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A Critical Reflection on the Implications of Digital Design Technologies

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A Critical Reflection on the Implications of Digital Design Technologies

Abstract

Purpose. Highly sophisticated digital technologies, have distanced architects and designers from intimate and immediate hand-drawing practices. Meanwhile the changes they rapidly bring come with undetected changes in cultural and social norms regarding the built environment. The growing dependence on computers calls for a more holistic, socially inclusive, and place-responsive design practice. This paper attempts to shed light on what we are losing in the design process as we rapidly transition to digital media used to communicate architecture. We contemplate the paradigms in which the human body and physical objects still play an important role in today's design environment.

Approach. The paper looks at current trends in developing and establishing "computer imaging" within architectural education, and the architectural profession through parametric design and the area of sustainability. In order to reveal novel and hybrid ways of architectural image-making, it also looks into art forms that already experiment with bodily practices in design, taking an artisanal animation project as a case study.

Findings. The renewed longing for craft, haptic environments, tactile experiences, and hand-crafted artefacts and artworks that engage the senses can be exemplified with the success of the documentary *Last Dance on the Main*, an animated film on the endangered layers of human presence in one of Montreal's downtown neighbourhoods. The open possibilities for creative hybridizations between the handmade and the digital in architecture practice and education are exposed.

Originality. The influence of film on the perception and consequent design of cities is well documented. There is little literature, however, on how the materiality and process of artisanal film animation can provide alternative, if not additional, insights on how to communicate various aspects of the built environment, particularly those rooted in the human body. Furthermore, handmade film explores a broader understanding of sustainability, which includes considerations for social and cultural contexts.

Keywords: *Digital tools, handmade images, artisanal animation, parametric design, environmental sustainability, architectural pedagogy, reflection-in-action, hybrid visualization techniques, CAAD drawing, architectural design.*

1. Introduction

The digital age has brought tremendous changes to our world. In architecture, digital tools have revolutionized the way drawings are produced, as well as how buildings are visualized, optimized, assessed, and constructed. However, the recent developments in computing abilities are causing design and architecture to confront new technologies that are increasingly substantive. The process activates Feenberg's (1991) critical theory, where once a technology has been implemented, changes to practice inevitably follow, and it becomes difficult for actors to work against it.

Jacque Ellul (1964, p. 89) proposes that:

> "Technology never advances towards anything because it is pushed from behind. The technician does not know why he is working, and generally, he does not much care […] There is no call towards a goal; there is constraint by an engine placed in the back and not tolerating any halt for the machine[…] The interdependence of technological elements makes possible a very large number of "solutions" for which there are no problems."

Woodbury (2010) names these infinite solutions the "implicit design space": where the computer depicts all design possibilities, feasible or not, complete or not, that may or may not be visited by human designers. These thoughts evoke the scene Alvar Aalto (p. 161) described in 1958 as "Grown-up children playing with curves and tensions that they are unable to control."

Today, architectural design is increasingly relying on digital technologies. These technologies are changing our culture, introducing new values, and (re)shaping our social ideals. The evolution of media, from the manual to the digital, has deeply transformed our sense of scale and the relation between architecture and our bodies (Cormier, 2020), and has ushered in a new era of virtual reality aesthetics. Moreover, nascent digital parametric logics offer automated design solutions in a potentially boundless space, affecting gravely the way architecture and city come to be. Aalto's (1958, p. 161) assessment of the situation that "has led irrevocably to a fashionable architecture, which is a dead end.", is as real today as it was in 1958.

These complex processes are pushing the practice and field of architecture towards the latest stage of "simulacra and simulation", that of the pure simulacrum – where any connection to reality is perceived as oversentimental (Baudrillard, 1995). In this world of hyper-real simulation, dominated by technology, the architect, or architect-technician, needs to assume new responsibilities in order to justify their own existence and the relevance of the ever-evolving technologies.

With the many technical possibilities that the digital has provided to the practice of architecture, we take a step back to ask, "*what are we losing?"*. This paper explores how the digitalization of the built environment is putting at risk some of architecture's basic manifestations, namely architectural education and pedagogical practices, the design process, and architecture's visual expression.

