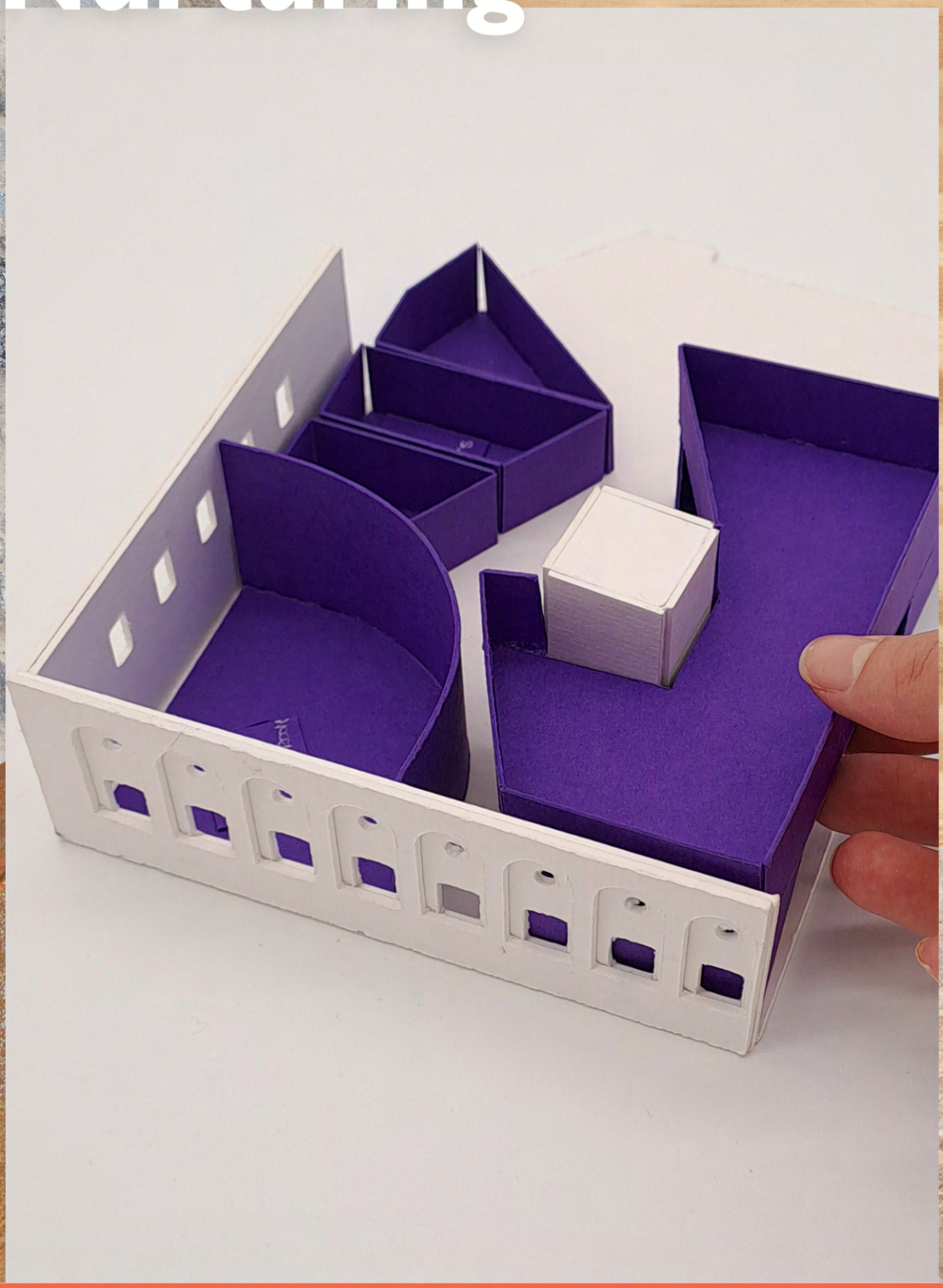
Nurturing



DESIGN TOOLS:

Architectural Progress Through Model-making

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Abstract

The increasing prevalence of retrofit and adaptive reuse projects in architecture introduces new challenges to the design process, requiring communication methods to better address issues of densification, sustainability, and historical significance. While computer-generated imagery has been a conventional communication tool, its hyper-realism may impose rigid perspectives. In contrast, analogue methods, particularly scale models with their three-dimensional quality, prove more effective in fostering inclusivity, discourse, and flexibility.

The dissertation argues that physical model-making, in contrast to digital technologies, is uniquely suited to address challenges of reuse projects and sustainability. After addressing the ways in which technology affects contemporary practice, the study establishes the effectiveness of scale models through case-study practices - Flores & Prats for retrofit projects and Material Cultures for innovative construction practices.

Introduction

Retrofit and adaptive reuse projects are on the rise. These projects are defined by transforming or incorporating already existing structures to rehabilitate them into more efficient and effective ones. By addressing pressing issues of densification and sustainability, this new category of projects brings new challenges to the design process. In addition, a practice must no longer please only their clients and stakeholders, but also every other group that has any connection to the existing structure, and its historic significance (Adams, 2022, p.22). For these reasons, methods of communication also need to be re-evaluated to disclose a degree of flexibility, so that the information can be understood by all stakeholders, generating inclusivity and ultimately better design and execution in architecture projects.

The usual method of communication for the last decades has been computer-generated imagery, renderings, and CAD models. But the hyper-realism of these images can denote rigidity, and prescription, (Young, 2022, p.96) both detrimental to a proposal in certain instances, when instead of effectively engaging the audience in how the problems were approached by the practice, the images may feel like an imposition of the architect's utopic idea. In other cases, it can portray an image that doesn't look remotely similar to the final result, because of lighting and

angle differences. Not to mention its dubious effects on anyone's perspective of scale.

Analogue methods of representation, on the other hand, create openness, discourse, and most importantly, inclusivity, all of which contribute to this flexibility being conveyed. Amongst the analogue methods of representation are hand sketches, collages, paintings, and scale models. All have been increasingly trending over the last couple of years for their effectiveness in communicating a project in a more ephemeral and interactive way when compared to photo-realistic renders. But out of all the methods, a scale model's specific three-dimensional quality is capable of responding to many more requirements of retrofit and adaptive reuse projects than the others are capable of doing in such a simple manner (Driscoll, 2013). This makes its return as a powerful ally of the architect, effectively supporting the design process visually, conceptually, and technically, whilst being easy to understand by the wider community of users.

Why Model Making

The most beautiful part about architecture is that once it's built it is an art pretty much free of charge. Everyone is constantly in contact with architects' creations, and each can see it through their subjectivity. This is only possible because architecture is built, it is structural and therefore present in most places. But had it not also

contained some creativity, all structures would look the same around the world, or perhaps we wouldn't even have any. The 2006 Turner Prize winners Langlands & Bell state, "Architecture is a public language. Everyone has their own relationship to architecture". What is relevant about their claim is the fact that architecture, much like a language, is an art that depends on structure, and vice versa. Architecture's inherent need for framework (data) and subjectivity (art) is the oxymoron uniquely present in scale models. They may range from largely abstract ideas to 1:1 technical prototypes, but both aspects will always be present in any given model. In this way, it is an outlet for critical thinking, an instrument that continually pushes the development of ideas and decision-making, but very sensibly so.

