The Post - orthographic Tinkerbell Effect

Why does everything have to be post-?

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Every time a model spins around inside a computer an orthographer falls down dead. Unlike the life-saving applause that resuscitates Tinkerbell in J.M. Barrie's *Peter Pan*, no amount of clapping will reinstate orthography as the primary system of architectural production. Post-digital, post-computational, post-human, etc. The prefix "post", marks the unending parade of revolutions in the teaching and practice of architecture. Out of the many post-worlds, post-orthographic is at the root of teaching beginning design students. An examination of post-orthographic processes might quell the chorus of applause that rings throughout schools when people claim that drawing is dead. Drawing is not dead, but orthographic drawing is not the primary method of architectural production.

This paper discusses how the contemplative space of iterative work is affected by labor time – the time defined by the medium used to produce work. The work developed in the beginning design studio presented in this paper focuses on the relationship between orthographic drawing, physical modelling, and post-orthographic imaging.

According to John May, the world of the orthographer was the combination of text and drawing. The world of the post-orthographer is defined by the simultaneity of models and images. [1] May supports this distinction by establishing precise technical definitions that parse out the contemporary ambiguity between drawings and images. Many beginning design curricula still confuse digital with computational processes, and refer to images as drawings. By now, it should be self-evident that digital does not only mean computational or electronic, and working digitally is not synonymous with staring at a screen.

The student work from the *Post-orthographic Tinkerbell Effect* combines orthographic and post-orthographic systems to reinforce that the speed of the medium is critical in its ability to shape thought. This paper asks how to afford computational and electronic media the type of iterative contemplation that is enmeshed in the labor time of hand-mechanical processes. Additionally, how do the technical nuances of these processes affect the methods used to review this type of student work?

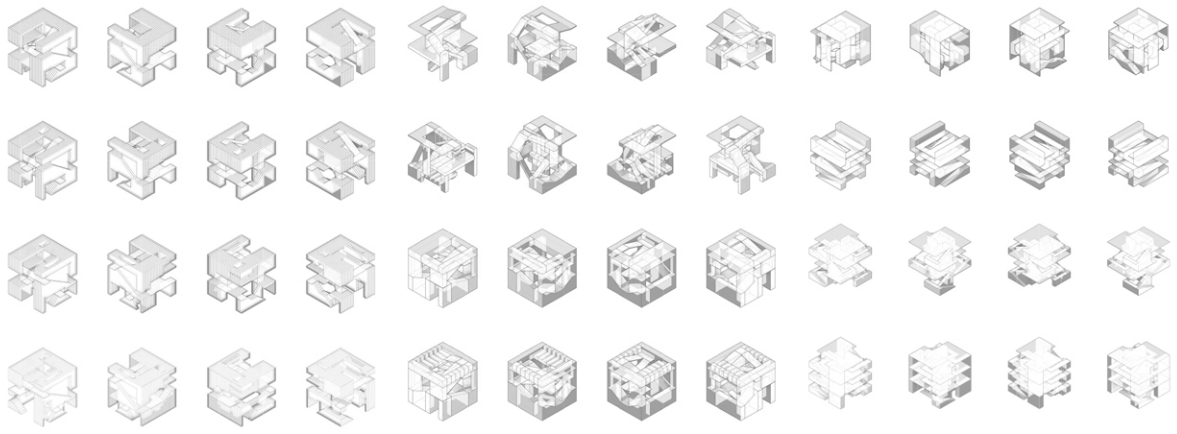

Fig. 1 Images output from Autodesk Revit. Every student modeled 12 cubes in Revit based on solid/void relationships designed through a system of stairs. Thirty students output 5 series of 48 images each, a total of 7200 post-orthographic images.

Technical Confusion

"Hay faltas de ortografía."

This is a common statement heard in primary and secondary schools throughout the Spanish-speaking world. Literally translated it means, "There are orthographic faults". In this statement, "*faltas*", implies something that is missing or lacking. It is not an indictment of the individual at fault, but rather a way to signal that something has deviated from the norm. In this case the deviation is of an orthographic nature. In many Latin-based languages, like Spanish, orthography does not conjure up ideas of drawings or graphical projection. Instead, *ortografía* (orthography) primarily refers to the structure of writing.

