Matter over materiality: lessons on authority from Eladio Dieste

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ABSTRACT: The education of architects is contingent upon learning how to describe buildings through the organization of materials – and their structural and spatial behaviors. Architects do not make buildings, they make and coordinate visual representations of buildings. This is the legacy of the modern authorial paradigm established by the Italian Renaissance architect, Leon Battista Alberti. In spite of the advent of computational tools, Alberti's influence is still evident in the education of architects. The preoccupation with authority – the presence of history and the evidence of authorship – is one of the most enduring effects of this 15th century legacy. This paper focuses on the role of authorship in architectural education. The focus of this study is the haptic-based pedagogy used to distinguish between matter and materiality in Dieste Walls, an architecture course centered on the work of the late Uruguayan engineer Eladio Dieste.

1 AUTHORIAL LEGACY

1.1 *Technical modes of historical authorship*

Authority has been central to the discipline of architecture since its inception. Some version of, "architects don't make buildings, they make drawings", a passage from Robin Evan's 1986 essay, "Translations From Drawing to Building" has been quoted in countless papers and conference prompts that address the relationship between ideation and execution in architecture (Evans 1986, 156). This was not a novel assertion when Evans made it three decades ago, but it was a precise observation, which is worth revisiting in the context of architectural authority. The continuous reference to this passage is significant because it binds architecture's representational and authorial projects. These two projects span over five hundred years of technical history that unfolds the connection between, hand, mechanical, and digital processes.

To link technical history with the project of architectural authority this paper considers two definitions of authorship: First, the historical traditions that define disciplinary paths to follow or challenge. Second, the underexamined and evolving collaborative nature of making architecture or what Mario Carpo refers to as "the style of many hands" (Carpo 2017, 136). Both definitions are intertwined, however, it is important to define each trajectory separately and contextualize each path in reference to the other sections of the paper.

The first definition is based on identifying an author responsible for defining historical traditions. In this case, authorship is almost always attributed to a single individual, accountable for formulating the architectural concerns of a specific era. Consolidating authorship is the basis for traditional forms of precedent study and the establishment of corresponding schools of thought, such as the Beaux Arts (Ockman 2012, 4). Studying precedents is a mimetic process – a systematic method of copying – that solidifies the dependency between the representational and authorial projects in architecture. For centuries, students have seldom had to understand how to build their precedent study, or become invested in the labor that produced the subject of their rigorous study.

Instead, preference is traditionally given to uncovering the ordering principles that reveal the subject's organizational strategies and conceptual underpinnings. This is one of the common threads that links centuries of western treatises from Vitruvius' Ten Books on Architecture to Durand's Recueil and Precis. Learning how to draw a precedent is a significant investment of time. This time-based exercise has given students authority over their own projects through a direct link to historical traditions based in representation. Historical links are the strongest alibi for student work in precedent-based teaching. Student alibies have changed as a result of the shift between the technical ages listed at the beginning of this section of the paper.

Mario Carpo traces the roots of this first definition of authorship and its alibi condition to the Renaissance Architect Leon Battista Alberti. For Alberti, a building is the identical copy of the architect's design. In contrast to Alberti, Filippo Brunelleschi established authority by being directly involved in the construction of the building. In essence, Brunelleschi considered the building to be his because he made it; Alberti considered the building to be his because he designed it. The role of the author and the difference between Alberti and Brunelleschi is evident in Nelson Goodman's distinction between autographic and allographic arts. The former is based on the author's hands-on approach, while the latter is guided by the author, but executed by someone else. (Carpo 2011, 19). The distinction between these two forms of authorship is at the center of Carpo's arguments about Alberti's authorial legacy. Both versions of authorship, autographic and allographic, center on pre-mechanical means of production. Throughout the renaissance and until the industrial revolution, imitation and visual similarity framed the technical production of objects and buildings. This technical era reinforced the mimetic procedures of precedent-based teaching. Pre-mechanical artisan tools directly influenced the production of knowledge. Pedagogical strategies and the formation of knowledge were not based on identical replication (Carpo 2011, 16). This was not only a theoretical condition, but a consequence of the technical age at hand. With the advent of mechanical reproduction and the material consequences of the industrial revolution, identical and rapid replication began to drive building production. The start of the industrial technical age solidified the allographic dimensions of architectural authorship by turning material replication into the norm.