The article begins by exploring how technology can undermine issues of cultural relevance, place, learning, and creativity in the realm of education but also in professional practice, with a focus on the effects of parametric design. It then presents the case of sustainable architecture as an area where tensions between the digital and the cultural can be clearly traced, underscoring how the digital has pushed a "false sustainability", as architect and architectural theorist Juhani Pallasmaa suggests (2017a), whose writings on the value of the *haptic* in design support significantly the critical endeavour of the present study with regard to CAAD technologies. Finally, the paper explores how hybrid creative media, such as handmade film animation, can help bridge this gap by expressing the human qualities of built spaces while adopting an appropriate technology stance. The paper concludes with a series of reflections on the implications of the concepts explored and the role of designers in shaping architecture and, in-turn, the essence of human nature (Pallasmaa, 2017).

2. Critical perspectives on the tensions between the analogue and the digital

2.1. Architecture Education

Until the nineteenth century, when the French École des Beaux-Arts gave guidelines and training on the Classical Orders (Graham, 2003), architecture was not considered a "formal" profession, since there were no initialized educational and licensing programs.

With these roots in the fine arts, traditional pedagogy of architecture design studios relies on hands-on and experiential learning techniques. Studios equip students with the ability to critically reflect, brainstorm, and interact with their peers and surroundings while designing for time-intensive school projects (Schön, 1987). These peer-to-peer interactions, facilitated by the physical environment of the design studio, can be beneficial to the growth of an architecture student as they learn to exchange, debate, and reflect on key concepts, values, and design principles. Over time, these physical interactions inform their tacit knowledge (Polanyi, 2009) that govern their styles and workflows as future licensed and practicing architects (Schön, 1987).

Juhani Pallasmaa in *The Thinking Hand* observes that the skill most vital for an architectural designer is "to turn the multi-dimensional essence of the design task into embodied and lived sensations and images" (2009). Therefore, design studio pedagogies that derive from material-based art education models focus on developing skills of "sensorial reflection" by encouraging students to read, travel,

observe, sketch, and document their dynamic surroundings. These activities enable their "capacity for empathy" for lived experiences within the built environment.

However, the mandates brought by automotive and aerospace industries to construct buildings upward along the vertical axis provoked the rethinking of the architecture profession and its conventional qualifications to implement large-scale designs of the built environment. This resulted in the digitization of architecture, which can be traced back to the 1960s, and can be seen as analogous to the disruptive Industrial Revolution, which promoted innovations in speed, mechanical reproduction, and quantification of the design process. This uptake of digital tools was viewed, at the time, as a means that would facilitate a construction boom across the globe, post-World War II.

In response to these trends, architectural institutions reformed their vastly sensorial and artistic approaches to better integrate emerging digital technologies such as Computer-Aided Architecture Design (CAAD) that reflected new paradigms of mass-production and engineering in the construction industry (Gross and Do, 1999). As a result, the rapid digitization has transformed the nature of socio-cultural practices of learning environments in architecture schools.

The application of digital design tools in pedagogical architecture projects has had both positive and negative impacts on knowledge exchange between research and practice. While the swift adoption of digital technologies in the design process was imperative to the survival of architecture as a profession, the educational system continued to be sceptical of these advancements as it relied on the tangibility of creative outcomes through analogue resources such as hand-sketched project submissions, physical studio interactions, hands-on workshops, and field studies. Hence, most educational institutions persist in this tension between the digital and the analogue dimensions of architecture pedagogy, and this results in a curriculum that is ambiguous in its approach to sustainably train young professionals for the future. Assimilating the fundamentals of past creative practices in new technologies remains a conundrum.

This increasing polarity between the digital and the analogue is also observed in the user interface of CAAD tools that are often neutral and rigid in the hopes of simplifying, structuring, and democratizing the design process. CAAD functions simulate the analogue tools once used by architects but cannot essentially recreate the haptic experience associated with them. Furthermore, given that these tools are used by creative individuals with diverse socio-cultural backgrounds, the neutrality of its elements often flatten and undermine the complexity and inherent "messiness" of the traditional design studio (Gross and Do, 1999). While students are encouraged to experiment with unfamiliar materials and concepts, and come up with designs through trial and error, digital design technologies have added socio-cultural and psychological inhibitions to this process as they have promoted speed, efficiency, and accuracy of seemingly "finished" solutions.