Leon Battista Alberti was the author of the treatise "De Re Aedificatoria" ("On the Art of Building"), which, since written in the 15th century, became a cornerstone of modern architecture theory. It addressed issues of proportion and classical principles, but most relevant to the topic of scale models, he fiercely defended the use of scale models in the design process. According to Professor Rykwert's interpretation of the text, part of Alberti's argument focuses on the ability to find mistakes through 'translation'. As stated in one of his articles, "The passage from concept to graphics, from graphics to scale model, cannot ever be literal. Like many good translations it may–at every stage–reveal unsuspected inconsistencies and blemishes in the original". Each 'translation' (Fig. 1) can then be seen as a supposed

Figure 1 - Translations between two and three dimensional studies, Microsoft Milan design by Flores & Prats (Romano, F. Barraco, E. 2011)

stage of correction, with the final step being the translation from representation into sensibilia–real, tangible, built work (Rykwert, 2006). Scale models are an outlet for creativity and a tool for communication, but also offer an important opportunity to correct possible mistakes.

What the world has seen lately is a clear lack of translation between ideas and three-dimensional architecture models. This can be seen in the last few years of the Venice Architecture Biennale, which because of its lack of models might have not been fully understood, or not proposed enough solutions to please a huge chunk of its audience (Abrahams, 2023). As Alberti argues, study models are of extreme importance in the design process both creatively and technically to resolve mistakes and communicate the solutions in an uncomplicated way. A good example that illustrates the great use of scale models to promote solutions was the exhibition "Living in Lisbon", which featured a huge variety of architectural models of all possible scales, from 3D printed buildings and graphs to Styrofoam and paper models (Figs. 2, 3). In the exhibition, the issue of housing in the continuously densifying city of Lisbon was approached by various architects, most of whom were working with the reuse and retrofit of existing structures. The result was a plethora of interesting approaches and analyses in the form of buildings, or better, scale models. Some were projects that had been realised and built, and some were speculative solutions to a particular problem in a particular area of town. But all had

Figure 2 - Exhibiting models, Living in Lisbon exhibition at Centro Cultural de Belém, Portugal (Photo by author, 2023)

Figure 3- Different Scales, Living in Lisbon exhibition at Centro Cultural de Belém, Portugal (Photo by author, 2023)

at least one model to illustrate their designs, which made it incredibly easy to understand what was being conveyed (Living in Lisbon, 2023).

Perhaps it was the models that were able to communicate their original ideas exceptionally, but it is likely that it was their use of scale models that made the solutions exceptional in the first place. Alfredo Caraballo, an Associate at Allies & Morrison (Fig. 4) explains "There is a much better understanding and judgement of urban spatiality, context and structure when it is engaged through manual means as it is more connected to how the eye actually sees and how the body experiences and absorbs the urban realm" (Gallov, 2020). Designing through making has an inherent connection to how we intuitively sense and feel space. And this connection is quite a special one to cultivate. 'in space we have found the purest, irreducible substance of architecture – the property unique to it, that sets it apart from all other artistic practices" (Wouter, 2018, p.300) and there is nothing better than a physical model shaping real space in real-time to show what the architecture is really about.

Methodology

This dissertation examines why physical model-making is the most effective tool to address new challenges brought about by an increase in reuse projects. This is done by firstly contrasting it to technology to show they are not equivalent, and therefore one cannot possibly substitute the other. This removes technology from the role of

Figure 4 - Allies & Morrison facade, models clearly showcasing the practice's work to street users (Photo by author, 2023)

the ‘enemy’, and reframes it as a new environment instead of just a tool. After which, the effectivity of the scale model as a design tool is shown through the analysis of two case studies that demonstrate its merits in the two main processes outlined by Alberti: The first specifically for the conception (design process), and the second for innovating materiality in practice (realization, construction).

The first chapter will expand into model-making itself, define important terms, and establish a historical context. This chapter wraps up with a comparison to digital 3D modeling, as far as it concerns architectural design tools, and why the physical model is to be preferred for the conception process.

To discuss how model-making addresses the practical challenges of reusing existing structures within the design process, Flores & Prats will be the first case study. Having recently completed multiple highly regarded retrofit projects and been invited to exhibit at the Venice Biennale for the third time consecutively, Flores & Prats can be considered one of the best in their craft. The practice is widely known for their growing interest in reuse and retrofit projects both in practice and in architectural education, where they work closely with students and develop methods and theories, which are often proven by their professional projects. One of the key texts for this chapter was a recently published book, containing most of their published essays and interviews. It provided huge insight into their

unconventional ‘modus operandi’, and how it involves model making for the unification of practice and project.

Subsequently, focused on proposing new ways of building and developing regenerative materials and construction practises using prototypes, Material Cultures is a relatively new practice that has been able to pierce through a sector particularly resistant to change – construction. This is arguably due to their clever reliance on prototyping as a ‘demonstrator’ of transparency. Though their prototypes are often exhibited, they are all real tests run in an evolutionary way. That dissection of the built environment alongside their preference for pre-fabrication is perhaps an allusion to their own approach: small, repeatable parts that individually pass on message, but together can make up a whole building.

Chapter 1 – Model-making

To address the broadness of model-making as a field of study, this chapter begins by defining the different types of models relevant to this dissertation, before going through the history of model-making and explaining its revival and importance to the world right now. The last half of the chapter reframes the role of technology, explaining why it should no longer be considered a tool, but rather an environment.

The Model Types

An architectural scale model could never be reduced to a simple miniature. The very word ‘scale’ means the replica of the real-sized object is reduced proportionally by a specific number of times to remain a precise ratio, and therefore, measurable. There are multiple types of models as they may vary in scale, materiality, and purpose. For the context of this dissertation, models will be categorised under the following three groups: Study Models, Presentation Models, and Prototyping Models.

A ‘Study Model’ refers to any three-dimensional model that aims to study or develop an idea. Study models do not usually go alone. There will often be variations of the aspect being studied, e.g. different roofing structures or the placement of a window (Figs. 5, 6, 7). These are considered some of the most impressive records of the evolution of a project. Besides evidencing critical thinking, they have the power to linearize the progress of ideas (Wensing, 2012). Although useful for designing and communicating at the same time, these models are often not polished and do not portray fine detailing, as this can slow down their production and shift focus away from the area of study (Driscoll, 2013). This is the type of model Alberti argued is of extreme importance to architects. (Rykwert, 2006)

