-Japha, Iris Levin, and Sorin Solomon conducted in 1998 on the children's drawings, this subchapter concludes that representation guides entire mediation of brain, hand, and eyes. The last subchapter concentrates on drawing and how it is drawing as a representational technique that defines the tectonics and materiality of the design object. To do so, Robin Evans' examination of Albrecht Dürer's drawing plate of the 16th century is taken as an exemplary case as discussed in "Arch723 Advanced Architectural Design Research Studio" in Fall 2016 moderated by Ayşen Savaş.

The third chapter, "Representation as a Constraint of Architectural Design," takes a critical stance on representation. Firstly, the linear model of time orthographic representational techniques initiate, which tides the future possibilities to historical precedents, is considered as the main reason for the fragmentation of the awareness over the design work. As John May states that the orthographic ("gestural-technical") rule of drawing leads to mechanization on the operation of drawing, the following subchapter approaches design as a bodily performance to unfold the bodily procedures of thinking, seeing and drawing that initiate mechanism in the early design phases. It should be noted that although this subchapter on the embodiment of the design process primarily draws upon the findings of neuroscience referred to in Harry Francis

Mallgrave and Juhani Pallasmaa, what this thesis claims is indifferent to their suggestions on the sensual or phenomenological progression of architectural design.

The fourth chapter, “Imaging as a Technique of Representation for Architectural Design,” discusses the post-orthographic technical aspects of imaging. The chapter sets forth image manipulation as a design medium, which eliminates the deficiencies associated with drawing including linearity and mechanization.

The final chapter, conclusion, exploits research outcomes by “Aggregate,” an architectural history collaborative affiliated with scholars from the architectural community in Northern America. Notably, “Kinaesthetic Knowing: A nineteen-century epistemological principle” as referred by Zeynep Çelik Alexander, the statistical thinking associated with post-orthographic mediums of imaging introduced by John May, and the brief history of rendering by Lucia Allais offer highly stimulating insights to disclose naturalized practices, which post-orthography renders redundant, incompatible or even detrimental, in the contemporary educational settings and to speculate on the novel means of design education.

CHAPTER 2

REPRESENTATION AS DESIGN MEDIA

2.1. The Emergence of Thought: "Medium is the Message."

> "There are no pre-technical forms of thought, which is to say the notion that our ideas and thoughts can exist outside of their technical formation is perhaps one of the most pervasive fallacies of modern life."[14]

The quotation above by John May, suggests that even the thought in mind emerges with a form of technicality. Cited in May, André Leroi-Gourhan argues that so much as the primitive modes of thought and expression of humanity, including prelinguistic ideographic, pictographic, cuneiformic ones were entirely formed through "technical-gestural" performances of marking, inscribing, and engraving.[15] May further states that nothing is merely technical, which is to say that even the prosaic practices of daily technical routines reflect the tacit intellectual features of the practices in question.[16]

Much earlier to May's statements in 2017, in his book "Understanding Media: The Extensions of Man," published in 1964, Marshall McLuhan elaborates on the

[14] John J. May and Lucia Allais, *Newish Media: A Conversation with Lucia Allais and John May* (The USA: Harvard University, GSD Talks, 2017), https://youtu.be/gqCUh16R4yw.

[15] John J. May, "Everything Is Already an Image," *Log* 3, no. 40 (2017): 9.

[16] May, 10.

ingrainedly emergence of the ideas within their technical medium.[17] According to McLuhan, it is medium that manipulates the interaction of the audience and content, yielding to different inferences of the content.[18] Theorized as "The Medium is the Message," McLuhan briefly states that the medium itself delivers the idea rather than its content.[19] He justifies this claim by saying that the content of any medium is just another medium, as in the case of text whose content is speech, which is the medium of thought.[20] Thought itself is a medium, as also explained by May, whether nonverbal or not, surfaces within its own technicality.

2.2. The Interrelated Relation of Thought, Vision, and Representation

What can be deducted from the interdependency of medium and its message is that the development of thought in the context of architectural design is also inseparable from its technicality.[21] As Robin Evans explains within his conceptualization of "projection," design arises through the connected (by projection) mediation of mind, eyes, and hand.[22] These three agencies perform respectively "thinking," "seeing," and

[17] Marshall McLuhan, *Understanding Media: The Extensions of Man* (New York, NY: McGraw-Hill, 1964).

[18] McLuhan, 2.

[19] McLuhan, 2.

[20] McLuhan, 1.

[21] For instance, according to Johnathan Hill, the word "design" derives from the Italian word *disegno*, meaning both "drawing a line on a paper" and "drawing forth an idea;" Jonathan Hill, "Drawing Research," *The Journal of Architecture* 11, no. 3 (June 1, 2006): 2.

[22] Robin Evans, *The Projective Cast: Architecture and Its Three Geometries* (Cambridge, MA: The MIT Press, 2000), 363.

"drawing," which are, to Mark Hewitt,[23] the fundamental operations of design. Consequently, design is governed by the technicalities of thinking, seeing and representing.

Decomposing the initial design process helps to illustrate the connection between these fundamental operations of design. As indicated by Stephen Kosslyn, a psychologist and neuroscientist, the projection of a mental image is a standard method applied to seek and test a solution to any sort of problem.[24] Regardless of the fact that design is a visual matter, these issues solved through mental images include design problems. In fact, Gabriela Goldschmidt claims that mental imagery serves as the most effective cognitive faculty during the act of designing.[25] She also states that sketching extends the imagery in mind into an external realm.[26] Considering the fact that sketching is a representational technique, it is possible to claim that representation materializes the visual thought in mind. The vision projects what is represented in the

[23] Mark Alan Hewitt, "Representational Forms and Modes of Conception: An Approach to the History of Architectural Drawing," *Journal of Architectural Education (1984-)* 39, no. 2 (December 1, 1985): 2.

[24] Stephen Michael Kosslyn, W. L. Thompson, and G. Ganis, *The Case for Mental Imagery*, Ox Psych Series (Oxford University Press, 2009), 3. More recently, citing António Damásio, the head neuroscientist at the Brain and Creativity Institute of the University of Southern California, Mark Hewitt states that "all cognition uses images; they are the currency of the mind. All mind is made of images. From the representation of objects and events to their corresponding concepts and verbal translation, images are the universal token of mind;" Mark Alan Hewitt, *Lecture Series: Mark Hewitt | Crafting, Depicting, Assembling: A Cognitive Overview of Architectural Design* (The USA: New School of Architecture & Design, 2019), https://youtu.be/lENrOCOzNMo.

[25] Gabriela Goldschmidt, "The Backtalk of Self-Generated Sketches," *Design Issues* 19, no. 1 (2003): 82.

[26] Goldschmidt, 82.

external realm - regardless of its medium - into mind leading to the circular interplay of thought, representation, and vision between the internal and external realms.

Juhani Pallasmaa reassures this point by addressing design process as "a direct and delicate collaboration and interplay" of hand and mental imagery.[27] Pallasmaa also says that the order in which "the line," "the thought," or "the intention" come into being cannot be known.[28] In addition, referring to sketching, Goldschmidt states that, although the process of representation is informed by the mental imagery, it is highly likely that the developing relations of different sketch components like lines, dots, hatches, etc., may lead to unintended creations.[29] The interpretations of these relations of different sketch components emerge as new information, which intervenes in the design process.[30] Goldschmidt also states that the way sketches are produced not exclusively premeditated in mind.[31] Simply, depending on the various criteria, including experience and ability to sketch, the likeness of the mental image and sketch may vary. These varieties yield to specific pieces of drawing assigned with a new meaning[32] in the context of the sketch.[33] Therefore, what is drawn, even by a two-years-old, is a product of not only the subject matter and the intent of the drawing but

[27] To consolidate his claim, Pallasmaa cites Berger's conceptualization of "dialectic interaction of external and internal reality" as "Every line I draw reforms the figure on the paper, and at the same time it redraws the model, because it changes my capacity to perceive;" Juhani Pallasmaa, *The Thinking Hand: Existential and Embodied Wisdom in Architecture*, Architectural Design Primer (Wiley, 2009), 91–92.

[28] Pallasmaa, 92.

[29] Goldschmidt, "The Backtalk of Self-Generated Sketches," 83.

[30] Goldschmidt, 83.

[31] Goldschmidt, 73.

[32] Goldschmidt uses the term "meaning" in its simplest sense.

[33] Goldschmidt, "The Backtalk of Self-Generated Sketches," 73.

also of the interpretation of the characteristics and geometrical features of sketches.[34] In other words, inferences from the sketches – incidental or not – expands the problem space, within which novel arguments arise.[35] This is how Goldschmidt explains the sketching's involvement in design process. As she briefly summarizes, sketching modulates the problem space of design.[36]

On the other hand, it can be said that these unintended creations emerge through the operation of any other representational technique. "X-Ray Drawings" by Zaha Hadid, for instance, were created by overlaying the diagrams of different floor levels drawn on the tracing paper. Each of these diagram layers was developed in relation to the previous one. Even though these diagrams are lacking the uncertainty of sketch lines since they are composed of decisively drawn angular lines, each of them continually updates what is already drawn and projected into mind.

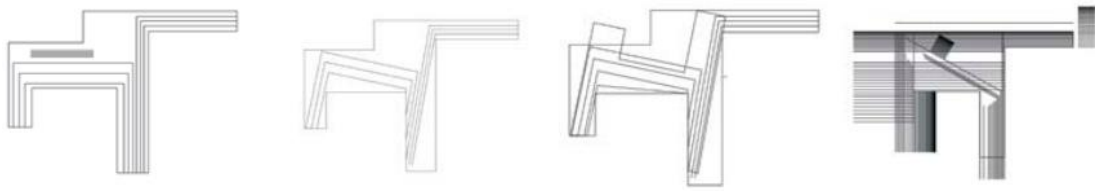

Figure 2.1. Overlaid diagrams by Zaha Hadid.

Source: Zaha Hadid and Todd Gannon, Zaha Hadid: BMW Central Building (Princeton Architectural Press, 2006), 18.

[34] Goldschmidt refers to an experiment performed by Adi-Japha, Levin and Solomon, where a nine years old attribute a lady in the sketch as pregnant whom she accidently adorned with a larger belly; Goldschmidt, 73.

[35] Goldschmidt, 79.

[36] Goldschmidt, 80.

In a similar but more theoretical manner, Evans explains, even though drawing suspends and fixes the relations of objects and their drawings with the agency of the imaginary projection lines, the imagination of the drawing's observer turns these frozen and linear relations into "a series of eddies and circuits."[37] He states that a mental picture enables the envision of the representation as real even before what is represented is not brought into existence.[38] It is imagination that reshapes and is reshaped by what is seen within the guidance of vision.[39] This is why drawing serves as the locus of speculation within the dynamic distance between the ideas and the objects.[40]

Evans also indicates that the source of imagination is not exclusively the mind of the architect.[41] Any technique of drawing, including orthographic projection, passively embodies the imaginative intellect as it is created by an intense effort of imagination.[42] For this reason, to Evans, the imaginative intelligence embedded in the technique is activated in the mind of the designer whenever the technique is employed.[43]

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[37] Robin Evans, "Architectural Projection," in *Architecture and Its Image: Four Centuries of Architectural Representation: Works from the Collection of the Canadian Centre for Architecture*, ed. Eve Blau and Edward Kaufman (Montreal: Centre Canadien d'Architecture/ Canadian Centre for Architecture, 1989), 19–20.