Our conception of time and the linearity of the world is a fundamental orthographic construct. This does not mean it is not part of our "reality"; it simply refers to the tacit agreement built around linear systems. They are not automatic or default conditions through which our heads are wired. While this type of conversation suggests metaphysical wanderings and other philosophical deviations—are there any other kinds—it is still central to the idea of architectural production and the role of orthographic drawing. If "orthography produced a framework for conceptual exactitude and brought the notion of literacy into the world", how did this framework manifest competing visions of the world? [2] The conceptual space between "*faltas de ortografía*" and "orthographic drawing" frames this competition.

In *Everything is Already an Image* (2018), John May describes one orthographic world built around the primacy of written and spoken language in which a linear linguistic apparatus is the means to structure and express thought. The second world described by May is based on orthographic drawing—it is unspoken and unwritten. It is a world expressed through "geometric gestures structured by the laws of scale and proportion representing the silence of lived spatial experience, thus placing form and materiality at the center of thought." [3] Centuries after the realization of these seemingly opposed orthographic worlds, there are still no teachers holding up papers talking about the "orthographic faults" in their students' drawings. These are not benign anecdotes. The spoken and unspoken tools that are used to structure thought are at the center of the technics or conceptual effects that turn these anecdotes into relevant historical markers. If the anecdotes are not benign, it does not mean they are harmful, instead they require closer inspection and pedagogical consideration. What is the technical difference between a drawing and an image?

According to May, "at base, architectural drawing refers to acts of geometric gesturing, always aided by mechanical tools. The gesture itself belongs to a synchronization between the hands and externalized instruments…images are the outputs of energetic processes defined by signalization, which accumulate to form data." [4] The interchangeable language used to describe the contents of Figures 2 and 3 is a sign of a pervasive technical confusion. Increasingly, student work consists of cutting and displacing views of three-dimensional computer models. The make-2D command in Rhino and the section tool in Revit do not

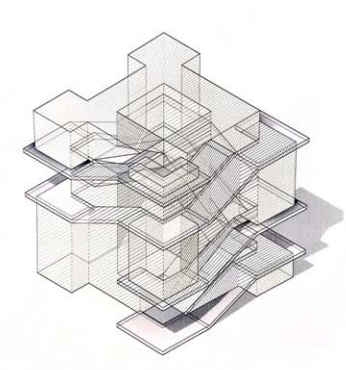

Fig. 2 Image from student Revit model.

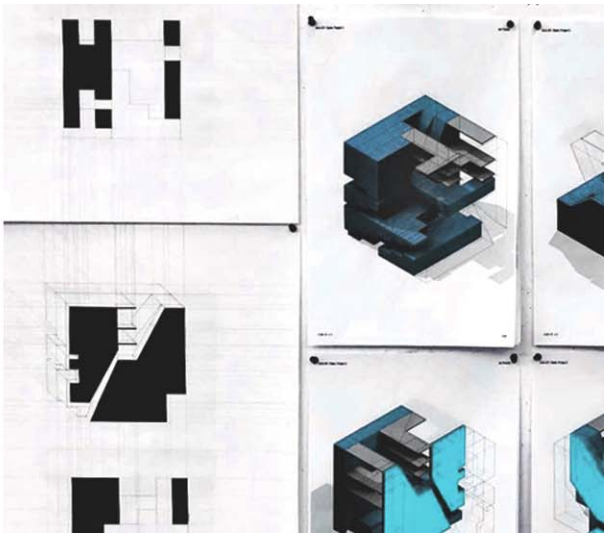

Fig. 3 Left: Orthographic hand-drawings (plan and section oblique). Right: Images from student Revit model.

produce orthographic drawings. Electronic media and computational processes do not produce static, geometric markings. Instead, they transmit electronic signals, commonly appearing as pixels that can be infinitely reconfigured. Yet, despite this simple and all too apparent difference, we continue to refer to images as drawings. The poetic value of images has been written about extensively — marking their intrinsic link to imagination. To consider images as techno-electronic constructions does not dismiss or neglect their emotive effects. On the contrary, unfolding the technical structure of images is a way to clear up confusion and grow our imagination around their ubiquity.