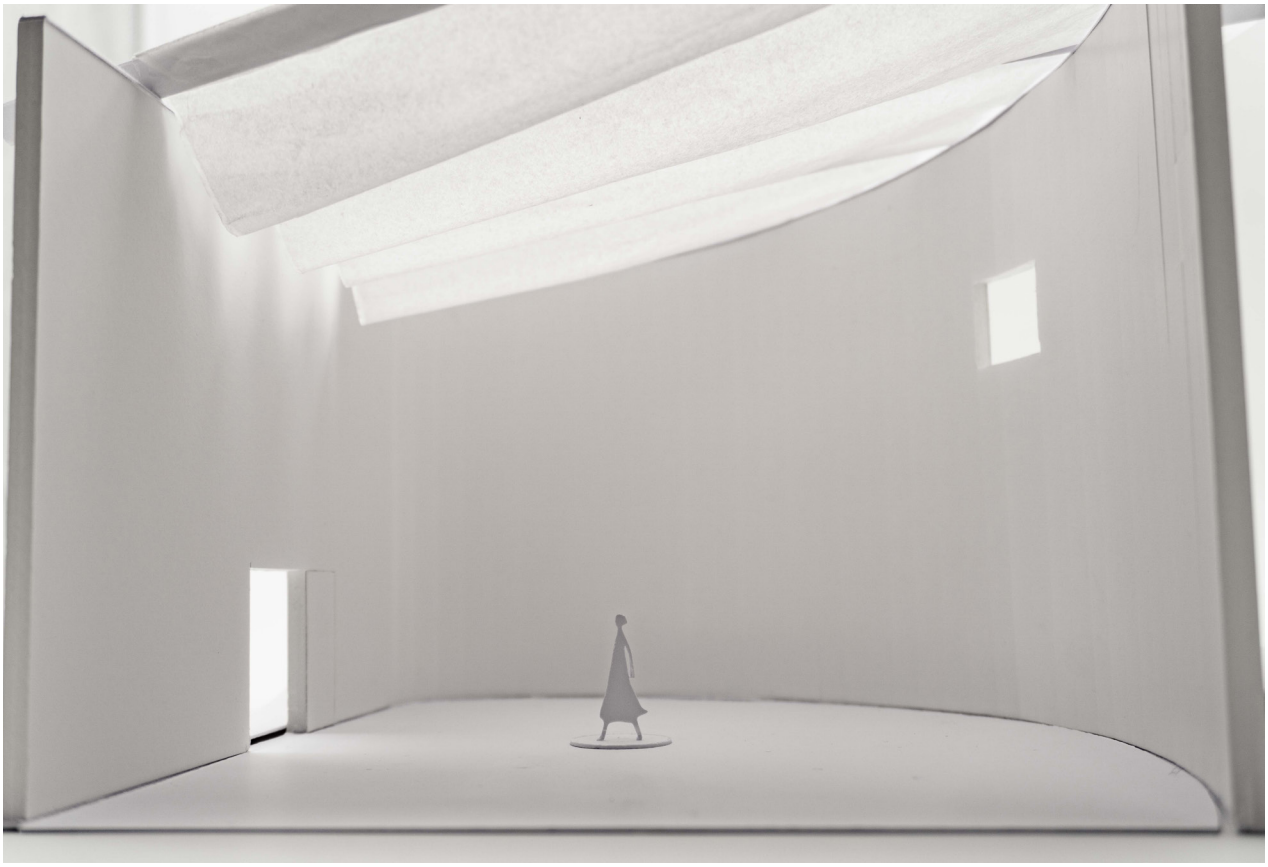

Figure 5 - Roof Options, study model made to test different types of ceiling options, made by author (Photo by author, 2023)

Figure 6 - Sculpting Space, study model testing spatial organisation made by author (Photo by author, 2023)

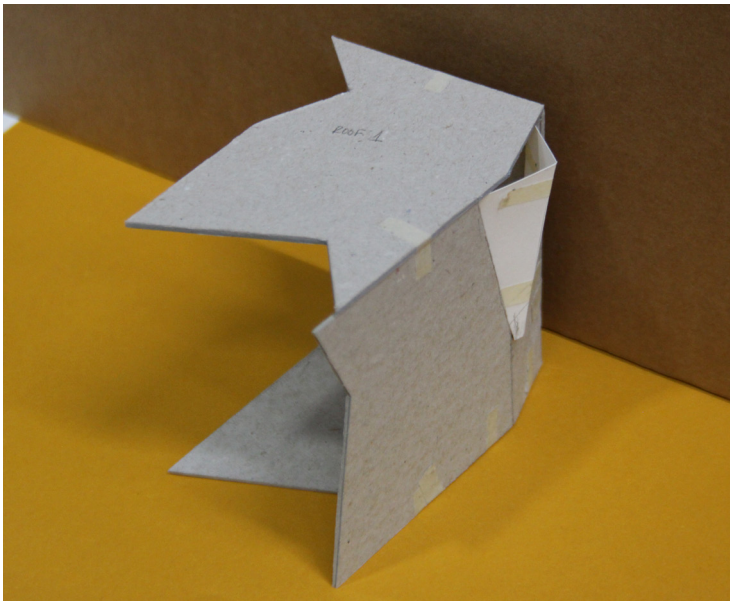

Figure 7 - Study Pod, study model testing shape of study pods that tesselate, made by author (Photo by author, 2023)

A ‘Presentation Model’ is a model made exclusively for display purposes. These models are completely finished products commonly associated with client meetings at architecture offices and are often present in exhibitions, museums, and sales suites (Fig. 8). Its purpose is to communicate the final decisions of the architects, to generate anticipation for construction or just generally aid the perception of the appearance of the building and its spaces identically to how it will look in real life (Driscoll, 2013). In order to leave little to no questions unanswered, presentation models are often quite detailed and as convincing as possible. Therefore, also incredibly time-consuming to make, as Alberti defended, they are in itself a kind of ornament. (Rykwert, 2006)

“Prototyping Models” or “Prototypes” here refers to a rather realistic approach to testing. This means it is generally a larger object aiming to simulate a real-life experience as much as possible (Fig. 9). This can be a material part, a section of the construction strategy, or aesthetic experiments for testing or displaying something in particular. But regardless of the type, prototypes offer a sense of reliability and reassurance for being a true-to-size replica.

(For the interest of this dissertation, models, unless specified to ‘Final Model’ or ‘Prototype’, refer to study models that support the design process.)

Figure 8 - Interior presentation model of Chase Manhattan Bank, made by Theodore Conrad (1910–1994) (Brown, D. C. Wayne, C. 1955-8)

Figure 9 - Wall build up prototype, made by Material Cultures in collaboration with After School Club and Store Projects (Material Cultures, 2023)

The History of The Model

Architecture was, in ancient times, a vaguely defined profession varying in skillset from person to person—some were master masons and others were carpenters or even sculptors (Jolliffe and Crosby, 2022, loc. 233). Nonetheless, their relationship with model-making was pretty much universal. Coming from the Latin word 'modulus', meaning 'a small measure', scale models were of absolute necessity for both quantity surveying (estimating how much material will be used) and structural problem-solving (Fig. 10, 11). In a world without computer-aided design (CAD), there were no alternatives to establish the limits of a structure or material other than to test them to a 'small measure' before investing time and resources into the full-sized structure—especially for the more complicated designs. Additionally, they were not only required practically, but also legally, as a way to prove feasibility to the building authorities of the time (Driscoll, 2013, p.6). As technology evolved through the centuries, so did the role of the model. Particularly during the mid-century Modern era after advancements in steel construction, it became a tool almost exclusively for conception and communication purposes. And, as history happens in cycles, when post-modernism took over with its quirkier shapes and bold structures, the flat quality of card and other study-model materials began to feel restrictive to any forms outside of those associated with the Modernist movement. Model making then had a decline, for it was unable to accurately depict

Figure 9 - Original Model for the Dome of Florence's Cathedral, Filippo Brunelleschi, completed in 1436 CE. (Sailko, 2020)

Figure 11 - Exhibition view, The Architectural Model – Tool, Fetish, Small Utopia at Frankfurt Deutches Architektur (Reetzke, N. 2012)

more unconventional, or organic forms. Drawing quickly took over instead, as a better way to communicate the more complex shapes and designs of the time.