Pallasmaa (2017b) observed that "...prior to our current industrial, mechanized, digitalized and materialist consumer and information culture, situations in daily life, as well as processes of maturation and education, provided a more comprehensive experiential ground for human growth and learning, due to the direct interaction with the natural world and its complex causalities" (Pallasmaa, 2017). On the other hand, today, CAAD tools with their immense capacity in facilitating students and practitioners to produce and share larger quantities of work, mostly online, spur on an unhealthy competitive environment with the bypassing of critical initial research, meditation, and reflection of design principles and values, and result in an uneven distribution of the quality of the creative outcomes (Buchanan, 2012).

However, recent paradigms of open-source networks in relation to participatory design practices with members scattered across the globe have redefined conventional, top-down instructor-student relationships in a design studio. In the traditional format of a design studio critique, students typically present their work in front of a passive audience and receive critical feedback from instructors only at the end of their design processes (Graham, 2003). In contrast, "e-studios" and digital pedagogies in architecture that adopt open-source principles of transparency and accessibility have led to a shift in the power dynamics of the learning environment, where the instructors and students now need to share a level plane of discussion and symbiosis of knowledge and other resources (Al-Qawasmi, 2005).

Today, and as witnessed during the COVID pandemic, traditional design studio dynamics of physical and synchronous interactions have given way to remote and asynchronous processes, demarked by an exchange of digital documents and online materials among individuals. The rise of "e-studios" has resulted in a change in communication, as students can share their work outside the physical boundaries of the design studio, right from the inception of the projects (Al-Qawasmi, 2005). Yet, although digital studios prompt students to think "fluidly" and generate multiple design outputs over a very short span of time, instructors now struggle to find new ways of giving quality feedback before submissions. Additionally, students tend to overlook the socio-cultural contexts of their designs by adopting global principles that arise from the gentrification caused by digital applications.

From this overview, it is clear that the paradigm of digital media in the design learning process needs to move away from a narrow technical perspective that views new technological as "value-free neutral (tools) that produce objective realities" (Al-Qawasmi, 2005). These digital tools have made architecture education more accessible and, arguably, more efficient in terms of time. However, the dramatic shift witnessed in the last fifty years has completely reorganized the basic principles of architecture pedagogy: where students are deprived of the merits of experimental hands-on sensorial reflection, and are simply trained in developing and transmitting solutions through digital tools. The e-studio, which is governed by the digital screen, favours emphatically an architecture pedagogy centred on vision that

ignores the multisensory nature of architecture but also the socio-cultural background and creative skills of the student.

2.2. The Design Process

Before the advent of computer applications in the design process, architects used physical tools for design, such as pencils and tracing paper, in a considerably time-consuming form-finding process. Owing to these limitations, precedents with complex curve forms cannot be found in previous decades, and only recently have they become predominant (Picon, 2010).

Digital tools in architecture have been adopted and used in many different ways. Their explosive growth has affected the core principles of architectural design. These technological advances, undoubtedly, offer new possibilities that were inconceivable only a few years ago (Picon, 2010) and have influenced the whole field of architectural design, leading to a new approach to design called *parametricism* (Schumacher & Leach, 2009). Architecture thus has found a new tool for conceptual design in digital media (Schnabel, 2007). This change is a result of the evolution of computer-integrated design from one-off design modelling systems to designer-supportive design environments and, eventually, to the truly generative geometric design machines, which were to substantively transform the nature of design methods and processes (Picon, 2010). Unlike past design processes, which were based on improving the quality of design step by step, architects can now quantify parameters to generate and control different architectural variations while designers can explore multiple viable solutions and concepts without being limited by their own drawing and modelling skills (Lawson, 2002). They can also change and modify their own rule-based representations in any stage of the design process (Schumacher, 2008). This availability and means that are offered by digital tools lead to innumerable design alternatives that can be generated in parallel, allowing for new modes of thinking and contributing to the explorative process (Barrios Hernandez, 2006; Holland, 2012; Karle & Kelly, 2011). A new set of design practices has emerged, which is the direct result of digital tools in architecture, and which affects not only the design process but also has significant impacts on the architectural forms. To assess the effects of digitalization in their entirety, we will examine the role of parametric tools in the following two aspects: 1) the design process, and 2) the final outcomes of the architectural process, namely, the architectural forms (Figure 1).