According to Lluis Ortega, "In the tradition of mechanical production, the main factors for evaluation with regard to manufacturing systems were based on the logic of how well a model could be reproduced and repeated. In the digital age, the evaluation is more closely tied to factors like time and the accessibility of the means – software and hardware – required by the designer. This change in efficiency framework is not only tied in with an economic discussion; it also has a very important impact on a conceptual level." (Ortega 2017, 22). Ortega expands the implications outlined in Walter Benjamin's Art in the Age of Mechanical Reproduction, another piece of writing well-quoted by architects and academics interested in formulating ideas about architecture's representational project. In broad terms, Benjamin's observations are based on the loss of originality of the object once it concedes all power to allographic or scripted production (Benjamin 1936, 103). The space of production highlighted by Ortega's work is concerned with the shortened distance between representation and production. The reconfiguration of this distance is afforded by the digital age of production and the establishment of new alibies. This "short distance" is essential for students to understand the authorial foundations of the stylistic goods they consume at high speeds through visual online platforms. The digital technical age is based on invisible algorithms developed by computational systems or sequences of operations that have reconfigured visual authenticity. Students work within an electronic framework that has moved past mechanical reproduction and into real-time images. As a result, the educational role of precedents has shifted significantly. Educators should be asking, what types of precedents address the complexity of the technical age our students work in? In the context of the rapid image production and consumption tied to digital culture, how and what do students learn from precedents?

To dwell on these questions it is necessary to unfold the second definition of authorship outlined at the beginning of this section. This definition centers on collaborative practices and their impact on contemporary education. It is easy to take for granted that architecture is a form of collective knowledge produced by groups of people across time. Because of its pervasiveness and intrinsic architectural nature, collaboration is pedagogical quicksand. If we can acknowledge that making architecture requires forms of collaboration, then why is it difficult to genuinely address collaboration in architectural education?

Figure 1. Students working on version two of ruled surface brick wall against string and wood formwork.

1.2 *Collaborative labor and Eladio Dieste*

In this paper, the pedagogical implications of collaboration are addressed through the teaching and study of one practice-based precedent, the work of the late Uruguayan Engineer, Eladio Dieste. This pedagogical effort is explored in an architecture course titled Dieste Walls. Dieste's work collapses the space between mechanical reproduction, digital processes and allographic representation. His work combines Carpo's idea of the digital, being a notational product, not a software product, with Ortega's concerns about mechanical reproduction's effect on authenticity. Since the early 1950s, Dieste's reinforced masonry structures have been admired for their material inventiveness. The pedagogical approach of Dieste Walls posits that structural admiration of Dieste's work should be framed by the relationship between Dieste and Montañez SA, the practice he established with his partner Eugenio Montañez, and the physical labor force that produced their work. In spite of working primarily in a pre-electronic era, Dieste and Montañez SA displaced the notion of single authorship in favor of collective labor. Who are the people captured in historical construction images, standing on scaffolding, organizing work, and moving materials on site? These images precede, both literally and conceptually, the evocative images of his completed buildings. Like many of his modern contemporaries, Dieste's work has been categorized into a branch of history that reinforces the importance of individual genius. It is impossible to argue against Dieste's structural prowess; this pedagogical approach does not refute the relevance of his intellectual labor. However, his practice did not pursue a representational project aimed at visualizing his structural intuitions. Several of Dieste's writings and interviews in which he discusses the role of labor, mark the introduction to this twelve-week-long course: "The builder is indispensable. In fact, the project for a building is not really complete if it does not consider how it will be built, and the ways in which a building can be built have a notable power of inspiration. All viable new structures are intimately tied to construction methods, and these methods are visible in the finished building." (Dieste 1996, 185).

Every aspect of work done in Dieste Walls is performed collaboratively (Figure 1). Designing the overlap of many hands and minds is fundamental to this work. The course is a part of a Building Shop sequence focused on the haptic intersection between representational and construction technology. The study of history frames this intersection — arguing that learning and engaging Dieste's work should be pursued through physical acts of making, rather than lecture-based instruction. Building Shop courses or "Shops" meet once a week and are made up of ten to fifteen

students ranging from second-year undergraduate to second-year graduate students in architecture. The content of the Shops mirrors faculty scholarship and research. Framing faculty work alongside students at different points in their education highlights the importance of collaborative practices in a digital technical age. In the case of Shops, collaborative practices are a way to connect architecture with construction history and the role of the humanities. The contemporary consequences of this history are pointed out by Joan Ockman in the Architect as Worker, "In architecture today despite the proclaimed integration of all phases of the building process through high-tech management techniques, the rhetoric of immaterial production contributes to absolving architects from accountability to material bodies and places, not to mention provides an alibi from legal liability." (Ockman 2015, xxiv).

Collaborative aspects of architecture are being leveraged through the use of tools that allow groups of people to simultaneously access and share information. Equating the processing of information with the production of knowledge, and the disregard for "the rhetoric of immaterial production" has contributed to the conceptual distance between matter and materiality. This distance defines the pedagogical space of Dieste Walls.