The Revival

By the 1970s, technology caught up with the specific needs of architects, and CAD software was being released to the masses. After which, the creation of CNC (Computer Numerical Control) machines over the next decades allowed for the automated production of complex shapes through, for example, wood milling, 3D printing, and injection moulding (Rykwert, 2006, p. 25). These machines almost completely resolved the need to make more complex or organic shapes to measure. Therefore, technology itself is one of the reasons physical model-making is now going through a revival. Other more recent reasons include the influential exhibition held in the Frankfurt Deutsches Architektur in 2012, (Fig 12) called Architectural Model: Tool, Fetish, Small Utopia, of which the catalogue is now worth hundreds of British pounds. The skilled curation of this exhibition put a spotlight on the power of the model to propose innovative solutions and revealed parts of projects that weren't shown before. Consequently, this led to an increased interest in aspects of the craft. (Jones, 2012). Along with the exhibition, in the last decade there has been an increased need for critical thinking when dealing with less space, more constraints, and a thirst for architecture that provides solutions. As will be evidenced by the case studies presented here, scale models are an incredible aid to

the collaborative endeavour of reusing our existing structures, and often lead to developing better and more flexible ways of approaching the act of building whilst doing so.

Digital vs. Physical: The Dichotomy

Despite last decade's revival of the physical model, both in historical research and professional practice, technology's continuous advancement within CAD software keeps thickening the debate between the physical vs. the digital model. After the rise of AI in the last year, questions concerning the over-digitalization of the architecture profession have been posed multiple times. In academia, experts like John May—codirector of the master in design studies program at Harvard— say our aim should be to seek more understanding about the digital tools we use, as they've evolved so fast that we no longer understand what we are actually producing with them: "if we continue to think of images merely as more-efficient drawings, or as technical enhancements of orthographic life – we will continue to drift unknowingly in an ocean of simulations for which we have no compass or concepts."(May, 2017, p.24). Here he engages in the misconception that technology is just a different method that leads to the same results we had before it came around. Arguing this couldn't be further from the truth, he urges people to understand the fundamental differences between an image and a drawing, which he

elaborates on later in his text. After all, as one of John May's disciples, Michael Young wrote in his book of a similar theme, "What is critical is not necessarily to dismantle, dissect, and dissolve algorithms but to understand how they arrange, associate and dissociate relations between humans and objects" (Young, 2022, p.7). This means our understanding has not yet caught up with the fact that using technology may produce a result that is different than what we believe it to be. It is important for designers to catch up with it and understand how it affects relationships between architecture and its makers.

Firstly, when comparing a digital model (Fig. 13) to a physical model (Fig. 14), we gain clarity into what outputs are being generated. Even in Revit, one of the most complex and complete BIM software to date, models are simply simulations, and will forever be so until materialised through construction. Like in most software, the lines aren't lines but coordinates with no thickness at all. For them to seem real, they need to be artificially "thickened" on the interface. Go one step further for to make a wall, parallel lines will need to be placed, adding yet another layer of artificial thickness. So, in short, a digital model is a big vacuum with lots of coordinates: data (Colman, 2005). The power of the digital model is its ability to model and store numbers, along with the ease and versatility with which this data can be extracted.

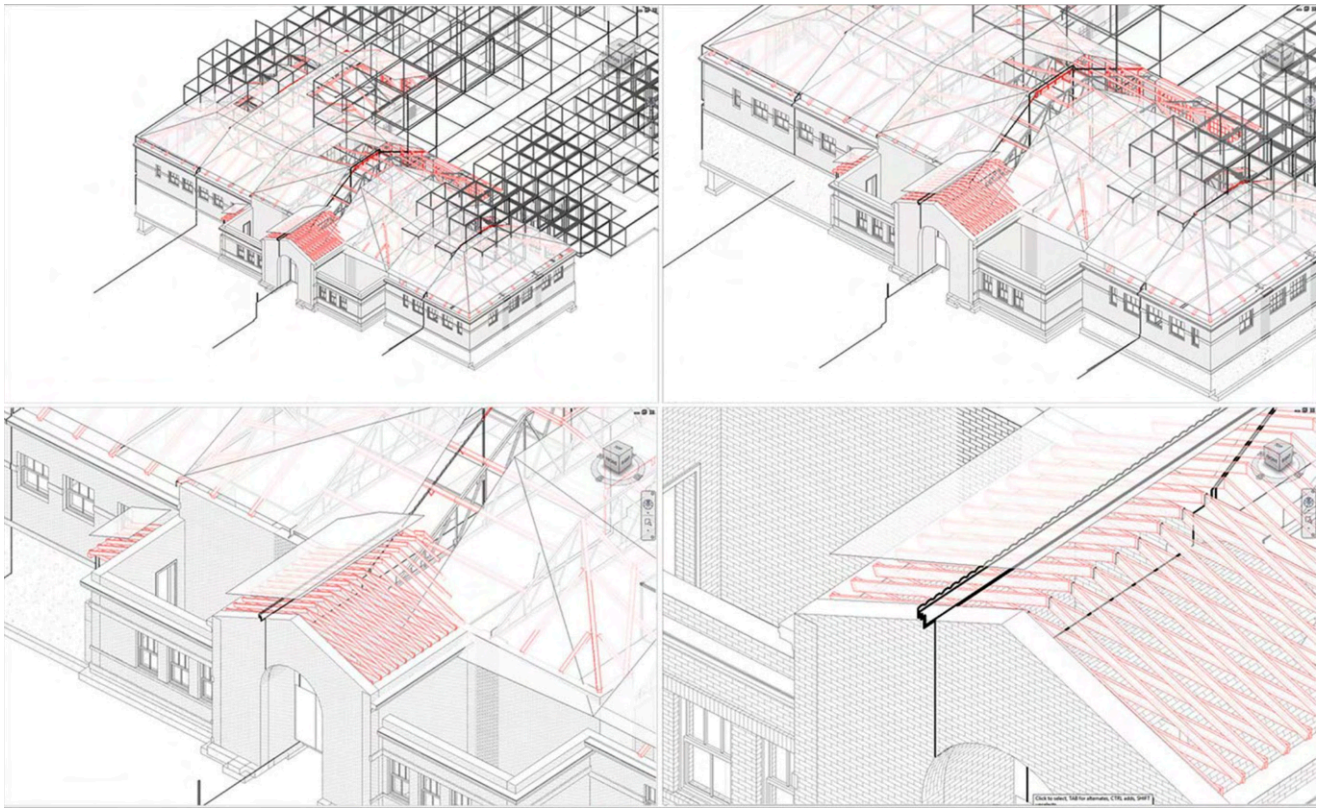

Figure 13 - "Zooming presents no scalable or finite detail between the "drawn" section and the modelled elements", digital model on Revit (Fritz, Jessica G., 2019)