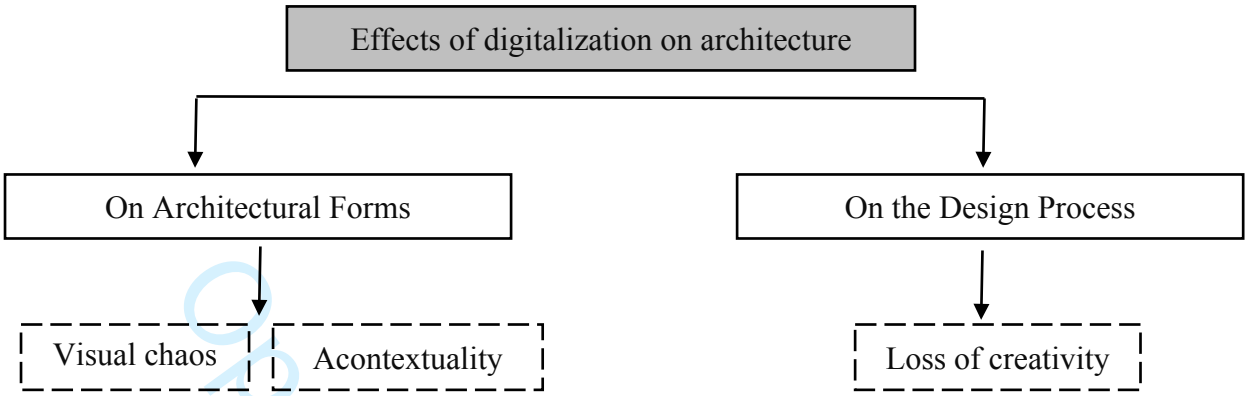

Figure 1. Assessing the effects of digitalization on both architectural forms and the design process

These drastic changes in the design process have extended the boundaries of design possibilities (Gero, 1996; Liu & Lim, 2006). With them, however, come some shortcomings with regard to creativity. Traditionally, designers spent a lot of time on the design process, whereas today, only one mouse click can provide thousands of alternatives. Sketches (conventional design practices) are a time-consuming process, have few details, and tend to suggest and explore, rather than confirm, by retaining a level of ambiguity (Poole & Shvartzberg, 2015). However, they allow the designer to spend more time on the artefact and engage in an exploratory search, discovering alternatives that are not conceived at all in the preliminary digital design phase . Schön (1987) names these emerging ideas a *reflection in action*. In other words, whereas in parametric design, all design alternatives are restricted to the initially defined code and parameters and cannot go beyond them, in traditional methods of design, the ambiguity of sketches has the potential to trigger new ideas outside a defined "box".

One might argue that in the parametric way of design, designers can change and modify their own rule-based models at any stage of the design process so that it can be kept open and flexible (Oxman & Gu, 2015). Yet, in reality, these possible changes are limited to the rules that the designers themselves have set for the design problem in the first place. Recoding the whole process would be more time-consuming than any traditional design method with the additional risk of missing all the initially generated alternatives. This complexity of modifying or upgrading the code forces designers to narrow their alternatives within the current platform, since they are reluctant to recode the whole procedure (Woodbury, 2010). Consequently, a code-based design process would hinder creativity, since it would restrict designers to only one possible range of solutions. By relying on digital tools such as computer-aided design software, architects miss out on the nuanced reflection in action the hand enables. Moreover, mechanical reproducibility of digital designs in architecture have nullified notions of authenticity as they take away the "aura" of the architect who left unique imprints on handmade construction drawings while engaging with a work through bodily interactions (Benjamin, 2007).

Although there has been a drastic increase in the efficiency of projects designed using digital and parametric design platforms, computational thinking renders a complex design problem into disconnected smaller parts and can discourage architects from critically reflecting on the outcomes of these codified processes (Kavousi *et al*., 2019). Digital design and parametricism can have dire implications for the skills of architects, as they are given the freedom to blame the "machines" for not producing the expected results, absolving them of responsibility as designers. Architect Markus Miessen (2016) critiques the rise of parametric digital design in architecture in his seminal work, *Crossbenching: Toward Participation as Critical Spatial Practice*:

> "(Parametricism) is used as a means to outsource (design) responsibility; and more specifically, to be able to claim that the end result of the design is not the result of specific decisions by the designers, but by the complex and pseudo-scientific processes based on a set of criteria that the designer defines, and which is brought to life by the computer."