What are the conditions under which this technical confusion has spread? First, the advent of electronic media is responsible for most contemporary media-based confusion. Post-orthography is not a symptom of confusion, but the result of new tools breaking the technical world that made them. Second, architectural education rarely problematizes *means of production*. The contemporary manifestation of the traditional design process does not actually question the *means of production* of student work. While process-driven pedagogies continue to be central to design education, the technical nuances of electronic media continue to be elusive. For example, what are the technical differences between building a computer model in Rhino or Autodesk Revit? Do students learn about these differences or the implications of these tools in a historical or theoretical context before or in tandem with their application? Beyond its clichéd political associations — sorry to all Marxists — *means of electronic production* have outpaced our own pedagogical language. Our linguistic apparatus is not keeping up with the electronic media of the post-orthographic world.

Uninteresting Cubes

Traditional beginning design studios introduce students to foundational concepts about space, form, order, hierarchy, composition, the list is expansive — the pedagogical language is solid. Media that range in scope and reflect specific teaching agendas unfold these concepts. The generalizations made about concepts and media in the two previous sentences illustrate the structured freedom required to cultivate creative impulses. In many design schools, creative structures have been explored through a version of *"the cube"* exercise, which is attributed to the pedagogical experiments of the *Texas Rangers* at the University of Texas at Austin in the 1950s. [5] In the context of this paper, the origins of the exercise are not important. *The Cube's* pervasiveness, adaptability, and intrinsic iterative nature are worth examining. Like the role of images, a lot has been written about *the cube*. Its philosophical, platonic groundings, its reinforcement of classical ideals, and its conceptual underpinnings have been digested independent from architectural pedagogy.

"The most interesting characteristic of the cube is that it is relatively uninteresting", remarked the American artist Sol Lewitt in 1966. [6] *The Cube* exercise is tied to Lewitt's work. His series of *Incomplete Cube Variations* expanded the context of iterative archetypal manipulation by claiming that *the cube* offers no direct symbolization. This claim is a clear indication of the relationship between written instructions and material execution. Beyond the instrumentality of this relationship, what are the ways in which student work can address the tension between written orthography (*ortografía)*, drawn orthography (projections), and post-orthographic (computational) electronic media?

Fig. 4 Foam cube models, 3x3x3 inches.

In the work show in this paper second-year architecture students use stairs as a fundamental architectural element — a mechanism for defining and seeing space. Stairs provide the vertical movement from one space to another, they enable ascent or decent, subtle or exaggerated. Stairs can also define a space onto themselves, a volume articulated by the stacking and arrangement of systems of different species of spaces. Students study and use stairs to explore spatial solid/void relationships and limited material constructions. This is an innocuous description of the studio, which reinforces an orthographically drawn vision of the world.

Figure 7 shows a sampling of one student's work. After a taxonomic stair cataloguing exercise, students remix their taxonomy into a series of 3x3x3 inch foam cubes. The "stair spaces" in the cubes are built by interpreting a series of ten rules — written orthography. Over the course of three weeks, each student makes three sets of nine cubes, twenty-seven cubes in total. The cubes are observed and reviewed together as large families. Despite the speed of production, each set of cubes demonstrates a unique set of characteristics based on students' interpretation of the written rules. For the purposes of this paper, a detailed description of the rules is not important. In fact, the exact nature of the rules may not be important for the exercise. The written instructions or rules are a mental speed bump, a way of slowing production, and establishing a space of iterative thinking through reproduction. This is common and tightly designed into many studio exercises. The rest of the paper unravels that pedagogical tightness by pulling at the media-based effects of iterative thinking.

New Iterations

"I made fifty models and one-hundred drawings (images)."

Iterative processes are synonymous with design work. Across design disciplines, curricula follow the mantra of "work iteratively". The educational legacy of iteration is attached to different pedagogical models, possibly most evident in the modern legacy of the Bauhaus. It is fitting, but perhaps surprising, that mathematics was one of the first disciplines to define iterative work.[7] In mathematics, iteration is rooted in the notion of *successive approximation*, used to develop theorems and subsequent proofs. It is not a coincidence that successive approximation or iteration is essential to computation. Like many core design ideas, iteration has been shoplifted with great dexterity from other disciplines, such as mathematics. Iterative work did not find its way into the world of orthographic drawing until the enlightenment or arguably the 15th century and the establishment of Leon Battista Alberti's authorial paradigm.[8] In fact, non-design oriented iteration belongs to the world of "*faltas de ortografia*", or in mathematical language, calculation code errors. How does the legacy of iteration affect the technical production of design work?