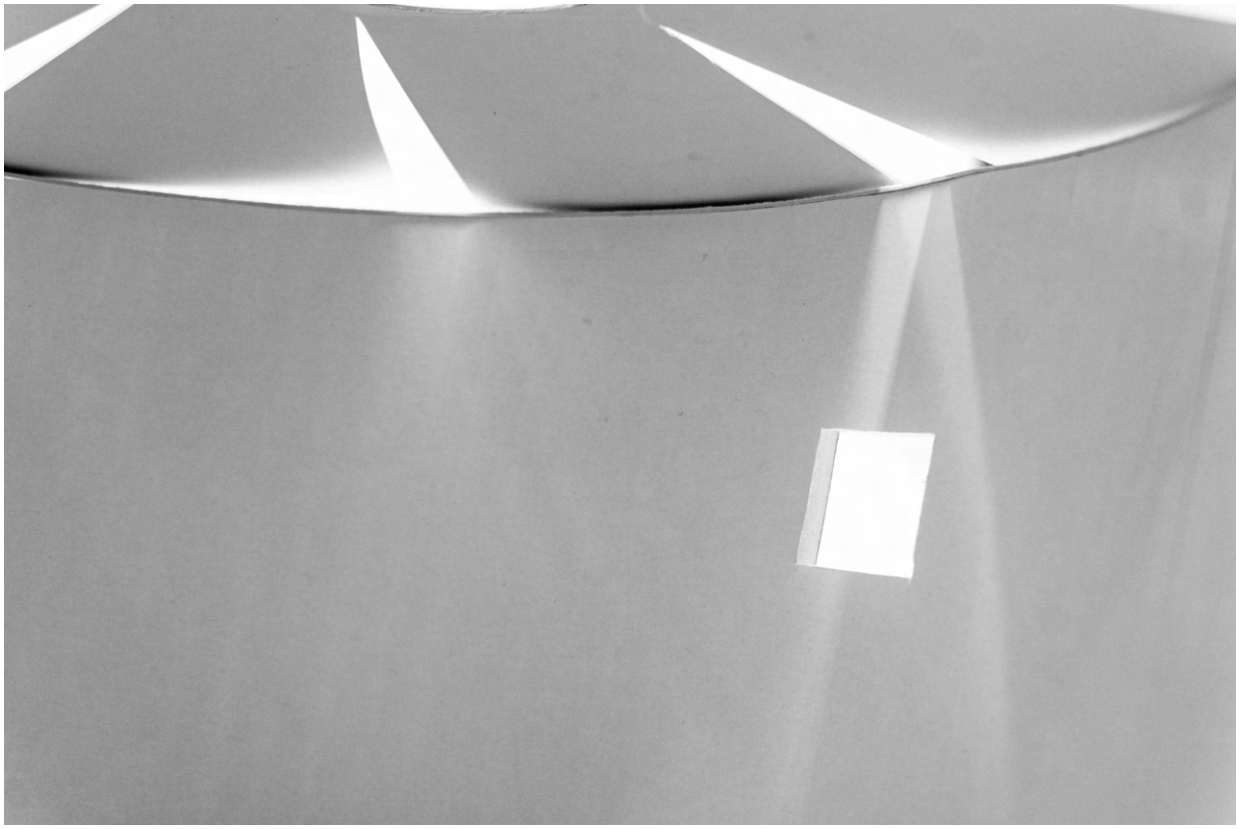

Figure 14 - Roof tests, study scale model of ceiling options, made by author (Photo by Author, 2023)

On the other hand, there is the physical model, which is a real structure–however small–in space and time. This allows it to respond instantly to the peculiarities of physicality. Gravity is one of them, models in this case allow for a fundamental understanding of the structural dynamics of a design even with the most basic of shapes. By manipulating physical materials, questions are constantly posed and answered: How can these elements all go together? What material would span this distance? Could that work as a cantilever? Maybe this way the circulation can be improved? This network of critical thinking and problem-solving is the instrument that mechanically pushes the design decisions forward and marks progress in the design. This does not happen in a digital model, which although may be slightly quicker to build, is in an environment full of cracks through which time leaks rapidly. An environment where the tools available influence the design, instead of having the design influence the tools ultimately used, leading to less creative solutions. It requires little to no thinking before attaching two pieces and it does not have a presence in a room to be seen and interpreted by real people, who are the users of real buildings. Physical models are thoroughly interactive, they move when you move (Wensing, 2012). Hence, the outputs, despite sharing the same title of "model", are miles apart (Figs. 15, 16, 17).

Promoting physical model-making is not about taking a position of technological pessimism but acknowledging that the view of technology as a "tool" is no longer

Figure 15 - The model moves as you move, M. J. Long Exhibition, Architecture Association (Photo by Author, 2023)

Figure 16 - The model live responding to light vs. static photos of the model, M. J. Long Exhibition, Architecture Association (Photo by Author, 2023)

Figure 17 - Model communicating circulation more clearly, M. J. Long Exhibition, Architecture Association (Photo by Author, 2023)

correct. Aligning instead with what Adam Feenberg refers to "Critical Theory of Technology", this dissertation understands technology has a much larger reach and influence than a simple tool could ever have. Similar to a Virtual Reality world, an environment that transforms everything visible into data: this is the digital environment. The problem is that this data looks like real images, making it difficult for the user to understand that what one is seeing is everything but real, a combination of 0s and 1s. Whether you think technology is good or bad does not matter anymore — once it is intrinsically present in everyone's lives, with substantive cultural, social, and political impacts (Colman, 2005) it is no longer an arbitrary choice of tool.

Since we now understand that technology is an environment and that model-making is a tool—hence, not equivalent—the debate regarding which one is better, is useless. However, it is important to bring up the dynamics of the interaction between the digital and the physical. Technology is now capable of creating its own subjects to extract data from. Physical models can't extract their own data, which means they rely on technology to do so. In other words, technology does not need the physical model, but the physical model will always need technology as a platform to fulfill the aim of getting built. From the digital environment, it will get not only its data but also information that affects construction, quantities of materials, estimates of air pressure, fire ratings, and U-values. This is why it is so

easy for practices to complete a full project in the digital environment. If the only certainty of architecture is its aspiration for construction, then, sadly, all one now needs for its conception is data. But that in no way means it is solving any of the issues it is meant to solve.

The creative process in the digital environment takes a different turn, where the time that would otherwise be essential to critical thinking and problem-solving is instead spent learning and manoeuvring the software. In the digital world, each mark is a result of having a series of future steps worked out before the present one. Where there is always a delay between thought and mark due to the mechanization of the creative process, which, unlike the general understanding, is not happening in the computer, but in the brain, taking up cognitive memory. As a result, people think that more software knowledge will rid them of the overwhelming feeling of not knowing what to do. So there's a pursuit to learn and get better at software with an inherent belief it will ease the process of conceiving better ideas. Another unfortunate side of chasing software knowledge is that a new version will come out yearly, which means time needs to be allocated towards getting re-acquainted with it in a never-ending cycle. This time spent re-learning a skill comes "at the expense of experimentation and investigation" (Colman, 2005, p.79) when what is actually lacking is exercising more translations between two and and three-dimensional forms, the important part of the process that Alberti so emphasized.