[38] Evans, 20.

[39] "Imagination works with eyes open. It alters and is altered by what is seen;" Evans, 20.

[40] Evans, 20.

[41] Evans, 21.

[42] Evans, 21.

[43] Evans, 21.

As Evans uses the term “drawing” to signify different modes of representation including sketching, orthogonal or perspectival drawing, mapping, and painting throughout the chapter “Architectural Projection,” the interaction of imagination, vision, and drawing induced from Evans’ statements on drawings can be attributed to the conception of representation. Consequently, it is possible to conclude that representation in any medium modulates the entire mediation of the brain, hand, and eyes through which design is produced.

2.3. The Interdependency of Representation and Design

> “Yet is there not, in fact, a constant interplay between the passive portrayal and the active remodeling of reality?”[44]
>
> “At present we are only just beginning to investigate the power that drawings and photographs have to alter, stabilize, obscure, reveal, configure, or disfigure what they represent. Whatever the final outcome of these investigations, we can be certain of one thing in the meantime: architecture is reliant on its own pictures to far greater extent than has hither to been recognized.”[45]

The previous subchapters discuss that the emergence of thought is inseparable from its technicality and how it is representation that implicates in the design process in-between thought and vision. This subchapter moves the discussion from the correlation of vision, thought and representation to the correlation of representation

[44] Evans, 20.

[45] Evans, 21.

and the architectural design work. In simple terms, it explores the governance that representation holds over the different extents of architecture.

First of all, Evans' examination of Albrecht Dürer's drawing plate in Figure 2.2 helps to unfold the way representation guides the tectonics of its object. Evans refers to the drawing plate of a fortress by Dürer as the earliest printed example of the orthographic set illustrating plan, section, and elevation formats together.[46] Even though the imaginary projection lines between these three formats are literally invisible in the plate, it is through projection that the locations of the inclined and battered arches on the curved and inclined wall are decided.[47] The narrower appearance of the arches on the ends of the elevation proves that the positions of the equally distanced arches of the same size on the plan have been taken as a reference to reflect them onto the elevation. Since it would not be possible to draw the arches on a curved and inclined surface with a compass, Evans states that these arches were mapped on the elevation with the aid of projected positional information.[48]

[46] Evans, 21.

[47] Evans, 22.

[48] Evans, 22.

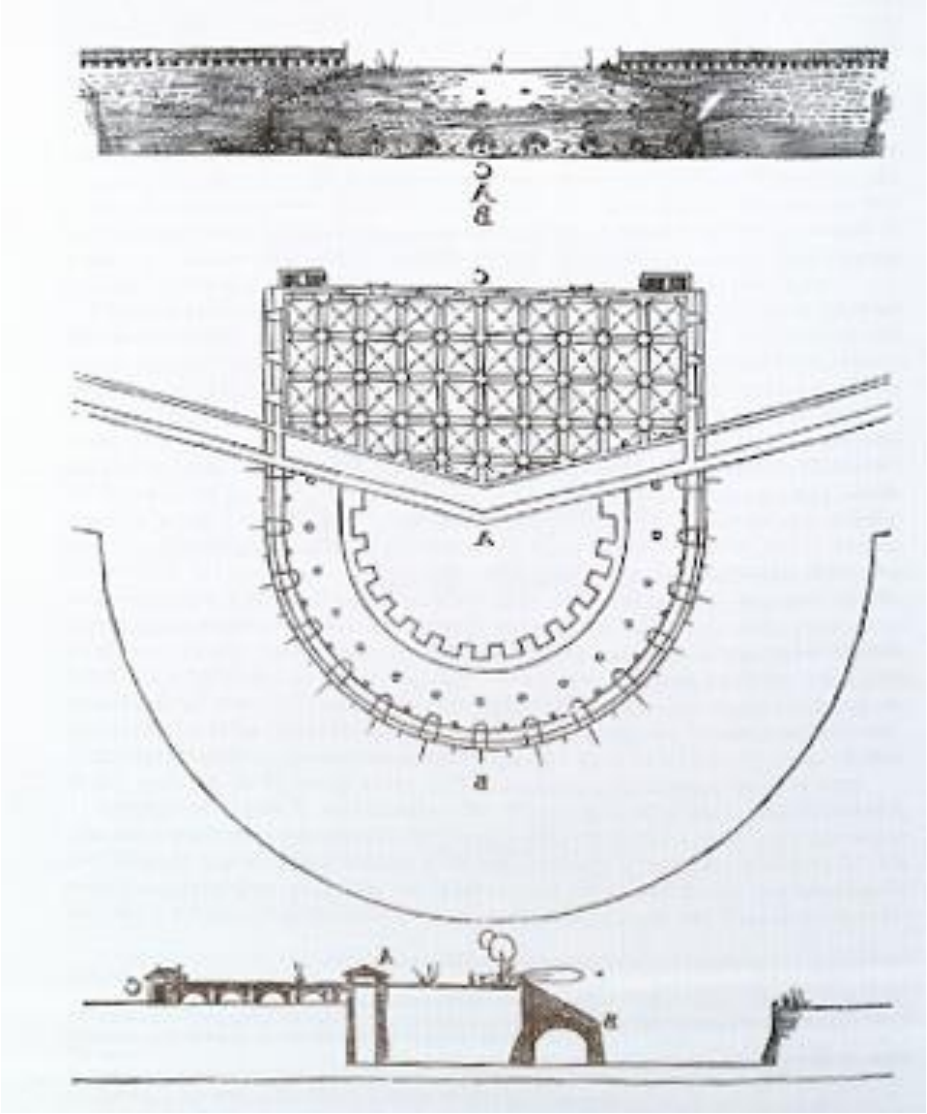

Figure 2.2. Albrecht Dürer's drawing plate of a fortress, 1527.

Source: Robin Evans, "Architectural Projection," in *Architecture and Its Image: Four Centuries of Architectural Representation: Works from the Collection of the Canadian Centre for Architecture*, ed. Eve Blau and Edward Kaufman (Montreal: Centre Canadien d'Architecture/ Canadian Centre for Architecture, 1989), 22.

Based on these premises of Evans, it is possible to highlight a particular point: projection defines not only the shapes in the drawing but also the way articles in the drawing are produced. As they are integral parts of each other, it is not possible to

delineate the forms of the arches and the wall separately.[49] With circulating information among plan, section, and elevation, projection enables the calculations of each piece without the help of their tridimensional models or built form. Had the fortress been built by casting mold, the common practice of building would have rendered the drawing unnecessary. However, drawing supplies all the required information for the construction of the fortress by cut stone.[50] In other words, the way design is represented defines its implementation, making the object reliant on its image.

It should be noted that this interdependence of design and its representation is evident in other aspects of architecture in addition to its method of construction, tectonics, and materiality, as explained above. Briefly, according to Goldschmidt, paper became available to designers in the late fifteenth century in Europe, with the developing paper manufacturing upon the increasing demand for the printing presses.[51] The availability of paper provided the designers with a medium of experimentation with their ideas. As Cammy Brothers explains, paper replaced tax tablets and parchment, which were expensive hence reused for the following projects.[52] While it was the malleability of wax and parchment that enabled their reusage, it also led to the erasure of the thoughts the previous drawings initiated and to the prevalence of the traces of the "conventional formulae."[53] To Brothers, paper marks the moment of the outbreak of a design process, which begins on a surface clear of any reference to precedence and continues within

[49] Evans, 23.

[50] Evans, 23.

[51] Goldschmidt, "The Backtalk of Self-Generated Sketches," 80.

[52] Cammy Brothers, *Michelangelo, Drawing, and the Invention of Architecture* (New Haven and London: Yale University Press, 2008), 11, 12.

[53] Brothers, 12.

the guidance of its own progress.[54] Brothers states that the portfolio containing the drawings of antiquities stands for the architect's proficiency of Roman architecture for the potential commissioners.[55] The act of drawing prevailed even though the printing press enabled the circulation of architectural picture-books providing copious amounts of sources to classical forms even for the ones far from Rome.[56] For the sixteen-century architects, drawing offered "a form of research, investigating the materials, ornaments, orders, and compositions of ancient buildings and in the process assembling a toolkit of reusable ideas."[57]

Therefore, this case illustrates that the interdependency of design and its representation shifted the way designers used to progress their work. Moreover, this shift was inserted by the technicality of the medium in which representation took place.

[54] Brothers adds, "From this point of view, the use of paper marks the triumph of the archive," Brothers, 11, 12. Goldschmidt notes that the experiments on paper were called *"pensieri,"* which mean "thoughts" in Italian; Goldschmidt, "The Backtalk of Self-Generated Sketches," 80.

[55] Cammy Brothers, "What Drawings Did in Renaissance Italy," in *Companions to the History of Architecture, 4 Volume Set*, ed. Harry Francis Mallgrave and Alina Payne, vol. Volume 1 (Hoboken, NJ: Wiley-Blackwell, 2017), 5.

[56] Brothers, 6.

[57] Brothers, 8.

CHAPTER 3

REPRESENTATION AS A CONSTRAINT OF ARCHITECTURAL DESIGN

> "Materiality, physicality and corporeality must be edited out of drawings in order for drawings to express themselves."[58]

Even though there is an extensive body of research discussing the interdependency of design and its representation, the issue has been addressed unilaterally, ignoring the two folded nature of representation as "enabler" and "constrainer." While this interdependency of design and its representation has been widely studied in regard to the affirmation that representation brings design into being, searches on the literature reveal that the delimiter character of representation has received very little attention from the scholarly realms. It is possible to claim that consideration of certain techniques like drawing and their technical qualities as natural to architecture disguises limitations they impose on the representational processes and the necessity to re-question the engagement of architecture with them.

In one of her interviews conducted in 2004, Hülya Yürekli explains that the ability to draw interferes with and hinders the thinking process of some students while she was expressing her opposing ideas on the admission of students into architecture schools based on a drawing aptitude test.[59] To Yürekli, students may engage with the formalist

[58] Noam Andrews, "The Architectural Gesture," *Log*, no. 33 (2015): 137.

[59] Gülcin Ipek, Hülya Yürekli, and Ferhan Yürekli, "'Mimarlık: Bir Entelektüel Enerji Alanı,'" yapi.com.tr, 2004.

tendencies imposed by what they can already and skillfully draw.[60] Marjan Colletti also adopts a critical stance on the employment of hand drawing for architectural design. His concern focuses on studio critics. Cited in Peter Cook's book "Drawing the Motive Source of Architecture" in 2008, Colletti confesses that the sketches he produces for his students become eventually alike.[61] He prefers to explore beyond "what can be drawn" rather than restricting the representation by the extent of his "gifted hand."[62] It is possible to read a much clearer critical statement about the restrictive character of representation in the arguments of John May. In his article "Everything is Already an Image," published in 2017, May states that orthogonal representation techniques lead to mechanization in the operation of the technique concerned.[63] Drawing is ruled by specific tools and gestures. Hand becomes predictable and controlled even during the act of "so-called" free-hand drawing due to the mechanized bodily actions.[64] Therefore, considering the interrelated mediation of thought, vision, and representation, it is possible to argue that mechanization of the representation techniques makes design bounded by the way it emerges, beginning from the initial stages of thought. In relation to mechanization, fragmentation of design process emerges as another conception to explore the restrictive character of representation as design requires instant and total awareness over the work.