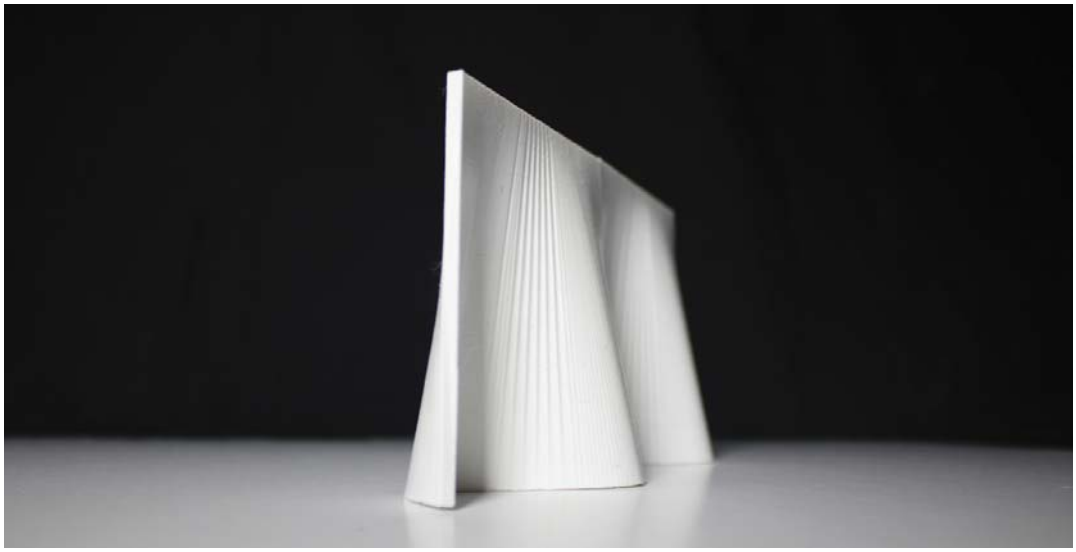

Figure 2. Three-dimensional, extruded plastic print of two ruled surfaces using direct to fabrication files.

2 MATERIALITY MATTERS

2.1 *Fear of error and the confusion between matter and materiality*

Mechanical and digital production are at the center of authorial concerns because they imply a loss of originality in the object, and therefore a displacement of traditional authority. Section one of this paper focused on displacing forms of allographic representation in favor of leveraging digital processes that expand and question mechanical production. For architects and students, the reconfiguration of authority is embedded in the need to predetermine the behavior of physical matter through drawings or models. The architectural anxiety over authorship is detrimental to the confusion between matter and materiality. According to Francesca Hughes, "architectural culture's very particular construction precision and fear of error constitute a powerful undertow in all its relations to the process of materialization."(Hughes 2014, 29). The fear of error and its effects on materialization are one of the criteria that define materiality as the visually mediated, representational understanding of physical matter. Most architectural education is focused on the exploration of materiality, not the behavior of physical matter.

Unlike materiality, matter is the physical constitution and behavior of materials in-situ. The conflation of these two terms affects the core of architectural education. One contemporary approach that confronts this space of uncertainty is the erasure of allographic mediation by producing direct to fabrication files (Figure 2). This approach may form new processes of materialization, however, these processes also propose a new type of authorship based on the reconfiguration of the labor used to choreograph physical matter. In the United States, architects are legally excluded from the means and methods of construction. This exclusion magnifies the authorial paradigm's influence in separating graphic ideation from material execution. Historically, there have been modes of work and practices that address this exclusion by reformulating the architect's interaction with labor. This is evident in academic and professional design/build strategies, as well as other methods of work that combine the need for material control with financial models.

It is important to point out that Dieste Walls is not a design/build course. The class is indebted to, but does not follow the influential design/build pedagogy pioneered at Yale University in the 1960s (Stern and Stamp 2016, 231). Most design/build pedagogy is a simulation of "real circumstances". Typically, this is based on material and industry partnerships, public political navigation, and other forms of simulated practice. This type of work is valuable and can be an appropriate precursor to professional practice. On the other hand, the work from Dieste walls is interested in establishing preconditions or precedents for deploying other design/build pedagogies. At the root of these preconditions are under-valued questions, such as, how is the history of labor taught without positioning construction as practical means to stylistic ends?

Figure 3. Four weeks of collaborative wall deconstruction and material cataloguing of the first ruled surface brick wall built in the spring of 2016.