The question of digital vs. physical recalls French philosopher Paul Ricoeur's quote: "There is the paradox: how to become modern and return to sources" (Ricoeur, 1965, quoted in: Haagan, 2022, loc 136). In the context of the architectural design process, returning to sources is what will lead us to true modernity. There is no more reliance on scale models for the structural integrity of full-sized buildings, technology can do that in the background. This frees us to experiment. Reuse and retrofit projects require raw imagination and creativity, and scale models are the tool that can help unleash that.

To conclude this chapter, model-making went through phases over the centuries. From being a pre-requisite for construction to a tool that aided conception and communication, to something that restricted ideas because of the lack of appropriate materials, to something that is on the rise again because technology now provides those materials. But most importantly, model-making allows architects the flexibility and freedom to carefully respond to the challenges of reuse projects: creativity, collaboration, and critical thinking.

Digital models may seem like substitutes for the physical model, but they are not. Digital environments are great for data, but not the best to aid creativity, collaboration, and critical thinking. Whilst model-making is a great creative outlet

for critical thinking, technology is specificity, it is a binary field made up of 0s and 1s. And to address the question of how to advance society whilst holding on to traditional practices, one needs to acknowledge that technology's substantiveness in our reality makes it much more ubiquitous for it to be referred to as a tool. It has now become an environment where analogue practices can be enhanced, not substituted, as they produce completely different outcomes.

The following case studies are practices that understand and harness the study model as a method of communication and ideation. The first is focused on the micro-scale within the design process, and the second in the macro effects of prototyping material innovation.

Chapter 2 - Flores & Prats: Adaptive Reuse and Design Process

Flores & Prats is a practice located in Barcelona, Spain. Most famous for designing the Sala Beckett Theatre (Fig. 18), an adaptive reuse project in the building of a former cooperative in Barcelona, Flores & Prats has an admiring interest in the art of working with the existing, both from a micro (project) and macro (urban)

perspectives (Flores, Prats, 2023). Quite present in academia, together Eva Prats and Ricardo Flores have led their own studios in multiple universities in Europe. This, alongside their practice, has been a crucial piece in the revival of analogue methods of architectural representation in the last few years. As taught by Enric Miralles – for whom they both worked before establishing their practice – their approach consists of 'drawing without erasing', resulting in several piles of what they call "Dirty Drawings" capturing all doubts, faults, and decision-making within the design process (Fig. 19).

The numerous layers allow for a unique depth of discoveries and is the approach that makes them so good at what they do. Not particularly because of the drawings themselves, but because their "omnivorous curiosity for reality" allows them to inform their projects with reality first, to manipulate it afterward (Gallanti, 2023, p.8). In other words, it seems they've adapted Picasso's quote "Learn the rules like a pro, so you can break them like an artist" into their architectural modus operandi: Know the site like it's yours, to then transform it like an architect. Though their drawings get most of the fame, their approach to models is very similar–except their models aren't dirty–they are often plentiful and are stored in boxes made to measure (Fig. 20) . According to the directors, these boxes are essential to tell the story of the project's conception and are often the objects that steal the show at presentations and exhibitions, including their multiple features at the Venice Biennale. While the

Figure 18 - Interior of the Sala Beckett Theatre by Flores & Prats (Goula, A., 2014)

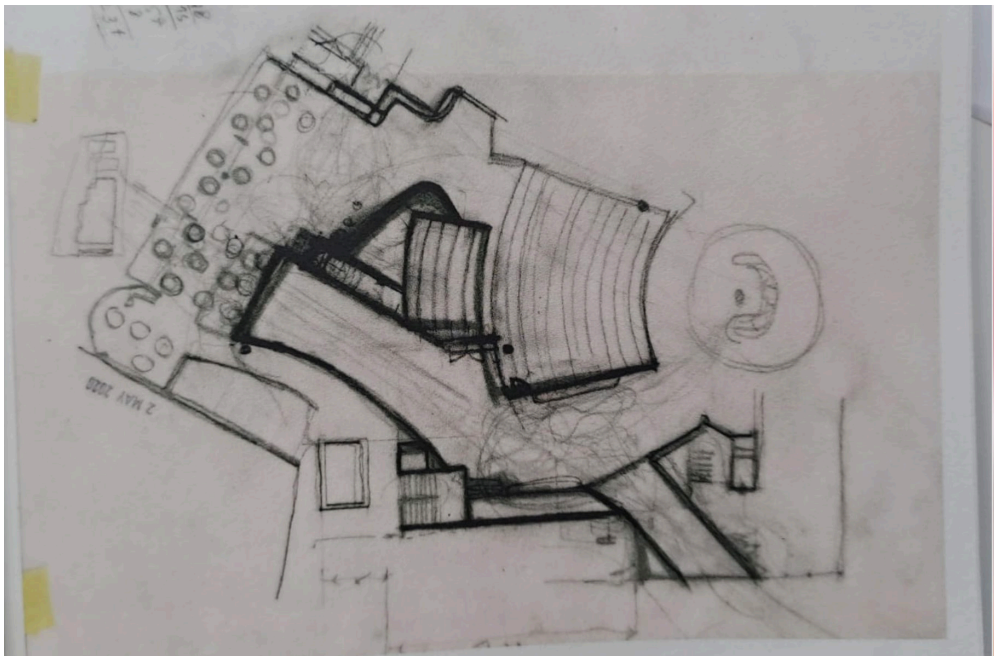

Figure 19 - 'Dirty Drawings' by Flores & Prats (Casas, J. 2023)

scale models of the existing site support critical analysis for integrating existing structures, models of the proposals are not only testing possibilities and proportions, but they are also bridging the gap between practice and project to make the best out of the site.

Know the Site Like It's Yours: Surveying

Having an extremely thorough site survey is one of the most important requirements of any adaptive reuse project. It not only informs the project but also evidences care and respect towards an existing structure's importance and integrity. In this way, resulting in more comprehensive and creative changes which undoubtedly reduces the chances of having issues with cautious (and righteously so) preservationists.

To Flores and Prats, extracting data is not sufficient, the meaning has to be extracted with it. Surveying the site through analogue methods helps them to slow down and do just that. Prats herself says, "[computer drawings] were full of lines, but in hand drawing there are no lines, everything has been created with meaning: one thing is a stair, the other one is a wall." (Prats, 2023, p.68, 69). In other words, the meaning of the existing site comes from taking the time to acknowledge the wholeness of its parts. From this, it is possible to assume that the job of the architect in this kind of project is to consolidate these meaningful parts back

Figure 20 - Bespoke model boxes, by Flores & Prats (Casas, J. 2023)

together through their new interventions. In the context of the Sala Beckett project, it seems their site models aimed to promote an integration of the building back into the local life (Fig. 21). It provides the team with a consistent understanding of all parts of the site and how they relate three-dimensionally, as well as indicating measurements, constraints, and opportunities. Although drawings are a necessity for a thorough survey, a scale model shows a more heightened attention to the site's meaning, as well as its technical data.