[60] Ipek, Yürekli, and Yürekli.

[61] Peter Cook, *Drawing: The Motive Force of Architecture* (West Sussex: John Wiley & Sons, 2008), 218.

[62] Cook, 217.

[63] May, "Everything Is Already an Image," 11.

[64] May, 11.

Accordingly, this chapter initially revisits the phenomenon of linearity in the context of orthography. Later on, it revisits the acts of thinking, seeing, and representing as bodily activities to unfold the bodily implications of these three acts on mechanization.

3.1. Orthography as Representation: Fragmentation of Design Process

> "The specific conception of time embedded in a technical system is inseparable from the forms of thought and imagination it makes possible or impossible."[65]

John May's quotation above suggests that technical systems are tied to their own understanding of time.[66] This is to say that the pace thoughts and actions are registered in any technical medium guides the ways of perception of those thoughts and actions.[67] For instance, regardless of written or drawn content, orthography operates on the linear mode of time within which the content was formed by "rule-bound lines with beginnings and ends."[68] Driven by geometric gestures, orthography imprints preconceptions as intelligible lines and texts.[69] As simply put by John May,

[65] May, 10.

[66] May, 10.

[67] May, 10.

[68] John May defines orthography as "something like "straight scratching," or more precisely correct scratching/digging/inscribing;" May, 14.

[69] May explains, "orthographic reasoning transformed a preconceptual visual world of mythical markings, always arranged in a non-linear, associative fashion, into linear depictions of the world." Respectively, he states orthography and history coemerged and presents two reasons for it. The first one is "recording and archiving of events" enabled by the lines and texts of orthography. The second and more sophisticated one is "a historical sensibility in which the

"orthography was predicated on linear historical time, materialized in texts, drawings, and mechanical clocks."[70] For this reason, reading any text or drawing produced in the orthographic regime rises a "historical consciousness" as their production based on a laborious process.[71]

In his book "Drawing Distinctions: The Varieties of Graphic Expression," Patrick Maynard provides more technical explanations for the linearly formation of orthography. Referring to Philip Rawson, Maynard states any drawing is underlain by a latent movement pattern given that "drawing is done with a point that moves."[72] Cited in Maynard, Elderfield states that drawing documents and displays the actions of the drawing hand since a drawing is "a network of recorded movements."[73] According to John Elderfield, the time through which the movement produced drawing is ingrained in the drawing.[74] It is for this reason that the acts of both drawing and reading the drawing involve in the retrieval of "these movements, their duration and their accumulation" in mind.[75] What is meant by "historical consciousness" in

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past was tied to the future" produced by "the character and speed of that recording and archiving capacity;" May, 14,15.

[70] May, 19.

[71] May briefly states "Thus the act of drawing was always an act of drawing the historical present, and the drawing itself (in its labor time) was a "stage" of history – not the textual-phonetic history of historians but rather the silent tectonic history of architecture past;" May, 17.

[72] Patrick Maynard, *Drawing Distinctions: The Varieties of Graphic Expression* (Ithaca: Cornell University Press, 2005), 190.

[73] Maynard, 190.

[74] John Elderfield, *The Drawings of Richard Diebenkorn*, ed. John Elderfield, 2nd ed. (New York: Museum of Modern Art, 1988), 190.

[75] Elderfield, 9.

May's statements is these retrievals. Also, it is possible to argue that the process signifying drawing's technical progression is apparent in the drawing.

In the case of architecture, Stan Allen more specifically indicates that "building is both imagined and constructed from accumulated partial representations."[76] Design object is conventionally developed on the two-dimensional surfaces of a transparent box assumingly enframing the object (Figure 3.1).[77] Certain guidelines of projection and representation incorporate the segments on these imaginary surfaces into a virtual whole called architectural design.[78]

[76] Stan Allen and Diana Agrest, *Practice: Architecture, Technique and Representation*, ed. Saul Ostrow, Critical Voices in Art, Theory and Culture (London: Routledge, 2003), 151.

[77] Allen and Agrest, 151.

[78] Allen and Agrest, 151.

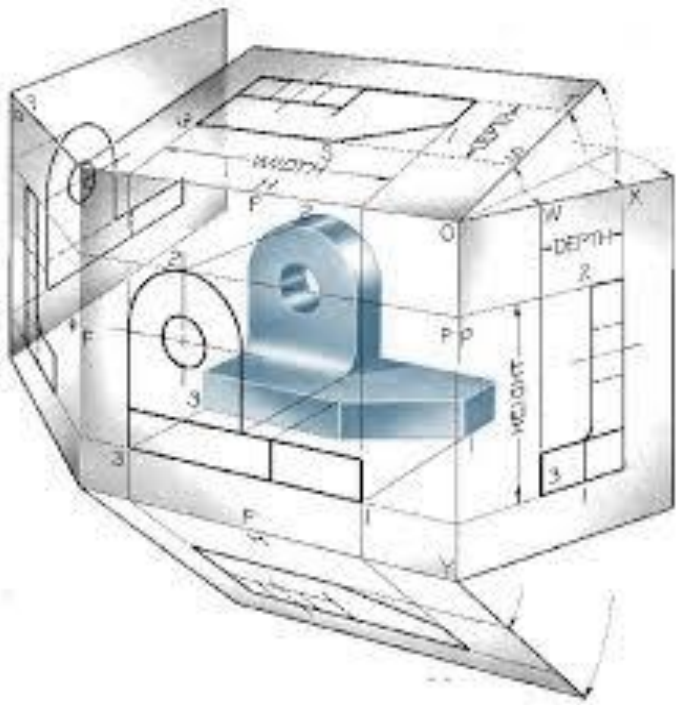

Figure 3.1. Transparent box enframing the design object.

Source: Stan Allen and Diana Agrest, *Practice: Architecture, Technique and Representation*, ed. Saul Ostrow, Critical Voices in Art, Theory and Culture (London: Routledge, 2003), 144.

These statements suggest that within the orthogonal set, architects work on the dissected parts of the work. Called plan, section, and elevation, these dissected parts, according to Evans, can be created individually.[79] While even the juxtapositions of these parts may not necessarily evoke the idea of projection, the relations of these parts are established by the agency of projection. Projection continuously compromises the different and innate instructions of these parts. It is possible to claim that this compromisation process takes place on an individual or binary basis. The orthographic projection reflects any particular modification on one part to another respectively.

[79] Evans, *The Projective Cast: Architecture and Its Three Geometries*, 113.

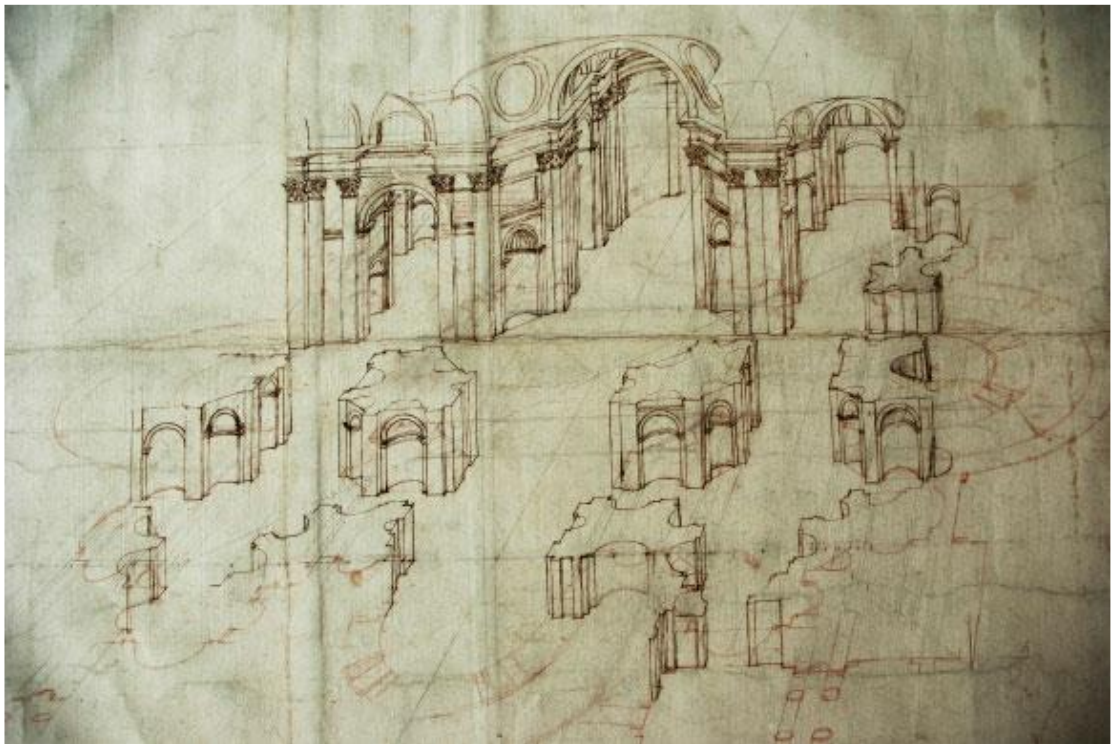

Figure 3.2. “Baldassare Peruzzi, design for Saint Peter’s, pen and ink, black and red chalk, stylus, 53.8 × 67.7 cm.”

Source: Cammy Brothers, “What Drawings Did in Renaissance Italy,” in *Companions to the History of Architecture, 4 Volume Set*, ed. Harry Francis Mallgrave and Alina Payne, vol. Volume 1 (Hoboken, NJ: Wiley-Blackwell, 2017), 13.

The drawing for Saint Peter’s by Baldassare Peruzzi in Figure 3.2 helps to explain that orthography can only operate linearly. The drawing simultaneously depicts the views of the building otherwise seen in different planes. It includes both horizontal and vertical sections on different levels, a distorted ground plan, perspectival views of both interior and exterior surfaces of the building.[80] Cammy Brothers claims that the drawing evokes the idea of temporality as the distorted plan suggests a process of conception, and the piers in different height, as well as the back wall fully formed,

[80] Brothers, “What Drawings Did in Renaissance Italy,” 10.

implies the course of construction and execution.[81] In other words, the information constituted by the different modes of drawing corresponds to different stages of design. The availability of this information on a single plane or in a single moment of gaze on the plane connotes McLuhan's interpretation of collage. According to McLuhan, Cubist collage suppresses the ambiguity of perspectival view by providing a sudden understanding of the whole since it enables the holistic perception of information to be extracted from the dissected representations of the work by means of the depiction of these parts in a single two-dimensional setting.[82] In other words, collage offers an instant and a total awareness of the work. Even though Peruzzi's drawing offers the same awareness for its spectators, it was created over time through a gestural process.

During this process, According to Ömer Akın, designers basically engage with two distinct but both hierarchical approaches in order to be able to arrive at an optimal solution among the endless possibilities of compromisation.[83] In his book "A Cartesian Approach to Design Rationality," Akın states that one of them is the "breadth-first" approach, within which designers firstly go through all distinct main options without delving into any of them thoroughly.[84] Designers progress the exploration of all the main options gradually. In the other approach, "depth-first," each main option is completely exhausted before any attention spared to any other main option.[85] Such deep involvement is repeated for each main idea respectively. Both approaches have certain drawbacks. For instance, as Akın says, what is determined in

[81] Brothers, 10.

[82] McLuhan, *Understanding Media: The Extensions of Man*, 12.