In a series of perceptive works, Juhani Pallasmaa examines the entire creative process of the architect through the interaction between body and mind, between hand and eye. Without denouncing the conveniences of CAAD, he underlines the importance of conceiving architecture and even fabricating objects by engaging all of the senses, away from the computer screen. He argues that any tactile experience using a computer mouse is still an operation that takes place in an immaterial world and that "computer imaging tends to flatten our magnificent, multi-sensory, simultaneous and synchronic capacities of imagination by turning the design process into a passive visual manipulation, a retinal survey." (2009, pp.96-97)

The transition from hand-drawn to highly computerized architecture design has brought possibilities to the table never imagined before, yet the drawbacks of computer-generated architectural forms are quite obvious in buildings today. In terms of formal features, incoherency can be considered a common characteristic, in matching the exterior design to that of the interior and also to their descriptive qualities. (Hazbei & Cucuzzella, 2021). Digital tools increase computational control over design geometry (Dino, 2012) and are mostly used to create seductive and spectacular forms or even create an environmental envelope around the building, overlooking basic architectural formal qualities such as the connection between site and building. In describing this technological advancement in architectural forms, Dalibor Vesely states that "complexity can be produced, but richness must be created" (Burry, 2013).

Digitalization facilitates form-finding processes and responds to site and climate requirements. However, these practices are increasingly depriving contemporary architecture of meaning (Grobman & Neuman, 2013). Parametric architecture, as it is practiced today, cannot convey contextual significance, since it considers merely climatic, topographic, and energy as regional factors (Mahgoub,

2007). In other words, parametric design focuses on digital forms and simulation techniques for buildings without addressing the cultural significance of local places (Lorenzo-Eiroa & Sprecher, 2013). Although this development in architectural digital tools can be considered a way forward in environmental sustainability, it is a counteractive approach to cultural and social sustainability, producing acontextual architecture.

3. The false sustainability of the efficient digital machine

Pallasmaa (2017a) classified the commercial approaches to sustainable architecture as a type of "false sustainability". Digital tools have allowed to simulate, estimate, predict and generate multitudes of balance sheets. While many of us still associate, ground, and define sustainable architecture through eco-efficiency (i.e. the optimization of environmental performance metrics), this measurement-driven definition contradicts the multitude of meanings, and non-technical layers that can contribute to the sustainability of a *place* (Cucuzzella & Goubran, 2020). It also disregards the formal definition of sustainability as an intersection of domains; the social, economic and environmental, in its most basic sense, with the addition of the cultural (McMinn & Polo, 2005), ethical (Ehrenfeld, 2009), or spiritual (Walker, 2006, 2015) in its more elaborate forms.

While the digitalization of sustainability approaches, through simulation and optimization tools, has brought about speed, it has been primarily focused on and is inevitably linked to mitigating predictable risks (Cucuzzella & Goubran, 2020). While data and technological gadgets will certainly be defining to the future of all architecture, including sustainable building, what we are losing sight of are the core concerns of expression, contextuality, functionality, and aesthetics. Most importantly, and as Pallasmaa (2017a) points out, this efficiency and technology-based sustainable design approach aims at creating instantaneous impressions and neglects architecture's temporal dimension.

While technologies, and information and communication technologies (ICTs) in specific, have become defining features to our sustainability approach, it is essential not to confuse the designer's role with that of the technology integrator. In that sense, we have to consider that sustainability can only be attained by balancing between the high- and low-tech (Beder, 1994), between the smart and the human, between the digital/artificial and the natural, and the imagined and the real. These choices require judgement (Collins, 1971) rather than optimization algorithms. They require judging how, beyond the digital screen (Cormier, 2020), an element can fit on its site, and in its context; how an architectural element can project meanings – as forms of ecological lessons (Cucuzzella *et al.*, 2020) and a form of cultural symbols (Goubran, 2019; Hattenhauer, 1984)); how the project can integrate both the

anthropological and digital (Cucuzzella & Goubran, 2019), and how the design can consider both the predictable and prospective (Cucuzzella, 2020).