Transform it Like an Architect: Design Process

Intuitive making and designing are highly regarded in their office, which is why they managed to fit a rather large model-making space in their apartment office space in Barcelona (Fig. 22). A model's ability to unify knowledge in one place facilitates the illustration of that intuition. If drawings are often exclusive, as geometric projections can only be fully understood by professionals who are used to them, models are the opposite. They show all there is to be seen, dimensions, perspectives, and proportions in tangible spatial quality. "The hand does not ask how many meters the living room should go back from the façade, but rather the decision is made more intuitively, based on proportion." (Flores, Prats, 2023, p. 125). Through models, intuition can be communicated effectively, fairly illustrating the amount of value that is attached to it.

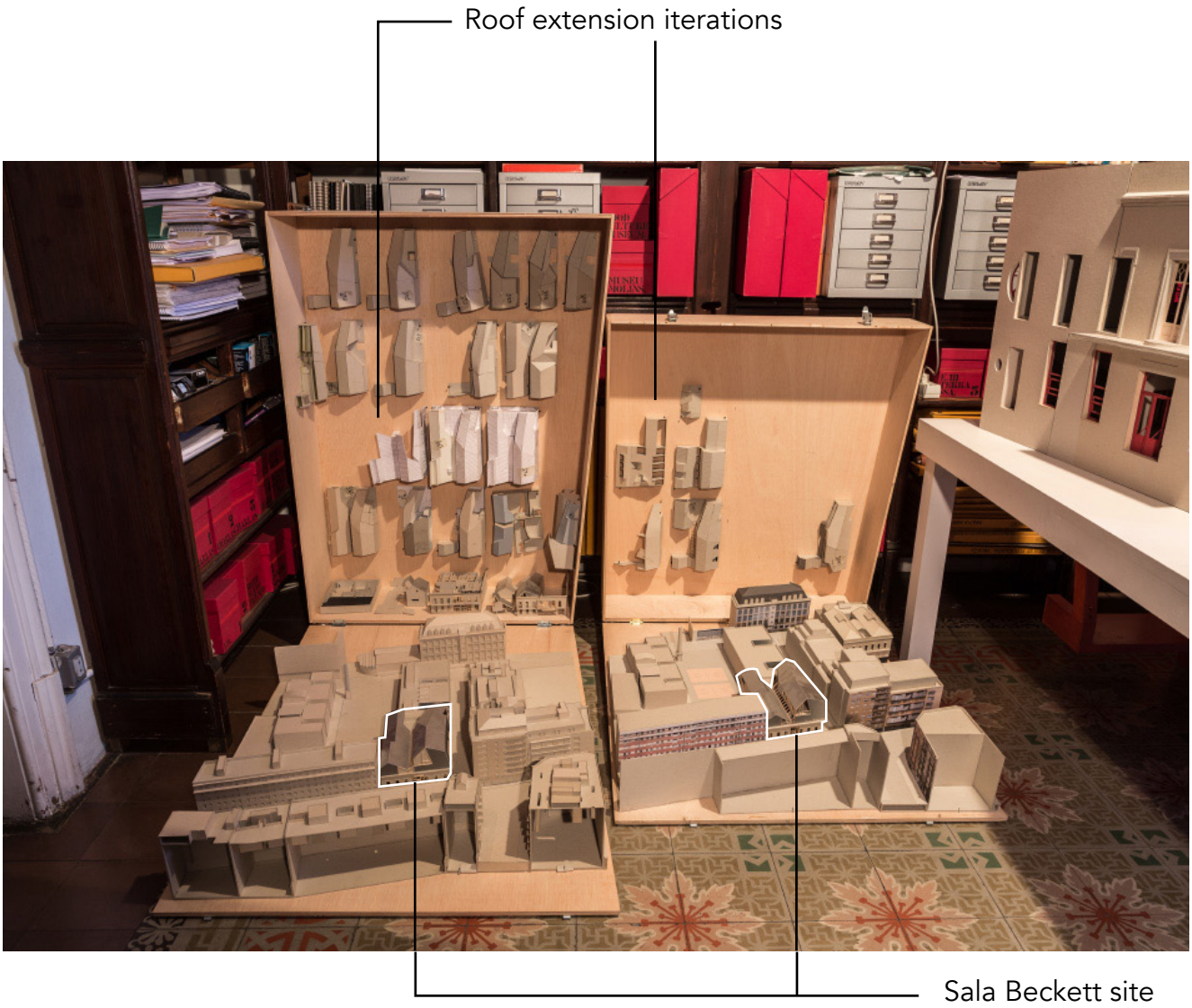

Figure 21 - Sala Becket site model, integrating the building back into the context, by Flores & Prats, overlay by author (Casas, J. 2023)

Figure 22 - model-making area, Flores & Prats office (Casas, J. 2023)

An architecture project can easily involve hundreds of people for completion, and a clear understanding across the most distinct demographics and skills is a priority for a practice that prides itself in being quite inclusive and collaborative. When using the model as a tool, you are not only able to communicate the physical features of the site but also to relay a non-verbal idea of worth. Flores & Prats evidenced this by cataloguing over 100 items in the old Sala Beckett building which they intended to keep. They later said it led to them being handled with care, due to the builders' increased perception of their worth (Flores, Prats, 2023, p.66). The act of making an inventory represents that you not only know something exists, but that you really like it, and care for it. This is an example where non-verbal communication comes into play between professionals with different skill sets and motivations. The model in this instance is much more than a scaled version or replica of the real thing, it carries raw meaning with it.

After dealing with multiple reuse projects, they noticed a need to eliminate gaps that appear between the practice and the project. They mention in multiple essays that over time they learned to detach from the idea of episodes in the life of a building that architects are trained to recognise, as these can often establish a temporal distance between the building and the designer. The solution is to work with a uniform and present view of an existing space. They named this theoretical approach 'The Right to Inherit'. The clever choice of words here was arguably

arbitrary, inheritance has a familial connotation that instigates personal care towards the subject matter. The act of recreating a miniature, is in any case, an exercise in making something “your own” and brings attention to previously unnoticed details, shifting the way in which changes are developed. After all, in three dimensions the existing is being considered in plans, elevations, sections, and perspectives, simultaneously in one place. By eliminating distance, scale models breed a more careful approach towards what is existing and more efficiently turn constraints into possible opportunities throughout the design process.

Chapter 3 - Material Culture: Prototypes and Regenerative Practices

Prototypes aid the testing of new materials and construction techniques, and being that construction is responsible for 40% of greenhouse gas emissions, even the smallest changes in materials or techniques used can lead to giant results (The Climate Group, 2023). But change isn’t something easy to achieve, especially in this industry. It requires a lot of time, research, and collaboration in the creation and testing of new techniques to prove their safety, structural integrity, and feasibility. This is why Material Cultures is brought in for their consistent use of prototypes to

efficiently push for change. “In their residential design projects, directors Summer Islam, Paloma Gormley, and George Massoud are hands-on, working with one-to-one prototypes and material samples they often develop themselves” (Janowicz, 2023). Despite being focused on residential professional practice and less on creating theories, they still partner up with educational institutions around the world, encouraging young professionals to have a critical and creative eye towards the ‘material cultures’ they are involved in, right from the start of their careers (Fig. 23).