[83] Ömer Akın, *A Cartesian Approach to Design Rationality* (Ankara: Middle East Technical University, Faculty of Architecture, 2006), 59.

[84] Akın, 59.

[85] Akın, 59.

an earlier phase of the depth-first process may contradict to any decision to be made in the further stages of design due to the innately related features of the options.[86]

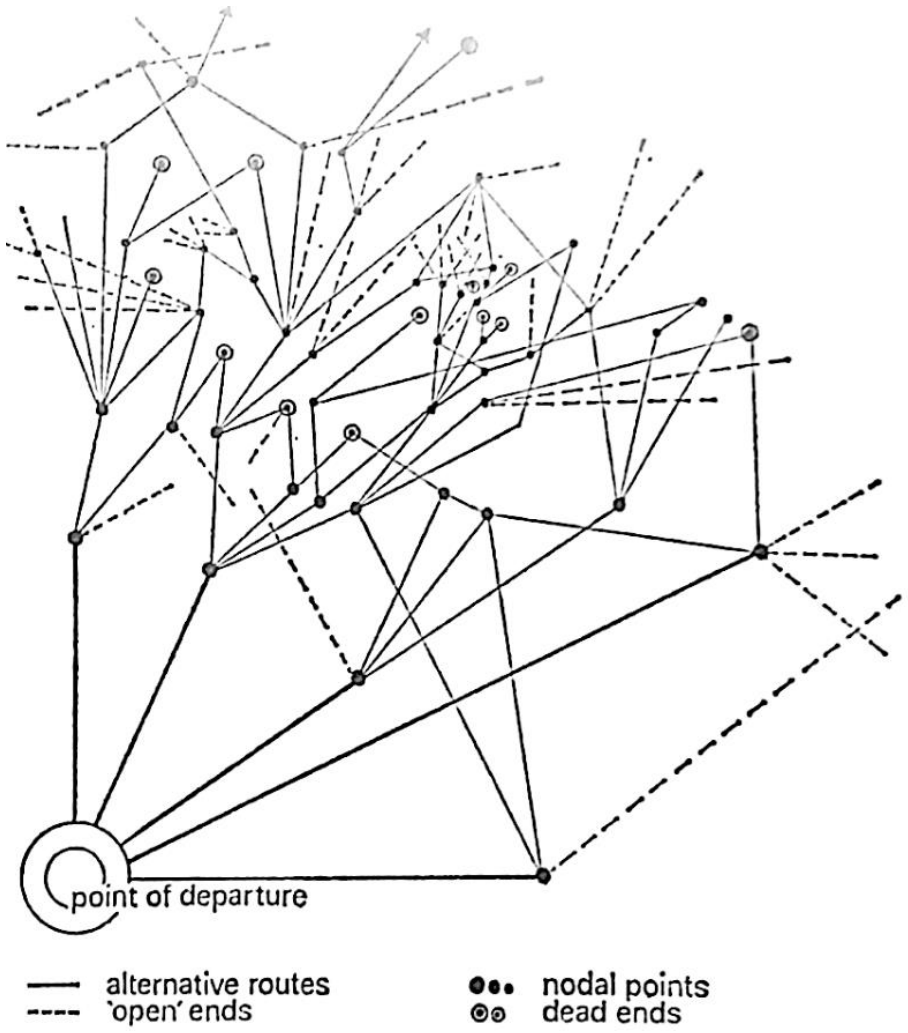

Figure 3.3. "The maze (serial structure) of a creative search."

Source: Juhani Pallasmaa, *The Thinking Hand: Existential and Embodied Wisdom in Architecture*, Architectural Design Primer (Wiley, 2009), 108.

[86] Akın, 59.

This linearity of "creative process" was also acknowledged by Anton Ehrenzweig. In his book "The Hidden Order of Art: A Study in the Psychology of Artistic Imagination," published in 1967, the original caption of Figure 3.3 above[87] reads, "the creative thinker has to advance on a broad front keeping open many options. He must gain a comprehensive view of the entire structure of the way ahead without being able to focus on any single possibility."[88] Even though Ehrenzweig states that the way leads to "correct choice" does not require the consideration of all possible options one by one,[89] according to Pallasmaa, Ehrenzweig's conceptualization of creative thinking as "serial structure" fails to inform the instances like repetitions, revisions, ruptures and re-engagements accompanying thinking processes.[90] While the claim by Pallasmaa can easily be validated for architectural design, it should be noted that these instances only ratify the linearity of design process.

[87] Originally labelled as "the maze of a creative search;" Anton Ehrenzweig, *The Hidden Order of Art: A Study in the Psychology of Artistic Imagination*, Study in the Psychology of Artistic Imagination (Berkeley: University of California Press, 1967), 36.

[88] As cited in Pallasmaa; Pallasmaa, *The Thinking Hand: Existential and Embodied Wisdom in Architecture*, 108.

[89] He suggests, "Any creative search, whether for a new image or idea, involves the scrutiny of an often-astronomical number of possibilities. The correct choice between them cannot be made by a conscious weighing up of each single possibility cropping up during the search; if attempted it would only lead us astray;" Ehrenzweig, The Hidden Order of Art: A Study in the Psychology of Artistic Imagination, 37.

[90] Pallasmaa, *The Thinking Hand: Existential and Embodied Wisdom in Architecture*, 108. Similarly, two decades before Pallasmaa, Akın as well explains that experienced designers tend to combine "breadth-first" and "depth-first" procedures during the initial design phases, since they are able to anticipate any possible constraint that would arise in the further stages of design; Ömer Akın, *Psychology of Architectural Design*, Architecture and Design Science (London: Pion Limited, 1986), 93.

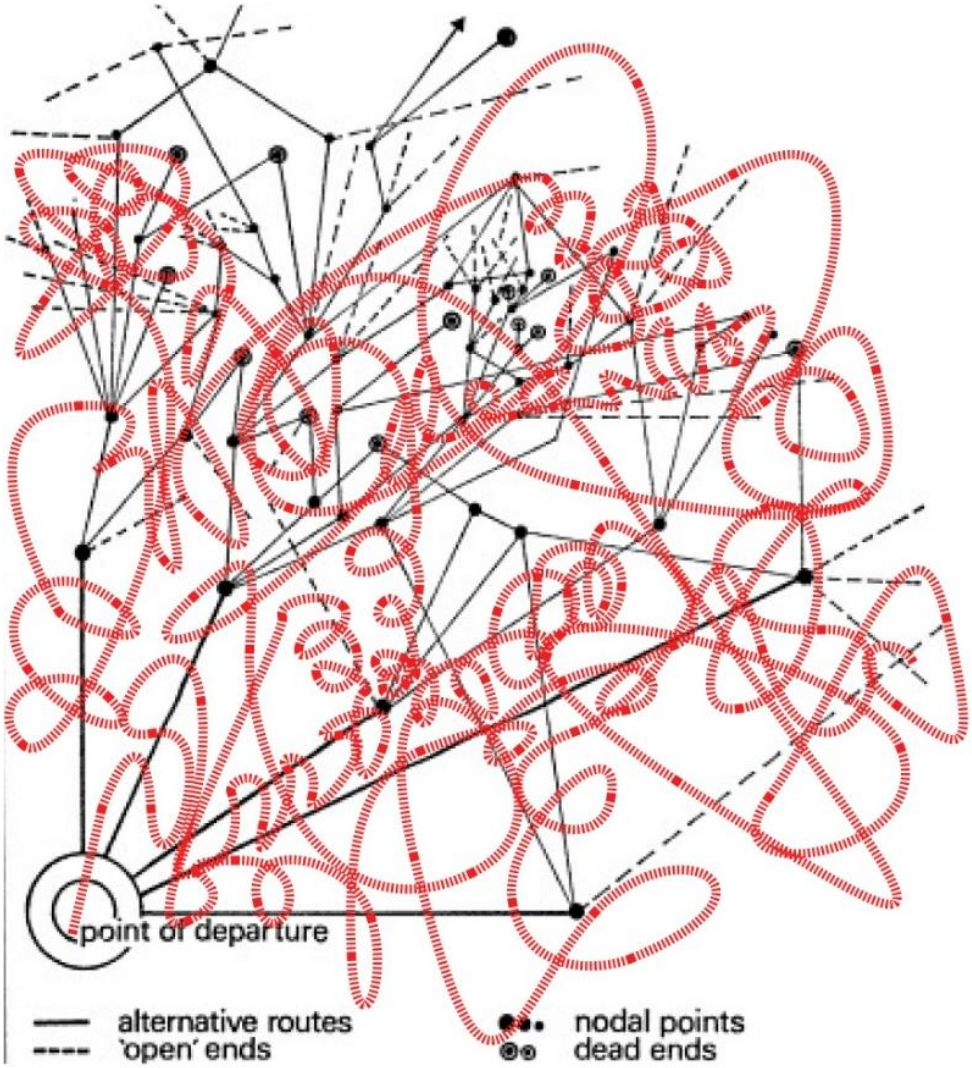

Figure 3.4. Ehrenzweig's creative maze with repetitions, rejections, and crosses.

Figure 3.4, a reproduction of Ehrenzweig's chart, shows that the different patterns designers may involve in to proceed, including Akın's suggestion of combination and Pallasmaa's repetitions, are all linear. According to Ehrenzweig, what requires this linear involvement in the possibilities is "the gestalt-bounded discipline of conscious

perception."[91] John May claims that thinking linearly or historically is not the default faculty of the human brain as he says that the understanding of time was radial before orthography surfaced.[92] May adds, "in orthography, all future architecture was "drawn out from" architecture's past – this is the logic of the precedent, which carried in its technical-gestural structure the geometric inheritance of past instances of order, propositions, symbolic expression, and so on."[93] Drawing, in its labor time, reveals "the silent tectonic history of architecture past."[94]

In this respect, it is possible to claim that what prevents simultaneous understanding of all the consequences of the potential compromises on the design work is the linear rule of orthographic projection itself. Therefore, it can be concluded that it is orthography of the representation techniques that fragments the consciousness over the design work by spreading design process linearly.

[91] What he refers by gestalt-bounded disciple is the differentiated vision of eye that is trained to process figure and ground respectively; Ehrenzweig, *The Hidden Order of Art: A Study in the Psychology of Artistic Imagination*, 31.

[92] May, "Everything Is Already an Image," 17.

[93] May, 17.

[94] May, 17.

3.2. Embodiment of Representation: Mechanization of Design Process

> "[I]t would be overly optimistic to assume that one's perception of the architect's body within the drawing is somehow distinct and outside of the hegemony of mediation."[95]

It is possible to quote various scholars who claim that representation relies on the body. It can also be said that body's involvement in design is not confined to representation or to the transmission of mental imagery to the external realm. Even in the case of a direct reflection of mental imagery to any external medium, further engagement with these assumingly perfect reflections would be required to progress design. Although the acts of thinking and seeing are currently regarded as bodily performances, what makes the body directly involved in the design work is the gestures of the hand.[96] However, as Noam Andrews explains, while the consideration of artwork as "the product of body's movements" emerged since the inception of abstract expressionism, the contemporary discipline of architecture has been indifferent to the "materialities" of drawing, which are intrinsic to drawing's production process.[97] This is what motives the exploration of hand's gesture as one of these material nature and qualities of drawing in the context of initial design phases.

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[95] Andrews, "The Architectural Gesture," 138.