In a series of articles published in the early 2000s, Guy and Farmer (Farmer & Guy, 2004, 2005; Guy & Farmer, 2000, 2001) have established a seminal vision to comprehending and applying the concept of sustainability meaningfully – in what they defined as "pluralistically". This is well-aligned with the view that a stable, or bounded definition of sustainability in architecture, will reduce the process of design (i.e. sustainable design) to a series of managerial decisions around energy, water and feasibility (Cucuzzella & Goubran, 2020; Pyla, 2008; Vandevyvere & Heynen, 2014). Of course, a fuzzy definition always creates a more complex problem, which, in the context of digital tools, is harder to model, predict and compute. Here the role of a sustainable design architect has to transition from that of the technical advisor to one of "a more sociological engineer or entrepreneur" (Mooi, 2014). An exploration into this new, pluralistic, definition of sustainability in design is offered by Walker (2006, 2015) in the following basic design guidelines: 1) to reconsider the material culture and aesthetic conventions. This would also entail removing our production modes from the technological or product push and market pulls (Tarkhan, 2020); 2) to consider the "history(ies)" of sustainability. And in turn, untangling the concept from its political dimensions (Hajer, 1995); 3) to consider sustainable design as a critical process of inquiry. This grounds the role of the designer as a reflective practitioner (Schön, 1987); and 4) to disassociate sustainability from the new or leading-edge, by assessing design through its functional worth – and its spiritual potential.

While we transitioned our collective understanding of sustainability from a product-focused one (i.e. green design) to one of system innovations (i.e. design for sustainable transitions) (Ceschin & Gaziulusoy, 2016), we have been unable to grasp the cultural and the aesthetic, to decipher the competing histories, to deal with complex thought or to comprehend the spiritual potentials of material objects. Our modern digital and technological tools have failed to catch up with how our understanding of “sustainability” has evolved. Sustainability entails qualitative considerations that go beyond mere things. Awan *et al.* (2013) address issues of accessibility and spatial agency in the practice of architecture and sustainable development such that the “knowledge and rituals” of the profession are awkwardly hidden from the larger public. “A closed loop is set up whereby the profession designates knowledge which architects must possess […] Spatial agency ruptures this professional closure, first in its inclusion of others in the processes and secondly in its rejection of the building as the sole source and representation of expertise”. As we will see in the following section, new tools and techniques continue to enter this space of inclusion whereby architectural representations are demystified in a socio-cultural dynamic that unlock the potential of a given complex situation and enables open engagement.

4. Film as Architecture Communicator

4.1 The Digital that is Tactile

If digital technologies and parametricism obscure the role of architects and the degree of their responsibility vis-a-vis the design process, one has to recognize what that role is, namely, the creative role, the one being most at risk of being compromised. Bodily ways of making are still crucial in the creative stages of architectural practice. Walter Benjamin in his seminal essay *The Work of Art in the Age of Mechanical Reproduction* observed that architecture as art requires not just optical contemplation but also "tactile appropriation" that is mastered and sustained by gradual habit (1986). This argument extends, naturally, into the realm of *communicating* architecture, in the classroom, the design studio but also in society at large.

Long before 3D CAAD modelling, film was able to capture the three-dimensionality of architectural space by virtue of techniques such as camera movement, depth of field, and the perspectival features of three-dimensional space onto the two-dimensional photographic plane. The possibilities of architectural representations in film are not limited to documenting building forms but also informing our ideas about materiality, atmosphere and use, as well as expanding into *future visions* of built environments. Perhaps it is no coincidence that Juhani Pallasmaa is also a keen expert in film, which, according to him, is the medium *par excellence* in communicating architecture (2001, p.13), echoing thus a position held by numerous film scholars, going back to cinema pioneer and theorist Sergei Eisenstein himself (Eisenstein, Bois, & Glenny, 1989) or Walter Benjamin who stated that "by close-ups of the things around us, by focusing on hidden details of familiar objects, by exploring commonplace milieus under the ingenious guidance of the camera, the film, on the one hand, extends our comprehension of the necessities which rule our lives; on the other hand, it manages to assure us of an immense and unexpected field of action" (2007).

With this understanding of film's capacity in expressing architecture, it is no surprise that the discourse around new moving image technologies and their potential to now act disruptively to the norms of photorealism is a very familiar one to architecture and film scholars alike. As CAAD technologies are increasingly encroaching on the realm of animated representations of space, critiques on how CAAD has limited design creativity logically extend to the computer-generated moving image. Architect and essayist, Stan Allen, used low-tech animated films as a paradigm for an approach to CAAD that focuses on abstraction and significance rather than on precision (2009, pp.89-90). This viewpoint echoed a wave of writers on film and filmmakers who had already explored the materiality of the medium itself within its analogue past but also in ways of experiencing space in film that is not centred around vision (Marks, 2000; Bruno, 2014).

Ultimately, all of these arguments are directly linked to a more holistic understanding of architecture, one which corresponds better to the human lived experience. One can argue that the banishment of the body and the excessive reliance on photorealism, as encouraged in major CAAD software, is at the expense of meaningful architecture and, consequently, a sustainable one.