Change of Scale – From Model to Prototype

In the scenario of construction, the smaller nature of scale models may omit important aspects of the construction details, hence Material Culture’s tests will often progress into 1:1 scale. As Leon Battista Alberti mentions in his book “De re Aedificatoria”, one of the most important reasons behind testing a design through a physical medium like a scale model or prototype is to verify measurements. A prototype emphasizes any discrepancies there might be on the drawings and confirms the suitability of the chosen dimensions. But more than that, it acquaints the designers to the making process which builders are likely to experience. In this way, the process is challenged just as much as the materials and measurement choices (Figs. 24).

Figure 23- Carbon Copies, making process of facade prototype (Material Cultures, 2023)

Figure 24- Testing reed cladding system, trying ways of thatching using crops from different harvests, recent instagram post (Material Cultures, 2024)

This drive to produce new materials and processes means the whole life of a resource is analysed closely. Material Cultures even grow plants from scratch before incorporating and manufacturing them into new solutions, precisely disclosing the multiple ingredients and energy used in the procedure. This act of probing an idea at every stage, literally from seed to building, leaves little room for disbelief but plenty of room for further research to make it better. For this reason, Material Cultures often call their prototypes "demonstrators"; they are mediums that spread the potential of innovation, how it can be done, and exactly what they are made of (Janowicz, 2023). Looking closely, it's the act of 'dissecting' that is so convincing. Whilst online images or articles may outline benefits of new materials and try to make change that way, it is the transparency of what stands in front of you that can dissolve any pre-assumptions that might have prevailed before (Fig. 25).

The House as a Prototype

The residential projects undertaken by the practice may seem relatively small when compared to the number of ongoing new build housing developments. But in one way, those homes are also prototypes (Fig. 26). Live prototypes that are actively inhabited and closely connected to their users, who "test it" daily offering a rich

Figure 25- Facade prototype, 'demontrator' (below) in compariason to online images of description (above) (Material Cultures, author, 2023)

post-occupancy evaluation of the design. This is, in fact, one of the reasons they enjoy and strive to work in the residential sector, Summer Islam reassures that homes are where their impact can be felt the most. Their bio-based materiality tends to captivate those who come in contact, not only for being healthy to them but also for the environment. Cultivating an endorsing community of loyal supporters.

Though their projects often encompass a principle of pre-fabrication, no project is the same. The directors will often refer to how their projects vary slightly. Be it for the aim of trialling and fine-tuning approaches, or for the varying conditions of the site and material sources available. Despite the differences, they are part of the same chain in an evolutionary way. At the end of the day, this is why they choose to spend their time with prototypes, because prototype by prototype they reflect on each iteration to design and build better (Figs. 27, 28). Consequently, home by home they get better and the family expands. Suddenly, what seemed like a small part of a residential toilet, becomes one piece of a huge puzzle–much larger than any skyscraper will ever be.

Catalyst for Conversation

Figure 27- Carbon Copies, facade prototype in collaboration with MA CSM architecture students (Material Cultures, 2023)

Figure 28- Carbon Copies, facade prototype in collaboration with MA CSM architecture students (Material Cultures, 2023)

Construction is the part where years of architectural hard work get materialised. There is a plethora of professionals involved, each holding a great set of skills and experience, a pinch of skepticism, and a full scoop of preconceptions too. These professionals not only work in different environments and software but also have different priorities and concerns revolving around the same things, which makes collaboration quite a complex endeavour. Summer Islam herself, one of the founding directors, mentioned in an interview that their "biggest barrier is understanding" (Janowicz, 2023). It is relatively easy to see that their work focuses acutely on dissecting information to facilitate this understanding. Research states that cross-disciplinary work as early as possible in the design process is what makes a project successful in "integrating building, community, natural and economic systems for sustainable development" (Magent, et all, 2009). The act of dissecting brings transparency. Material Cultures are effectively unravelling this complexity by bringing the focus back onto the common interest: good buildings. In making prototypes more ubiquitous through exhibitions and presence in practices and universities, they are empowering a collaboration among professionals that will result in a widening understanding of regenerative construction. And from the inside out, the power of the prototype is being harnessed, slowly changing perceptions through conversation, and from there onwards exponentially advancing the way we build our structures.

Conclusion

Although it is generally agreed that model-making can be beneficial, this dissertation explains that the necessity for creative solutions is the force behind the recent revival of the craft. It is the most effective way of finding the plurality of solutions required for the present and future challenges of reusing existing architecture. With technology becoming more specified each day, there needs to be a change in perception regarding the vastness of its outputs. Technology has outgrown the label of "tool" and therefore is no longer an optional substitute to other analogue practices, it is now an active environment where things are constantly turned into data. This brings awareness to the ways in which creation and experimentation can easily fall behind software knowledge. But software will never have the physical spatial qualities that a scale model does. And something most architects will agree with, is that space is the very essence of architecture. The stimulating, vulnerable, physical space. According to Leon Battista Alberti and his disciples, the most important points in any design process are the points of translation between two and three-dimensional studies, which is what the two practice case studies clearly evidence.

Flores & Pratts, a practice that aims to blend practice and project, building and city, architects and community, uses models as a bonding tool that allows those integrations to happen. Material Cultures, on the other hand, use the model in the opposite way, to dissect. Their larger-scale prototypes aim to provide transparency and understanding, separating the material from the process to advocate for the potential of bio-based regenerative practices.

Other papers have detailed the advances of model-making technology, categorised models through history into different types, and outlined the benefits of models for the architectural design process. This research was focused on the application of model-making in practice when dealing with reuse and sustainability, two changes that will be impacting practice for, at least, a few decades to come. This is all about finding the best approach for a future that will require a completely different attitude towards design, one that benefits architects, stakeholders, and the planet.

More research could further study the potential of model-making to aid other parts of professional practice. For example, legal and contractual, as relating to the architect's responsibility for the built product. This is currently done through the submission of legally binding (often) digital files and drawings. Joseph Rykwert, Professor at the University of Pennsylvania argues in his article "Translation and/or Representation" that because of the very "ease with which computer

representations -both two and three-dimensional- can be altered […] they will no longer be regarded as reliable documents"(2006). Whilst this is a daring prediction, he mentions in the financial sector this process has already happened whereby "screen-registered and transmitted information is not considered binding". If this is the case, three-dimensional models and physical prototypes could in the near future have a beneficial contractual importance alongside drawings, perhaps reducing the number of legal issues that architects– sometimes unfairly– have to deal with.

This research highlights how the use of scale models in the design process can affect understanding among professionals in architecture. When used in the design process they promote translations between mediums for better decision making and care for existing structures. During the later stages of the project, it can aid understanding between professionals and lead to better processes– that in turn lead to happier workers, happier users, and ultimately a healthier world.

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