[96] As Robin Evans defines design as a process performed through mind, eyes and hand; Evans, *The Projective Cast: Architecture and Its Three Geometries*, 363.

[97] Andrews adds, "architects are trained to read an orthographic projection, but the gestures required to produce the drawing in the first place, the material properties of the page itself, even the physical space within which the drawing is composed, are rarely taken into consideration;" Andrews, "The Architectural Gesture," 137.

In respect to drawings of a chapel by Baldassare Peruzzi (Figure 3.5), Noam Andrews finds the lines representing the ornamental figures distinct from those representing the spatial configuration.[98] Andrews further states that it is not possible to trace the hand of the architect through the straight or curved perspectival lines, which constitute the architectural space.[99] Named as "gestural lines," the sketches drawn to illustrate the semiabstract ornamental figures, makes the movement of the architect's hand perceivable.[100] To Andrews, the true expression of the architect is articulated in these gestural lines.[101] Following Michael Braddick, Andrews also states that it is possible to consider the gestures, "the expressive bodily motions of persons," as the direct reflections of inner consciousness.[102]

[98] Andrews, 145.

[99] Andrews, 145.

[100] Andrews, 145.

[101] Andrews, 146.

[102] Andrews, 146.

Figure 3.5. Baldassare Peruzzi, Chapel Design, 16th century.

Source: Noam Andrews, “The Architectural Gesture,” *Log*, no. 33 (2015): 144.

On the other hand, the visibility of the drawing body on the "gestural lines" of these sketches does not stand for the novelty of the architect's expression. Indeed, drawing depends on the mechanical relationship between hand and a tool.[103] With the recurring practice of drawing, gestures of the hand become mechanized.[104]

This builds a paradox. As Pallasmaa says, drawing skill is a "trained practice."[105] In his book "The Craftsman," Sennett also states that continuous and iterative exercise is required for learning any skill.[106] Also, many of humanity's vital skills are incorporated within one's self, and are automated as responses above the human degree of awareness and intentionality.[107] According to Pallasmaa, the complicated array of actions and spatio-temporal relations of the effort required for practice to acquire a new skill are "unconsciously internalized and embodied rather than understood and remembered intellectually."[108] This suggests that motor abilities, including hand gestures, are not always deliberately performed. In addition to the guidance of mechanistic relations of hand and tool, the "unconsciously internalized" movements repeatedly performed for the acquisition drawing skill leads to

[103] May, "Everything Is Already an Image," 11.

[104] May, 11.

[105] Pallasmaa, *The Thinking Hand: Existential and Embodied Wisdom in Architecture*, 79.

[106] Truly dubious about "innate and untrained talent," Sennett claims that it is training that yields to extraordinary results even in the cases of prodigies. According to Sennett, Amadeus Mozart was believed to be capable of instantly externalizing what he heard in his mind. However, his repetitive experimentations with the notes evident in his letters suggest that he developed means to recall high number of note patterns with the aid of education he received in his early childhood. What he had special was actually "his great innate musical memory," which he learned to train; Richard Sennett, *The Craftsman* (Yale University Press, 2008), 37.

[107] Pallasmaa, *The Thinking Hand: Existential and Embodied Wisdom in Architecture*, 22.

[108] Pallasmaa, 22.

mechanization on the gestures of drawing hand. This means that by experience, the ability to draw turns into a restrictor of what is aimed to be achieved.

In addition to gestures of drawing hand, the bodily act of thinking itself causes mechanized processes in the design process. Brain's embodiment is well articulated by Mallgrave as:

> "If you remove a brain from a cadaver and look at it from below, you see immediately that the eyes are simple neural extensions of the rear portion of the brain. What this suggests is that vision is not a "sense" separate and distinct from the brain, as we say in our every-day language, but biologically an appendage of the brain conveniently located at two portals in the skull. The same is true if you attach all of the neural circuits that extend down through the arms and legs. Quite simply, the brain is an embodied organ, and in this regard even that old distinction between the mind and body is breaking down. The neurons in the big toe are as much a part of the brain as those neurons in the frontal lobe that allow us to think about the big toe. The brain is the body in all of its workings, and vice versa."[109]

Referring to neurons as the building blocks of the brain, Mallgrave states that a brain of average size is composed of a hundred billion neurons.[110] However, it quadruples

[109] Harry Francis Mallgrave, *The Architect's Brain: Neuroscience, Creativity, and Architecture* (West Sussex: John Wiley & Sons, 2010), 135.

[110] Referred as building block of brain, a neuron "consists of a cell body, axon, and dendrites. It operates by generating an action potential or tiny electrical charge through the passage of ions (positively and negatively charged atoms, such as potassium and sodium) along its main stem or axon;" Mallgrave, 126.

its weight until its growth completed, although the total number of neurons only slightly increases.[111] The growth of the brain depends on the connection of neurons, which entails the attachment of neural synapses that are chemically sensitive rhizomic extensions.[112] For this reason, the materiality of the brain predominantly builds upon neural connectivity. Called "plasticity of the brain," the ability to create and to modify synaptic networks among neurons is informed by the external interactions in most cases.[113] Fundamentally, to Mallgrave, this is the reason for the idiosyncrasy of the brain. He concludes that humans are "the specific neural circuits or maps," which they formed throughout their life span.[114]

Besides, referring to Charles Jennings, Elizabeth Dougherty explains that thought is initiated by the stimulation of neurons either internally or externally.[115] The energy released from such stimulant generates a signal in the relevant neurons by activating their electrical content.[116] What initiates the connections of neurons is the transmission of these signals.[117] Simply, thinking, the electro-chemical connection process of

[111] Mallgrave, 135.

[112] Mallgrave, 135.

[113] Mallgrave, 135.

[114] Mallgrave, 135. Referred as "sculpting," the growth of brain is explained also by Warren Neidich as "[t]he brain, its neurons, synaptic connections, and neural networks are sculpted by the inputs it encounters after birth;" Warren Neidich, Blow Up: Photography, Cinema and the Brain (New York, NY: D.A.P./Distributed Art Publishers, 2003), 26.

[115] Elizabeth Dougherty, "What Are Thoughts Made Of?," MIT School of Engineering, 2011, https://engineering.mit.edu/engage/ask-an-engineer/what-are-thoughts-made-of/.

[116] For instance, in case of reading Dougherty explains: "the photons associated with the patterns of the letters hit your retina, and their energy triggers an electrical signal in the light-detecting cells there;" Elizabeth Dougherty.

[117] Elizabeth Dougherty.

neurons, shapes the brain by reconfiguring the neural networks. As also indicated by Mallgrave, the brain is able to operate autonomously without any outside alert; therefore, "the old model of the brain as a computer or processing center, passively taking its stimuli from the senses, is fundamentally flawed and has been discarded."[118] All these novel insights on the brain and its embodiment suggest that thinking is a bodily act and it constantly reshapes human bodily existence. On that note, it is a deception that intellectual undertakings are performed by an abstract entity called "mind."

Prior to these scientific revelations acknowledged by Mallgrave, the embodiment of thought had been central to the work of Juhani Pallasmaa. Pallasmaa explains that bodily experiences are all the immediate responsible for the production, organization and the storage of existential knowledge.[119] He claims, "reactions to the world and processing of information take place directly as an embodied activity without being turned into concepts or even entering the sphere of consciousness."[120] Pallasmaa also adds it is not possible to directly express this embodied knowledge with the mediation

[118] Mallgrave, *The Architect's Brain: Neuroscience, Creativity, and Architecture*, 134.

[119] For this claim, Pallasmaa directly cites the following quotation by Jean-Paul Sartre: "understanding is not a quality coming to human reality from the outside; it is its characteristic way of existing;" Pallasmaa, *The Thinking Hand: Existential and Embodied Wisdom in Architecture*, 13. Also, published before Pallasmaa, the embodiment of knowing is evident in the works of Alberto Perez-Gomez, as he says, "knowledge must be understood as a possession of embodied consciousness;" Alberto Pérez-Gómez, "Architecture as Embodied Knowledge," *Journal of Architectural Education* 40, no. 2 (January 1, 1987): 57–58.

[120] Pallasmaa, *The Thinking Hand: Existential and Embodied Wisdom in Architecture*, 14.

of languages, concepts or theories.[121] Indirectly related to the external realm, communication of knowledge is considered as a "closed system sealed in the body."[122]

In the same vein, George Lakoff states that understanding of abstract ideas occurs in reference to "concrete, physical, and interpersonal experiences."[123] In his book "Philosophy in the Flesh: The Embodied Mind and Its Challenges to Western Thought" he co-authored with Mark Johnson, Lakoff advances his arguments by saying that understanding appropriates and makes use of "the commonalities of our bodies and of the environments we live in."[124] Referring to Lakoff, Pallasmaa argues that the human mind is articulated in its physical environment.[125] With the guidance of these arguments, it is also possible to claim that bodily experiences reform the way the human mind process information, which sets thinking forth as an embodied performance.

[121] "In human interaction alone, eighty per cent of communication is estimated to take place outside the verbal and conceptual channel;" Pallasmaa, 14.

[122] Pallasmaa, 14.

[123] Lakoff further states that "notions as abstract as time, event, state, cause, purpose, means, and action are metaphorical – fundamentally understood in terms of physical experience;" George Lakoff, "What Is a Conceptual System?," in *The Nature and Ontogenesis of Meaning*, ed. David Stuart Overton, Willis F. Palermo (Hove, UK: L. Erlbaum Associates, 1994), 42.

[124] George Lakoff and Mark Johnson, *Philosophy in the Flesh: The Embodied Mind and Its Challenge to Western Thought*, Collection of Jamie and Michael Kassler (Basic Books, 1999), 6.

[125] Pallasmaa, *The Thinking Hand: Existential and Embodied Wisdom in Architecture*, 117.

Furthermore, Mallgrave suggests that seeing itself is not a mere sense indifferent to thinking since the eyes are "the neural extensions of the human brain."[126] Yet, the embodiment of seeing is not only a consequence of the biological integration of the brain and eyes. Seeing involves an intricate series of neurological activities. With reference to György Buzsáki, Mallgrave explains that rather than adopting external stimuli as bare facts, the brain continually re-arranges its self-generated neural patterns with respect to those stimuli.[127] This is what makes the vision a bodily constructed representation, not a straightforward reflection of outside reality.[128] More specifically, Jonathan Fish and Stephan Scrivener indicate that seeing is dynamic mental imagery based on the constant progression of the fragments of what is seen rather than static reflections of luminance and colors on the retina.[129] Scrivener's remark of seeing as imagery construction is also evident in many other and newer studies.[130] Cited in Kosslyn et al., William Thompson states that visual perception exploits the same set of brain processes followed for mental imagery since over the ninety percent of the areas in the brain where these two different phenomena are implemented overlap.[131]

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[126] Harry Francis Mallgrave, *The Architect's Brain: Neuroscience, Creativity, and Architecture* (Malden, MA: Wiley-Blackwell, 2012), 135.

[127] Mallgrave, *The Architect's Brain: Neuroscience, Creativity, and Architecture*, 128.

[128] Mallgrave, 128.

[129] Jonathan Fish and Stephen Scrivener, "Amplifying the Mind's Eye: Sketching and Visual Cognition," *Leonardo* 23, no. 1 (1990): 120.

[130] See for instance; Giorgio Ganis, William L. Thompson, and Stephen Michael Kosslyn, "Brain Areas Underlying Visual Mental Imagery and Visual Perception: An FMRI Study.," *Brain Research. Cognitive Brain Research* 20, no. 2 (July 2004): 226–41.