As a type of film that can largely involve the handmade, film animation is particularly well positioned to express architectural space in all its hapticity. Film animators study and manipulate each film frame individually. This arrest of time allows them for a greater involvement of their bodies onto each frame that can be a photograph of a hand drawing or of a hand-crafted set, as is the case with stop-motion techniques. Interestingly, digital technology, instead of replacing, has in fact encouraged such techniques (Parks, 2020), resulting to new, hybrid, more accessible ways of expressing architecture.

In fact, craftmanship is no longer a thing of nostalgia but rather an integral part of new design technologies. Richard Sennett (2008) envisions that these new media of hybrid communication have ushered practices that put bodily craftsmanship and skill development as primary drivers of the design process, irrespective of the dichotomies between the digital and the analogue. He observes that "the past life of craft [...] suggests ways of using tools, organizing bodily movements, thinking about materials that remain alternative, viable proposals about how to conduct life with skill" (Sennett, 2008, p.11). This reinforces the necessity of revisiting hands-on and sensorial ways of material engagement in traditional architectural practices in order to bring about a hybridized balance with current technologies that continue to veer toward the other extreme of digitization in the design spectrum. As highlighted by Sennett, hybrid tools could strive to augment the “intimate connection between hand and head” where the hand relates to the analogue while the head relates to the digital.

4.2. Last Dance on the Main: As an example

In his own work as film animator, Aristofanis Soulikias seeks to express the built environment beyond its Cartesian constraints of measurable space, in the realm of the lived and bodily experience, which is communicated through the handmade aspects of his filmmaking process, such as the non-digital nature of the materials he uses and the physical environment in which he captures the individual photographic stills. *Last Dance on the Main*, his 2014 animated documentary about the demolition of a row of historic buildings in Montreal’s former Red-Light District and the successful resistance put up by local artists and activists to preserve their venue is a characteristic example (Plate 1). All the scenes and movements in the film were manually fabricated, captured by a digital camera, and assembled into a film with a special stop-motion software. The handmade component of the film was the cutting of paper silhouettes and other translucent surfaces as well as the use of ready-made objects and printed material, all placed on a light table as to be mostly backlit. The incremental changes in position were done by hand, often

by trial and error and many repeated attempts. The digital component consisted of the capture of photographic stills with a mounted DSLR camera facing the horizontal light table surface and connected to a computer to which the images were instantly sent. With the help of the stop-motion software, the computer screen could display the camera's live view or any preceding frame and could also playback any set of stills in the form of a moving image. These images could then be exported into a video file or as a series of still images to be processed further in a more powerful software (Plate 2).

Plate 1. Still from Last Dance on the Main - © Aristofanis Soulikias

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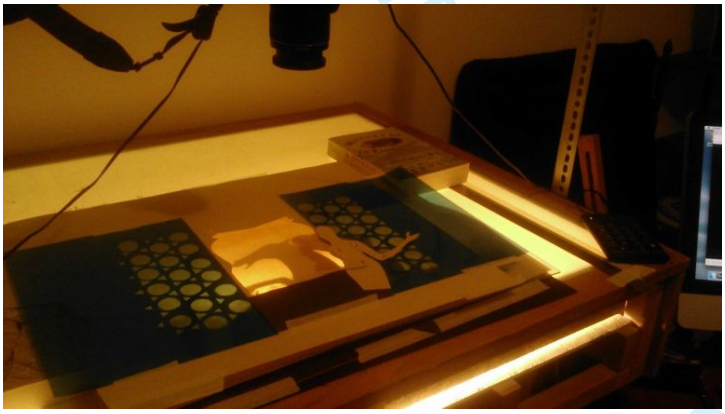

Plate 2. Production Still - © Aristofanis Soulikias

Despite being a digital end-product, digital tools did not dictate the overall aesthetic or animation of the film but rather facilitated the registration, selection, and processing of the images, allowing for the artist to better concentrate on animating the paper silhouettes and the other objects he used for the film. Within this hybrid form of film animation, enough of the multi-layered work made by hand became perceivable, as to become itself a metaphor for the layers of significance of the endangered buildings and the communities that supported them. Furthermore, a film that was made with relatively modest

means and resources reached 65 festivals worldwide and won several awards, posing the question of what is ultimately important in communicating ideas on architecture.