Most scholarship addressing the link between media, iteration, and production references Walter Benjamin's, *Art in the Age of Mechanical Reproduction* (1900) — it is a seminal text. One of its most fascinating characteristics is the frequency with which it is used to explain the contemporary effects of electronic media. The rate of the text's own reproduction leads to different interpretations and nuances offered by several authors' readings of

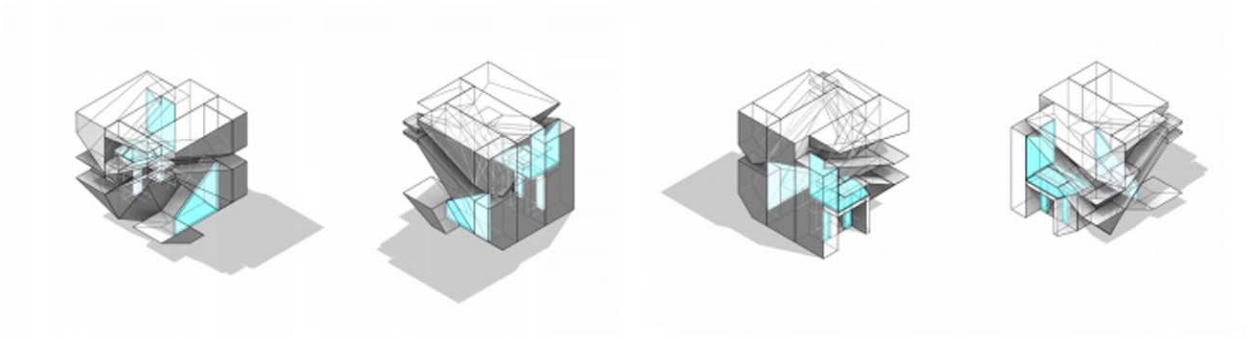

Fig. 5 Image set from student Revit Model, four sides.

Benjamin's work. This paper does not offer any insight of its own, but rather looks at the space in between other nuanced readings of *Art in the Age of Mechanical reproduction*. The references are cross-disciplinary and ample. Coincidentally, mathematics fascinated Walter Benjamin, yet mathematicians do not cite his work very often. [9]

Boris Groys extracts Benjamin's notion of *aura* as the relationship between the work and its external context. *Aura* is an intrinsic quality of the *original* work, defined by its autochthonous nature. The *original* has a site, a place where it emanated from. Unlike the *original*, *copies* are virtual, siteless, and ahistorical; from the beginning they appear as potential multiplicity. [10] By default, the act of reproduction becomes an act of displacement. The mechanical age of production is about this form of iterative thinking. For Mario Carpo and Lluis Ortega, identical replication was the defining feature of mechanical reproduction. Their interpretations of contemporary reproduction differ in language, but coincide in the move towards a visual environment dominated by *transmissible and invisible algorithms* (Carpo) and the *possibility of speculative production* (Ortega). [11] The move towards invisibility, and its mechanical ancestor, are both preceded by a world of hand-making in which visual similarity and imitation were the norm, while identical reproduction was the exception. [12] All three interpretations of Benjamin's work: Groys, Carpo, and Ortega's, suggest that electronization turns visual arts into performing arts, suggesting a split between *presentation* and *representation*.

Presentation Problems

Electronic media is a medium of presence; its temporality is the immediate present. These forms of production transmit and receive information without intermediaries. [13] This type of non-mediation makes up real-time processes that reconfigure the space of representation into a space of presentation. Post-orthography is a product of this reconfiguration — it is a form of presentation that is asked to operate representationally. In a linguistic sense, representation implies a static form of communicative knowledge, analogous to hand-mechanical drawing, while presentation is defined by multiplicity, or what John May refers to as "simulations of all possible future drawings." [14]

How does electronic media affect iteration in *the cube* exercise? Without recalling Sol Lewitt, iteration is critical to the development of this traditional beginning design project. Less obvious is the relationship between *original* and *copy*, *representation* and *presentation*. In *the cube* exercise, there are three sets of *originals* entangled in an iterative game of *copies*.