[131] Stephen Michael Kosslyn, Jennifer M. Shephard, and William L. Thompson, "Spatial Processing during Mental Imagery: A Neurofunctional Theory," in *Spatial Processing in Navigation, Imagery and Perception*, ed. Fred W. Mast and Lutz Jäncke, SpringerLink: Springer e-Books (Boston, MA: Springer US, 2007), 1.

This suggests that perception and imagination are biologically associated.[132] For these reasons, both thinking and seeing are subjective activities. The execution of these activities is informed by the subject matter. What is thought is decisive for the neural connections, which carries out that thought, and thus the way the brain is shaped.[133]

Therefore, it is possible to claim that mechanization of thinking in the design process is not solely imposed by the mechanized gestures of the hand. Thinking itself is bounded by its own bio-technicalities. The differences implied by the brain's technicality depend not only on biological selfhood but also on the cultural context (like the school of thought) that imposes the stimuli urging the neural connectivity. This is how Mallgrave justifies his claim that "there is just a thing as an architect's brain."[134] Correspondingly, the way the brain is "sculpted" is decisive for the way new stimuli is processed. An electrical signal fired by a stimulus best travels through already established neural connections. Certain neural paths prevail because of this

[132] Also, for Mallgrave, it for this reason that perception and understanding linked as he states, "thus, the philosophical question of what distinguishes perception from understanding – that long-standing epistemological issue – loses much of its relevance;" Mallgrave, *The Architect's Brain: Neuroscience, Creativity, and Architecture*, 143.

[133] For instance, as indicated by Mallgrave, "through a series of discoveries (the last being made as recently as 2005), we know that spatial understanding is mediated through groups of specialized cells in the hippocampus and the surrounding region, and it has been demonstrated that London taxi drivers, for instance, have an enlarged hippocampus. Given the spatial abstractions involved with design, we might expect this also to be the case with regard to architects;" Mallgrave, 131.

[134] He states that "Palladio's brain in its neural circuitry, for instance, was arguably different from that of Pierre de Meuron;" Mallgrave, 137.

innate preference of existing neural circuits motivated by efficiency.[135] This is the way thinking is conditioned by repetitive stimuli such as images.[136]

On the other hand, Mallgrave states that neural connectivity reduces over time due to the decay of synaptic structures with which neurons are connected.[137] It is for this reason that setting new neural connections or modification of existing connections becomes harder or even impossible for specific tasks concerning the motor skills of the hand.[138] However, Gregory Berns states, to think "creatively," it is necessary to form novel neural circuits.[139] This clearly means that brain's reliance on the existing neural networks must be challenged. It should also be noted that the formation of the newer neural circuit may not be initiated by the external stimuli in the context of design. Pallasmaa mentions a few individuals engaged in artistic endeavors, who attempted to reach different outcomes by manipulating the operations of representation techniques through the "close circuit" of "eye-hand-mind" union. Brice Marden, for instance, tried to defeat the determinacy of the hand by means of long sticks he holds to draw.[140] In a similar fashion, Jackson Pollock and Morris Louis relied on gravity to smear the paint onto canvas without the eye's visual instruction

[135] Mallgrave, 208.

[136] Cited in Mallgrave, Neidich explains, "recurring over and over again, over and above their naturally occurring organic counterparts, will have a selective advantage for neurons and neural networks that code for them;" Mallgrave, 208.

[137] Mallgrave, 136.

[138] Mallgrave, 136.

[139] Gregory Berns, "Neuroscience Sheds New Light on Creativity: What Neuroscience Reveals about How to Come up with New Ideas.," https://www.fastcompany.com/, 2008.

[140] Pallasmaa, *The Thinking Hand: Existential and Embodied Wisdom in Architecture*, 95.

and the muscular rule of the hand.[141] A more explicit example would be Cy Twombly, who, for a while, used his non-dominant hand to draw.[142] However, these individuals failed to recognize that the way thought is processed in the brain too involve in the process of "artistic" production.

There is one another important impact of the embodiment of thinking. As indicated in Mast et al., thinking of moving certain body parts stimulates the much of the same areas in the brain, as the ones stimulated during the actual movement of the body part in question.[143] Besides, both imagination and execution of the movement are performed through the same neural processes.[144] Called "motor imagery," this phenomenon can be observed in the imagination of the movement of hand[145] and fingers.[146] Motor imagery implies several critical points about drawing. The movement, which enables drawing can be premediated as mental imagery. Given their shared neural procedures, both drawing and the mental imagery of drawing provoke the same thought. Because motor imagery and motor functions are reciprocally related, the body parts that execute the movement affect the ability to imagine the

[141] Pallasmaa, 95.

[142] Pallasmaa, 95.

[143] Fred W. Mast, Laura Bamert, and Nathaniel Newby, "Mind over Matter? Imagined Body Movements and Their Neuronal Correlates," in *Spatial Processing in Navigation, Imagery and Perception*, ed. Lutz Jäncke Fred W. Mast, SpringerLink: Springer e-Books (Boston, MA: Springer US, 2007), 353.

[144] Mast, Bamert, and Newby, 357.

[145] Stéphane Thobois et al., "Motor Imagery in Normal Subjects and in Asymmetrical Parkinson's Disease: A PET Study," *Neurology* 55, no. 7 (October 10, 2000): 996.

[146] Carlo A. Porro et al., "Ipsilateral Involvement of Primary Motor Cortex During Motor Imagery.," *The European Journal of Neuroscience* 12, no. 8 (August 2000): 3061.

movement of that parts.[147] For this reason, Mast et al. state that motor skills can be enhanced with the aid of mental imagery.[148] Similarly, Jagna Sobierajewicz further claims that motor imagery contributes to one's process of acquiring a motor skill performed by hand.[149] Besides, Nico et al. perform an experiment on the preserved motor abilities in human memory. In this experiment, arm amputees were asked to judge whether the lines shown to them were drawn by a left or right hand.[150] Based on the reactivated sensations of the lost limbs reported by the amputees in the experiment, Mast et al. suggest that the motor commands compulsory for the amputee to make the judgment are retrieved from the motor imagery.[151] Based on this, it is likely that the retrieval of these gestures stored in the brain cause mechanization of the drawing hand.

[147] As it is also indicated that the physical practice of the body part influences the area in the brain activated during the motor imagery of the practice concerned; Mast, Bamert, and Newby, "Mind over Matter? Imagined Body Movements and Their Neuronal Correlates," 354, 358.

[148] Mast, Bamert, and Newby, 357.

[149] Jagna Sobierajewicz, Wojciech Jaśkowski, and Rob H. J. Van der Lubbe, "Does Transcranial Direct Current Stimulation Affect the Learning of a Fine Sequential Hand Motor Skill with Motor Imagery?," *Journal of Motor Behavior* 51, no. 4 (July 4, 2019): 493.

[150] Mast, Bamert, and Newby, "Mind over Matter? Imagined Body Movements and Their Neuronal Correlates," 354.

[151] Mast, Bamert, and Newby, 355.

CHAPTER 4

IMAGING AS A TECHNIQUE OF REPRESENTATION FOR ARCHITECTURAL DESIGN

> "Western painting is predicated on *the disavowal of deictic reference,* on the disappearance of the body as site of the image; and this twice over: for the painter, and for the viewing subject."[152]

Norman Bryson's remark above points out that what is just "drawn" in the Western painting makes the former (what is painted) invisible both for the hand and the eye since each layer of stroke covers the previous one. The painting does not disseminate any information regarding the painter's bodily labor. On the contrary, Chinese painting depicts the painter's movement in addition to its content (Figure 4.1 and Figure 4.2).[153] The audience of the Chinese painting is able to trace the production process on the painting.[154]

[152] Bryson, *Vision and Painting: The Logic of the Gaze*, 92.

[153] Bryson, 92.

[154] Bryson, 92.

Figure 4.1. Wen Cheng-ming, “Seven Juniper Trees.”

Figure 4.2. Chu Jan, “Buddhist Monastery in Stream and Mountain Landscape.”

Source: Norman Bryson, *Vision and Painting: The Logic of the Gaze* (New Haven, CT: Yale University Press, 1986), 92.

It is possible to draw a parallel between this comparison of Western and Chinese painting and collage and conventional architectural drawing techniques. Like Chinese painting, orthographic drawing relies on gestures. On the other hand, the erasive character of Western painting, referred by Bryson, recalls the palimpsest nature of superimposition. In Western painting, particularly in collage, the way gesture intermediate is indifferent to the product. Similarly, in collage, the production process is invisible. The same kind of indifference between gesture and the product and the disappearance of the process is also evident in electrical imaging. As John May says,

with “pixilation” or “instantiation” through which the electrical images are formed, “the great labor process is collapsed into a single automated process that takes place behind or below the threshold of perception.”[155] Because of their electrical content, images are “real-time” operations.[156] This induces the exploration of imaging as a design media freed from the linear historical rule and the mechanization of orthography.

The first of the following subchapters elaborates on the electrical image and the “real-time” consciousness it enables in design process. The second subchapter revisits image manipulation as an architectural representation technique freed from gesture’s mechanization.

4.1. The Electrical Image: A Post-orthographic Technical System

Technically defined as “photon detection” by John May, images are formed by processing the quantitative electrical charges named signals.[157] These signals can be stored, calculated, managed, and manipulated “through various statistical methods.”[158]

[155] John J. May, “Field Notes From The Instruments Project,” *Journal of Architectural Education* 69, no. 1 (January 2, 2015): 58–61.

[156] May, “Everything Is Already an Image,” 19.

[157] May, 12.

[158] May, 12.

Figure 4.3. "Signals represented in numerical format."

Source: John J. May, "Everything Is Already an Image," *Log* 3, no. 40 (2017): 18.

May adds, "images are the outputs of energetic processes defined by signalization."[159] They are instantly created as a result of electrical transmission of signals, and it is for this reason that images are -contrary to drawings and photographs- dynamic by their nature.[160] The storage format of images is "statistical-electrical," thus incompatible to

[159] May, 12.

[160] John May further states, "our tendency to think of them as fixed is likely related to the psychological residue of drawings and chemical photographs;" May, 12. Similarly, Marshall McLuhan refers

that of drawings and photographs.[161] These are the reasons why John May sets images forth as post-orthographic technical systems.

Unlike the historical time of orthography, which bounds the present and future to past through gesture, real-time, meaning "the specific conception of time" embedded in post-orthography, enables all future possibilities simultaneously in the present.[162] Accordingly, real-time brings forth the statistical form of thought, "in which futures knowable and unknowable are posed simultaneously, some more calculably probably than other, but all possible."[163]

to electricity as the solid reason of speed, which brings the instant occurrence of things resulting the invalidation of sequentiality of mechanism; McLuhan, *Understanding Media: The Extensions of Man*, 3.

[161] "Drawings are a hand-mechanical, geometric storage format; photographs are chemical-mechanical storage (granular and molecular, but not all geometrical);" May, "Everything Is Already an Image," 14.

[162] May, 19.

[163] May, 19.