Apart from the power of narrative, sound, and the moving images, the audiences recognized the various materials used in the film and to a certain extent the bodily work that was involved in their making. As animation scholar Paul Wells notes, "The re-animation of materiality for narrative purposes plays out an alternative version of material existence, recalling narrative out of constructed objects and environments, natural forms and substances, and the taken-for-granted constituent elements of the everyday world." (1998). Jennifer Barker reacts when viewing a film with animated handmade objects and exclaims that they "awaken an awareness of the viewer's own tactility" (2009). The fingerprints, the traces of the manual labour, and all the "imperfections" reveal not only the materiality and real space of what is depicted but also parts of the creative process, the human and, by extension, the social. In these techniques, the artist, the designer, regains control over the medium and assumes responsibility over the design process, reserving only non-creative tasks for the computer. Handmade film animation can be a useful paradigm for where future research can be directed for finding new design tools, which, with the advantages of the digital, will reconstitute that irreplaceable physical space for the imagination to happen and for an architecture that is responsive to the idiosyncratic yet familiar and demystified rhythms of the human body.

5. Conclusion

CAAD technology, as powerful as it has evolved, has had difficulty in encompassing important qualitative aspects in architectural design. The ultimate achievements of computational ways of thinking, speed, exactitude and efficiency, useful as they are, have yet to address successfully the particularities of social context. Digital tools cannot necessarily replace the creative environments needed in architectural education or the architectural office. Parametric design, despite its automations and spectacular outcomes still fails to sensitively address aspects of locality and culture. Sustainable buildings cannot be achieved solely with metrics that do not factor reflexivity, culture, history, and aesthetics. To address the growing share of responsibilities assigned to the computer at the expense of the human designer, with all the ramifications playing out in construction sites around the world, one needs to examine closely what is being lost and how that can be incorporated in today's architectural practices in order for solutions to emerge outside the conformist "digital box". This is not to imply that digital technologies cannot achieve some of the subversions and dissent from the tyranny of precision and speed (Hosea, 2019). However, hybrid ways of designing, making, and seeing, which involve both the digital and the analogue, the ideated image and the physical space, the mind and the body, point to that optimum where there is enough of that precious room for creativity, spontaneity, and, in general, a

more accurate and direct response to the lived human reality, both on the ground where architecture materializes and in the minds of citizens where it is imagined. Artisanal film animation offers us a precious glimpse into a vast territory of possibilities, where the physical and the digital are reconciled, adding meaning in the way we see, design, and build.

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Still from Last Dance on the Main

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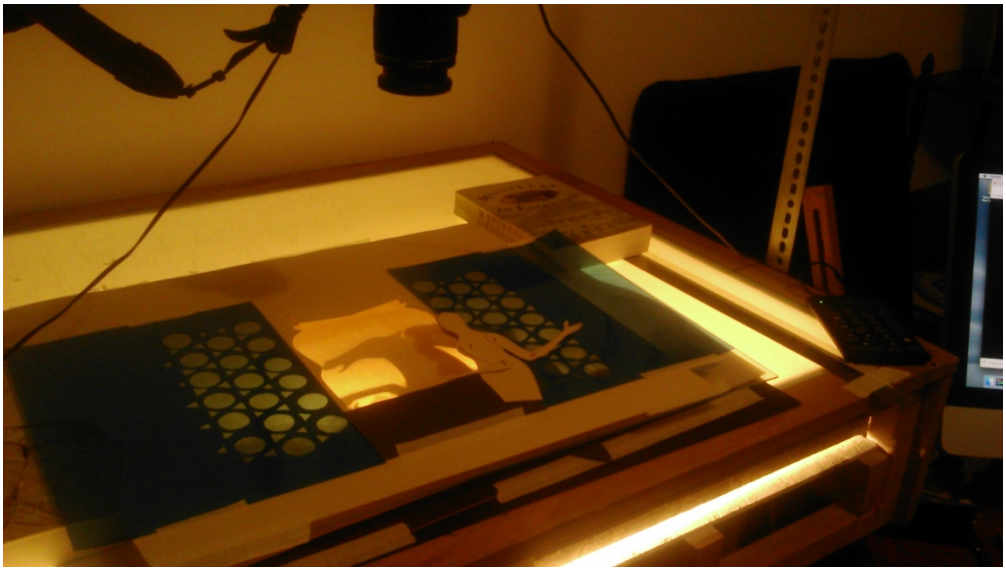

Production Still

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