1. *First foam cube (Fig. 7)*
2. *First orthographic drawing (Fig. 6)*
3. *First post-orthographic computer model (Fig. 5)*

The first computer model is a non-identical, virtual copy of the last set of foam models, which are hand-made copies of the first set of foam models. Subsequent computer models are virtual copies of the latest wood models (Fig. 8). The *original* presence of the computer model is invisible. It exists as the model file and subsequent output of image files or *copies*. These copies cannot

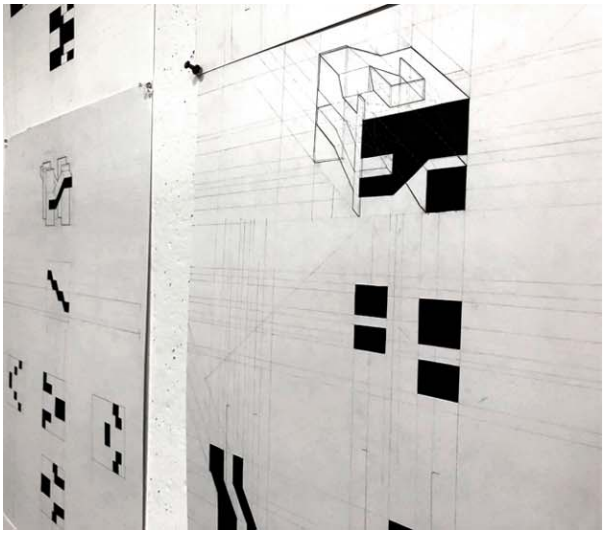

Fig. 6 Orthographic drawings: plans, sections, and section oblique.

Fig. 7 Top: orthographic drawings. Bottom: Foam cube models

be compared to the *original* because the *original is a*n invisible algorithmic set of electronic signals or data.

The first orthographic drawings in Figure 6 (two plans, two sections, and one section oblique) are two-dimensional reports from the first foam models. The last set of orthographic drawings (one plan, and one section oblique) are two-dimensional reports from the last set of wood models, and their corresponding computer models made as masses in Revit. The last mixture between drawings, physical models and computer models is where orthographic and post-orthographic systems collide.

This interference is only visible — able to be reviewed collectively — if students turn their post-orthographic presentation models into representations. When students export images they momentarily stop their real-time models and turn them into representations. The amount of time that elapses between this stoppage and the review of student work is critical. In machine or hand-mechanical processes, speculation took place in the space of representation. [15] The medium used to produce the work defines the radically reconfigured space of speculation in electronic virtual production. To avoid this reconfigured mental space, orthographic methods of reviewing student work insist that electronic work be turned into mechanical work. Traditional spaces of contemplation found in representation rely on the transformation — it is a way of clapping for Tinkerbell's life. In orthography, the means of production and means of review belong to the same world of conventions. In post-orthography, they belong to critically different worlds in which conventions are conveniently replicated.

Procedural replication was the tenant of the first wave of electronic tools, which began with the translation of some techniques from hand methods to computerized counterparts. [16] In a technical sense, Revit, Rhino, and other computational tools, with the exception of Form Z, do not produce measurable parallel projections or other orthographic conventions associated with this first electronic wave. Software interface distorts the dimensional accuracy of orthographic convention just enough to go unnoticed. The subtlety of the distortion is symptomatic of the need to keep referring to electronic images as drawings.

The ability to make computer pixels appear as hand-mechanical lines sustains our detachment from the technical dimensions of students' visual world and its computational logic. The technical foundations of these tools belong to another set of conventions associated with the production of virtual, three-dimensional geometry. These geometries can be "generated and accessed by both direct manipulation and by formula; the equation that generates the geometry is bi-directionally accessible to a clever programmer who can extract the length of a line or the radius of an arch, manipulate it by script, and regenerate the resulting geometry." [17] Parametric scripting plug-ins, like grasshopper (not so young anymore) or Dynamo for Revit, have not made the mathematization of geometry — a precondition for orthographic representation — any more transparent. The aim of this type of media is not to extend hand-mechanical drafting or orthography, but rather to break the world that made them. Somewhere inside this rapture is the interference described in *the cube* exercise.