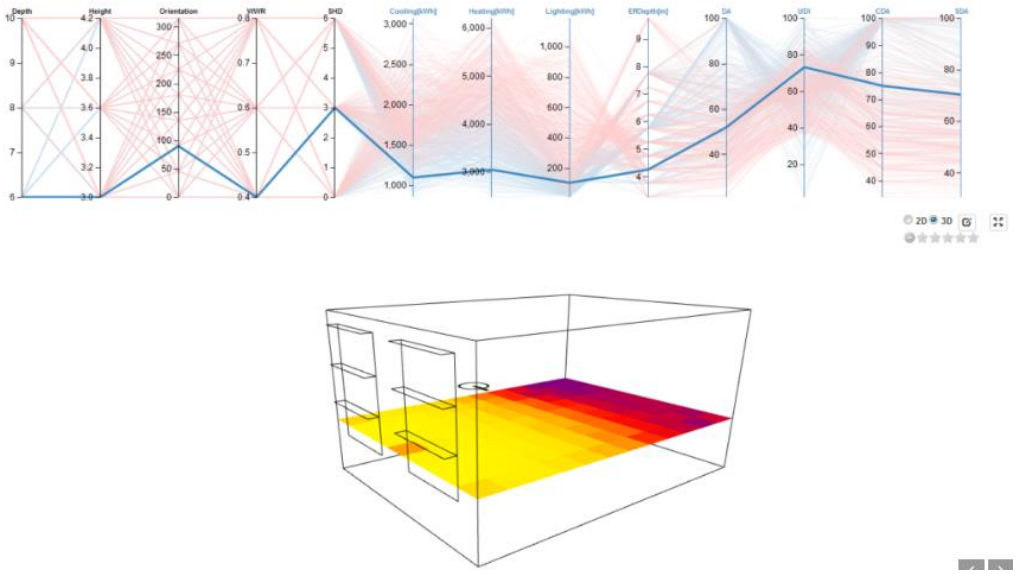

Figure 4.4. A Single model produced in “Design Explorer” with the different layers of data it is associated with.

Source: Thornton Tomasetti, Design Explorer Interface, 2019, CORE studio, http://core.thorntontomasetti.com/design-explorer/

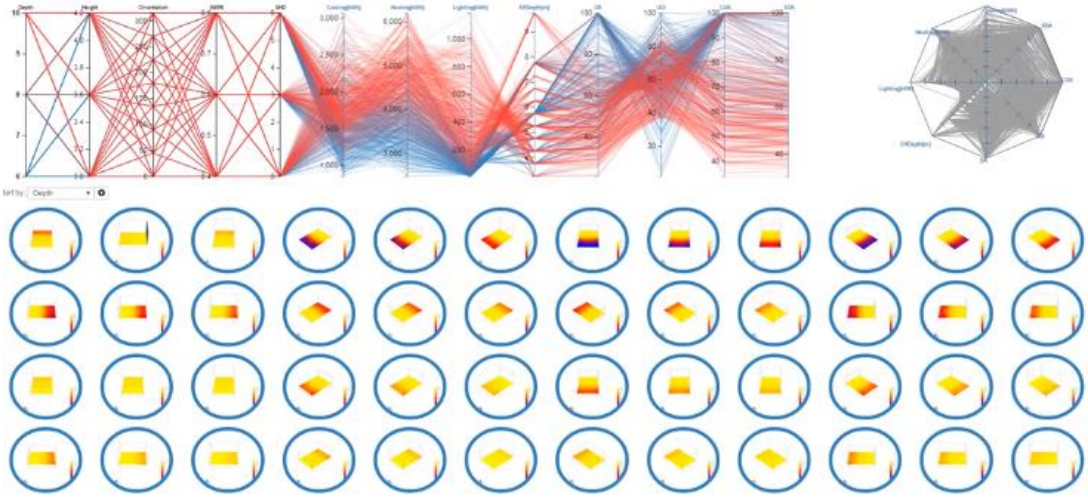

Figure 4.5. The model in Figure 4.4, with its multiple different versions and their relevant data.

Source: Thornton Tomasetti, Design Explorer Interface, 2019, CORE studio, http://core.thorntontomasetti.com/design-explorer/

It would take a single second to create the model in Figure 4.4 and to monitor all the relevant data associated with it. However, it should be noted that it would also take a single second to create many different versions of it. To restate May, all the future possibilities become available in real-time. Besides, the movement of the clicking hand would be indifferent to forming content. This suggests that imaging enables the progression of design among the endless array of possibilities through "statistical thinking."

In the context of map making, Laura Kurgan states the spaces, their representations, and the technologies employed for the representations share an intricate formation process.[164] However, as for architecture, the possibilities presented by imaging are imprisoned by the orthographic vision even in the mediums of electrical contents (Figure 4.6). Orthography haunts the design process through "stimulated" or "pseudo-orthography" along with the offerings by imaging to release it from learned and what comes from the memory.

[164] Laura Kurgan, *Close Up at a Distance: Mapping, Technology, and Politics* (New York, NY: Zone Books, 2013), 13.

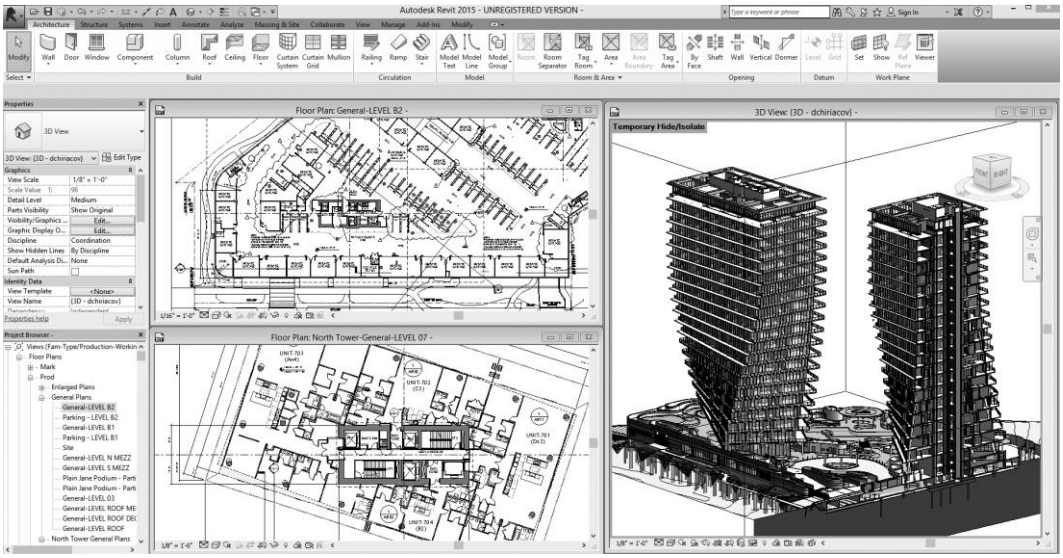

Figure 4.6. “Simulated Orthography.”

Source: John J. May, “Everything Is Already an Image,” *Log 3*, no. 40 (2017): 18.

4.2. Image Manipulation

According to Mark Hewitt, it is possible to classify architectural drawings by their medium, mode, and type.[165] "Drawing" and "ink" could be considered as "type" and "medium," while "perspective" can be the "mode" of a particular representation.[166] As designing requires the exploitation of different types of representation to maintain the awareness throughout the design process, modes, and medium of representation substitute each other. In his book "Drawing: The Motive Force of Architecture," Peter Cook quotes the explanation of Kenny Kinugasa-Tsui on his project (Figure 4.7 and Figure 4.8):

> "There are 100 digital scans of various colour pencil strokes, used as digital texture maps on polygon surfaces in 3D Studio Max, three-dimensionally assembled into a digital computer model to explore spatial compositions. The original analogue hand stroke qualities would intrinsically intertwine throughout with the digital 3D modelling process, thus allowing the benefits of preserving a certain 'looseness' and 'softness' in the sketches, while simultaneously capable to explore complexities of multiplications, fragmentation, and other geometric manipulations offered by the computer software. The camera in the 3D software allows each stroke to be spatially explored in 'mathematically correct' perspectives."[167]

[165] Hewitt, "Representational Forms and Modes of Conception: An Approach to the History of Architectural Drawing," 6.

[166] Hewitt, 6.

[167] Peter Cook, *Drawing: The Motive Force of Architecture* (Chichester, West Sussex: Wiley, 2014), 208.

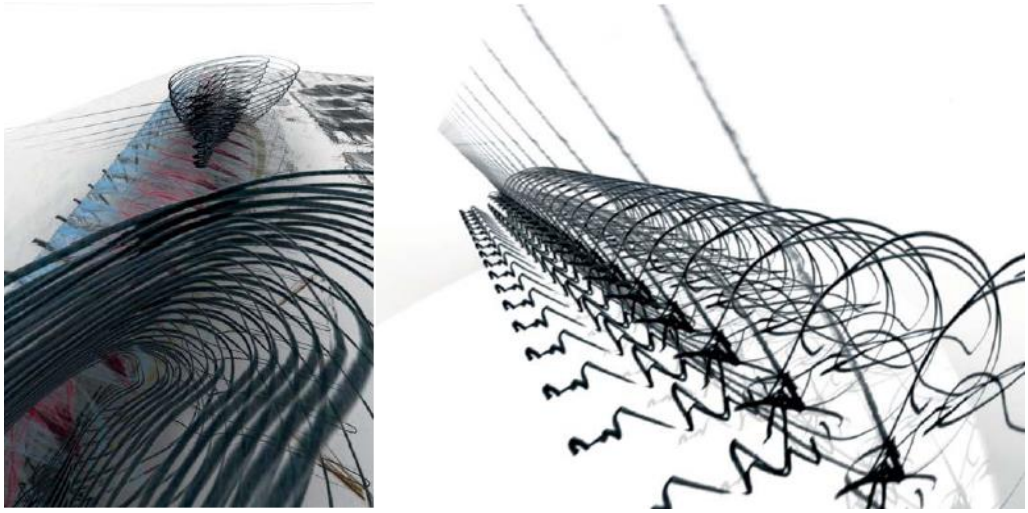

Figure 4.7. Image Manipulation by Kenny Kinugasa-Tsui.

Source: Peter Cook, *Drawing: The Motive Force of Architecture* (Chichester, West Sussex: Wiley, 2014), 208.

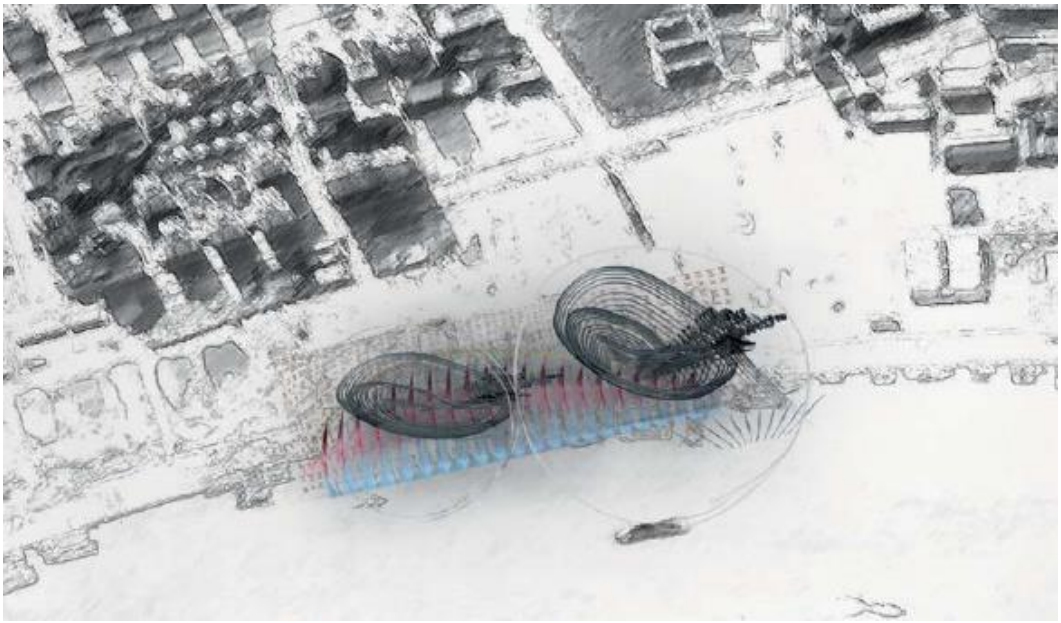

Figure 4.8. Image Manipulation by Kenny Kinugasa-Tsui.