2.2 *Making history through deconstructing Eladio Dieste*

In Dieste Walls, the means are the ends. For three consecutive years, thirty-five students ranging from second-year undergraduates to second-year graduate students have collaborated on the construction of three ruled surface – double curvature – walls made with the same bricks. Every semester students start with the deconstruction and material cataloguing of the wall built by the previous group of students (Figure 3). To shorten the distance between imagination and labor all forms of ideation are tied to methods of deconstruction. After choreographing and graphically documenting the deconstruction of the wall, students design formwork systems that define the double curvature geometry of the "new" wall. Scaled representations – drawings or models – do not precede the construction of the walls. The precise placement of strings vertically tensioned at different angles inside a wooden framework dictate the construction of each new structure. The assembly of strings and wood shown in Figure 1 is the formwork. Each adjustable formwork enables the construction of several walls. Material economy is integral to this process and it is emphasized by resisting gravity through form. Before, during, and after construction, students read Dieste's writings about the relationship between architecture, construction, and people. Through reading discussions, journal documentation, and collaborative construction, students engage the intellectual and physical dimensions of labor.

Dieste and Montañez SA's work is based on errors examined through strict numerical calculations. Unlike many of their predecessors and contemporaries, the practice did not develop double curvature forms through drawing or modeling. Alpha-numerical equations were the formal basis for the design and construction of their work. In essence, every structure was a highly calculated articulation of material error. Each structure asks, how does material bend and fail, and why do surfaces deform? The walls of the Montevideo Shopping Center anticipate the displacement of a straight vertical wall by using a ruled surface form that resists the horizontal thrust of the barrel vaults that rest on top of the curved walls (Figure 4).

The student work from Dieste Walls does not focus on the instrumentality of visual representation. What do students follow to make constructions if not drawings or models? How are the mechanical systems of reproduction defined? These questions suggest that the complexity of the system at play is not defined by the assembly precision of individual pieces. The complexity of the construction system is defined by combining geometry and material to absorb errors without undermining the system's structural integrity. Complexity is defined by the imprecise choreography of physical matter, typically referred to as material tolerance. Traditional authorial notions of tolerance are based on the physical accountability of visual representation. What is the difference between what I have drawn or modeled and what has been built? Dieste walls focuses on error prone, yet sophisticated distributions of matter, which are disassociated from physical accountability or material tolerances. A lot has been written about the role of errors and their serendipitous effects in the context of learning architecture. Most recently, in an issue of Perspecta that marked the distinction between accidents and error (Keller 2013, 33). This paper does not dwell on these distinctions, but rather amplifies an interwoven technical history, which unfolds the connection between, pre-mechanical, mechanical, and digital processes. Eladio Dieste's work and the work from Dieste Walls happens at the intersection of these three technical ages.

Figure 4. Panorama of ruled surface wall on the North side of the Montevideo Shopping Center in Uruguay.

3 READING DIESTE

This paper concludes by making a case for reading history in the context of contemporary authorship as a way to examine labor. The notion of "reading" is one of the most allographic aspects of the work of architects and students. One aspect of this work is the reading of written material, a foundational and almost automatic form of orthographic work. In architecture, reading is also a method of analyzing and intellectualizing physical structures. Many traditional readings of Dieste's work continue to lift his creative, individual genius as an expression of modernist ideals. The haptic-based pedagogy of Dieste Walls, asserts that his work remains largely unexamined because it displaced the central figure of the author by turning mechanical production into collective forms of labor. These forms of physical labor were inseparable from the ideation of structural forms. Additionally, Dieste and Montañez SA prioritized physical matter over representational materiality. Prioritizing matter over materiality and displacing individual authorship is at odds with many architectural education models. These labor-centric concerns counter Alberti's legacy of singular authorship and the primary methods of teaching architectural history.

Eladio Dieste passed away in July of 2000. Dieste and Montanez SA is still operating and thriving in Montevideo, Uruguay. In 2017, following significant efforts from architecture and engineering groups in Uruguay, including the newly formed Eladio Dieste Foundation, UNESCO visited Uruguay and granted five of Dieste's buildings world heritage status. This is a significant and well-deserved achievement for a practice that contributed ample material and structural knowledge for over five decades. It is time that readings of Dieste's work refocused on questions of labor. These are the aspects of the work that are critical in a post-mechanical, digital technical age. Additionally, these collaborative pedagogies can teach students about the displacement of individual authorship. Through the design of a collective construction process, students in Dieste Walls will continue to ask, how can physical matter—bricks and mortar—be organized to resist gravity through form? Furthermore, how does this process affect the distinction between matter and materiality and its relationship to authorship? It is important to teach students that by resisting simple classification, Dieste's work can become fertile ground for a new set of precedent-based pedagogical explorations.

Figure 5. Ruled surface brick wall prototype and string formwork secured at curved base.

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