Fig. 8 Wooden cube models, 6x6x6 inches.

The studio methodology presented in this paper extends the computational and electronic space of contemplation by giving images produced in Revit ample time to be reviewed as technical constructions. This time does not supplant the knowledge made or evaded (take your pick) during their production. At best, this approach is honest about the treatment of images as presentations of a model, not representations of a reflexive idea. There are three common ways of finding the space of electronic contemplation in virtual, real-time models:

1. *Reviewing virtual models live on computer screens (a seemingly benign desk-critique practice).*
2. *Exporting designed paths or views, such as animations and other spatial simulations.*
3. *Designing interactive virtual environments through gaming software and other platforms.*

These three approaches are not exhaustive, yet each one suggests that the iterative space of contemplation in electronic media is post-orthographic. The studio work presented in this paper does not use any of these methods. Instead, post-orthographic images produced in Revit and hand mechanical drawings are reviewed next to each other. This type of "mixed review" is not novel. It happens in almost every school. However, acknowledging the technical gaps in review language and dwelling on the differences between the means of production is unconventional. Reviewing and developing this work simultaneously is an essential part of addressing the underlying technical confusion. This approach is implicitly asking a simple question. Is orthographic knowledge a precondition for working in a post-orthographic world?

Labor-time

"The computer automates aspects of production that are detrimental to how students think. It's clear that drawing by hand is linked to forms of thought that are more analogous to what architects do…after all, computers are just tools, I mean, they're not design tools, they just express our ideas."

The conclusion of the Post-orthographic Tinkerbell effect falls under the weight of its own expectations. To displace some of the weight, every section of the paper starts with a self-serving, imaginary quote. The quote above was compiled from the memory of reviews at the end of the 20th century and the start of the 21st century. It implies two things:

First, that computational space is intellectually deficient because of its proclivities for automation and distance from hand-mechanical gestures associated with drawing and modeling. Rather than reinforce preconceived value judgements about tools, it is time to acknowledge that thinking in computational space happens radically different than it does in orthographic physical space. The environment is not better or worse. Its effects have not been examined enough to update our technical language by committing to the simplest of tasks, such as, calling an image an image.

Second, in spite of the focus on process-based education, the review of student work prioritizes outcomes and considers most tools, especially electronic media, as means to an end. The impact that computational processes have on everyday life attests to the way these tools structure thought. Architectural education is not immune to the effects of contemporary media.

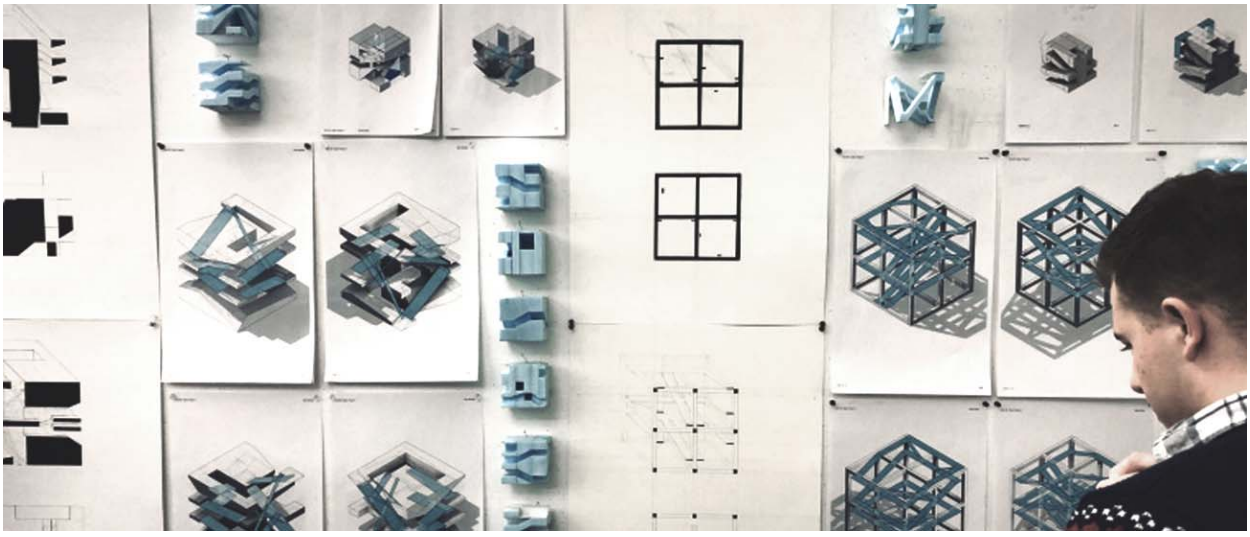

Fig. 9 Student Review.