Source: Peter Cook, *Drawing: The Motive Force of Architecture* (Chichester, West Sussex: Wiley, 2014), 208.

According to Hewitt's classification, the pencil strokes were the "mode" of the representation on the paper on which they were drawn. They constituted a plan drawing. Scanned into 3D software, the strokes turn into "medium" of the 3D model. The intuitive qualities that indeterminacy of sketching yields were converted into electrical contents to be further manipulated.

CHAPTER 5

CONCLUSION

> What happens to the architectural mind when it stops pretending that images of drawings made by computers are drawings? When it finally admits that imaging is not drawing but is instead something that has already obliterated drawing?[168]

These two questions above by John May signal that the qualities of orthography are migrated into post-orthographic mediums of imaging ignorantly. Although completely redundant, they are naturalized in the post-orthographic settings and in all of their associated operations and thus become transparent to intellectual perception.

One of these operations would be the "gestural-technical" performance of representation techniques institutionalized even in the contemporary scholarly communities. To James Ackerman, the reasons and the conditions of its emergence and the way it was progressed are what reveal the essence of a convention.[169] As for the modern design education developed in the Bauhaus, "kinaesthetic knowing"[170] provided educational methods dwelling on the techniques developed by the pedagogues of the German-speaking lands in the 19th century to train "the lesser

[168] May, "Everything Is Already an Image," 24.

[169] James S. Ackerman, *Origins, Imitation, Conventions: Representation in the Visual Arts* (Cambridge, MA, US: The MIT Press, 2001), 28.

[170] In Alexander's words, "nondiscursive and nonconceptual knowledge assumed to be gathered from the body's experiential exchanges with the world;" Alexander, *Kinaesthetic Knowing: Aesthetics, Epistemology, Modern Design*, 32.

subjects of modernity" such as children, women and the Catholics of the Protestant Prussian State.[171] Alexander also explains that these techniques were borrowed from experimental psychology, which employed strict protocols to measure the responses of the experimenters body parts to certain physical stimuli.[172] To avoid "the shaky foundation of fleeting inner experiences," Bauhaus masters as well applied these strict protocols in order for their students to explore their responses to the formal arrangement of lines, shapes, and colors.[173] For instance, the assignments, including the nine-square-grid problem in the preliminary design course by Wassily Kandinsky, forced students to contemplate a severely limited number of formal possibilities (Figure 5.1).[174] Alexander adds, "the pedagogical goal here was not to discover a correct solution but rather to make sure that the student meticulously followed the protocols each time."[175] Hence, drawing at the Bauhaus served as a medium of

[171] Alexander, 138. In the same vein, referring to pedagogical systems of Pestalozzi and Froebel, Kazys Varnelis states, "both systems would also educate the masses in the development of the motor skills needed for industry, with the particular intent of generating artisans capable of endlessly producing new designs for the consumer's endlessly desiring eye;" Varnelis, "The Education of the Innocent Eye," 214.

[172] Alexander, *Kinaesthetic Knowing: Aesthetics, Epistemology, Modern Design*, 188–89.

[173] Alexander, 189, 193.

[174] Alexander, 190. It should not be a coincidence that Ferhan Yürekli, who was acknowledged in Alexander's work, states that in contradiction with the conception of modernity, these exercises of formal exploration of the preliminary course at the Bauhaus was to stylize Modern Architecture as evident in the works by Kazimir Malevich. Ferhan Yürekli, *Inaugural Speech at The First Year Design Studios Meeting*, 2015, https://youtu.be/iXqx5UrYalE.

[175] Alexander, *Kinaesthetic Knowing: Aesthetics, Epistemology, Modern Design*, 190. Also, according to Kazys Varnelis, this is why what underlies Rousseau's learning-by-doing pedagogy still reflecting to today's methodologies is widely belied. Varnelis states, the student would be able to experiment only within the extent of the matter provided by their master: "Rousseau 's teacher offered the boy choice but controlled him through the choices available. For Rousseau, the most complete control would come with the appearance of freedom: "Let him always think he is master while you are really master;" Varnelis says, since then, the debate on education

abstraction of bodily responses through a peculiar language of geometry. Despite the fact that drawing sculps all the bodily activities of design from the movements of fingertips to neural circuits, as explained in the third chapter, drawing classes prevail today. Students are exiled into studios for endless hours of centuries-old orthographic productions, into remote areas of intellectuality in its all terms.

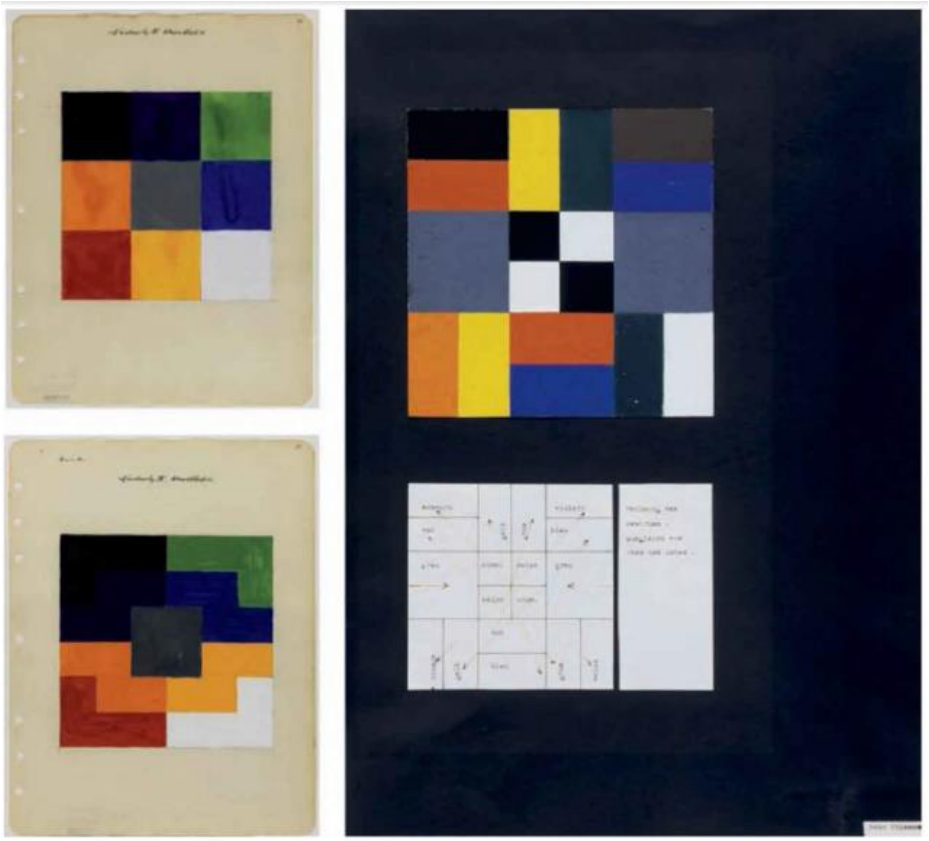

Figure 5.1. Nine-square-grid problem by Wassily Kandinsky.

Source: Zeynep Çelik Alexander, *Kinaesthetic Knowing: Aesthetics, Epistemology, Modern Design* (Chicago and London: The University of Chicago Press, 2017), 188.

have been accompanied by this proposition of Enlightenment that "democratic action is the ideal, but the ideal is tempered by the invisible hands determining the proper bounds of the discourse." Varnelis, "The Education of the Innocent Eye," 213.

More stealth example to the prevalence of orthographic mind would be the architectural juries. Lucia Allais articulates the emergence of "juridical"[176] approach in scholar realms as:

> "The act of committing buildings to papers … became systematized when architectural education was codified at the *École des Beaux-Arts.* No drawing at the *École* was considered complete until it had been rendered with a layer of ink, wash, or watercolor. Loaded with materiality, the rendering became a noun, *Le Rendu,* the rendering. In his 1830 *dictionnaire*, De Quincy defined rendered as finished, done, completed. The rendering served as a finishing stage not only in the production of buildings, but also of architects."[177]

She further states that the renderings would have been presented to a jury of critics.[178] This suggests that the design process for both the architectural object and the students was scheduled in terms of the "technical-gestural" rule of orthography and of the linear mode of time orthography enables. It is possible to claim that the procedure followed by today's certain schools is almost indistinguishable from that followed in École des Beaux-Arts. Design work is segmented by specific scales, which are canonized by the technicalities of orthographic drawing. The search in the studio is to be completed in the forms of "simulated" orthographic drawings or renderings, which are printed "by

[176] The terms refers to a mode of architectural reasoning, which architectural intelligentsia started to engage in post-war years in accordance with American legal system when "every active impulse towards ambiguity, every instinct towards the inexpressible is displaced by a preemptive system of discursive evidentiary justification;" John J. May, "Under Present Conditions Our Dullness Will Intensify," *Project: A Journal for Architecture* Spring, no. 3 (2014): 19.

[177] May and Allais, Newish *Media: A Conversation with Lucia Allais and John May*.

[178] May and Allais.

electromechanically depositing material (ink, starch, plastic, concrete, etc.) with a speed and precision unimaginable to any orthographer."[179] The individual design process of the students is interrupted at certain time intervals incompatible to post-orthography and real-time. Students' chance to individual and innovative interaction with the subject matter is compromised by "the geometric inheritance of past instances of order, propositions, symbolic expression, and so on,"[180] either in orthographic or "pseudo-orthographic" settings and presented to a jury of practicing architects for its members to approve or grade.

Given that they may lead to irremediable consequences to far reaching extents of architecture, should not we re-question the representational processes historically, ignorantly or deliberately naturalized as inherent to architecture? While the embodiment of representation, particularly the phenomenon of motor imagery, suggests that gestural skills like drawing are stored in the brain and can be retrieved even in the absence of the body parts that perform the skills concerned, architectural education still relies on the demonstration of the precedent accomplishments. This subtle reliance prevails because of the insistence on drawing since it can only yield to architecture tied to its own past.[181] Besides, with the real-time offerings of imaging, Ehrenzweig's argument on the impossibility of verifying the infinite number of possibilities to obtain an overall understanding of any creative search loses its validity (Figure 3.3). Since imaging already and momentarily enables all the possibilities, involving in a limited number of them within orthographic or pseudo-orthographic settings only leads to restrictive acquisitions both for the hand and the mind.

[179] May, "Everything Is Already an Image," 19.

[180] May, 17.

[181] Restating May, "In orthography, all future architecture was "drawn out from" architecture's past." May, 17.

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