Computational process and electronic media are not "just tools" or different ways to deliver information. Like most tools, hand-mechanical or otherwise, they have epistemological consequences. Unlike hand-mechanical tools, the techno-theoretical discourse — intense reflection about the means — built around electronic media is in its infancy.

Engaging in media-based discourse has always been a precondition for reviewing student work. In the 21st century, this is no longer the case. It would be easy to blame this change on a generational shift or contemporary trends. Rather than dwell on generational rivalries, Pier Vittorio Aureli reinforces Hannah Arendt's influential distinction between *work* and *labor*, asserting, "in architecture, a building, a project, a model, a drawing, a text, or a book is usually referred to as *a work,* or the *work of the architect."* [18] *Work* suggests the authorial breadth of production, while *labor* is much more difficult to understand because it surpasses traditional outcomes and the effort required to sustain *work*. Studying the technical space of means of production requires effort. It is a form of architectural labor. To review student work independently from student labor "obscures the fact that behind the production of something there is a much larger and wider agency than what is acknowledged in the public presentation of architectural work." [19]

Real-time, virtual media processes relocate the traditional space of iteration, while hiding behind opaque electronic interfaces that obscure architectural labor. It is time to update our *linguistic apparatus* and take hold of the language that affects all the technical revolutions we are eager to dismiss or embrace. If not, it is possible that techno-theoretical conversations — academic or professional — will always focus on resusitating Tinkerbell.

Notes

[1] May, John. "Everything is Already an Image" in Log 40, (New York: Anyone Corporation, 2017), p 12.

[2] Ibid, 15.

[3] Ibid.

[4] Ibid, 12.

[5] Carragone, Alexander. The Texas Rangers: Notes from the Architectural Underground, (Cambridge, MIT Press, 1995), p 12.

[6] Juhani, Pallasmaa. The Embodied Image, Imagination and Imagery in Architecture, AD Primers, (West Sussex, Wiley, 2011), p 60.

[7] Young, David. "A Historical View of Iterative Methods" in Computer Physics Communications, Volume 53, 1, (Amsterdam, Elsevier, 1989), p 1-17.

[8] Carpo, Mario. The Alphabet and the Algorithm, (Cambridge, MIT Press, 2011), p 16-18.

[9] Rosenbruck, Jonas. "Thinking the Limit of Allegory in Walter Benjamin's Trauerspielbuch" in the Germanic Literature Review, Volume 91, 2, (London, Taylor and Francis, 2016), p 126-128.

[10] Groys, Boris. In the Flow, (London, Verso Books, 2018), p 139.

[11] Ortega, Lluis. The Total Designer: Authorship in the Architecture of the Postdigital Age, (New York, Actar, 2017), p 22.

[12] Carpo, Mario. The Alphabet and the Algorithm, (Cambridge, MIT Press, 2011), p 16-18.

[13] Han, Byung-Chul. In the Swarm: Digital Prospects, (Cambridge, MIT Press, 2017), p 15.

[14] May, John. "Everything is Already an Image" in Log 40, (New York: Anyone Corporation, 2017), p 19.

[15] Ortega, Lluis. The Total Designer: Authorship in the Architecture of the Postdigital Age, (New York, Actar, 2017), p 23.

[16] Bernstein, Phil. "Parametric Value" in The Politics of Parametricism, Digital Technologies in Architecture, ed by Matthew Poole and Manuel Shvartzberg, (London, Bloomsbury, 2015), p 202.

[17] Ibid, 202.

[18] Aureli, Pier Vittorio. "Labor and Work in Architecture" in No Sweat, Harvard Design Magazine, Number 46, (Cambridge, Harvard Press, 2018), p 72.

[19] Ibid, 73.