Learning from the Construction Site

An Epistemological Investigation of Stonemasons and Architects in Action

A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

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Declaration

I certify that except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the thesis/project is the result of work which has been carried out since the official commencement date of the approved research program; any editorial work, paid or unpaid, carried out by a third party is acknowledged; and, ethics procedures and guidelines have been followed.

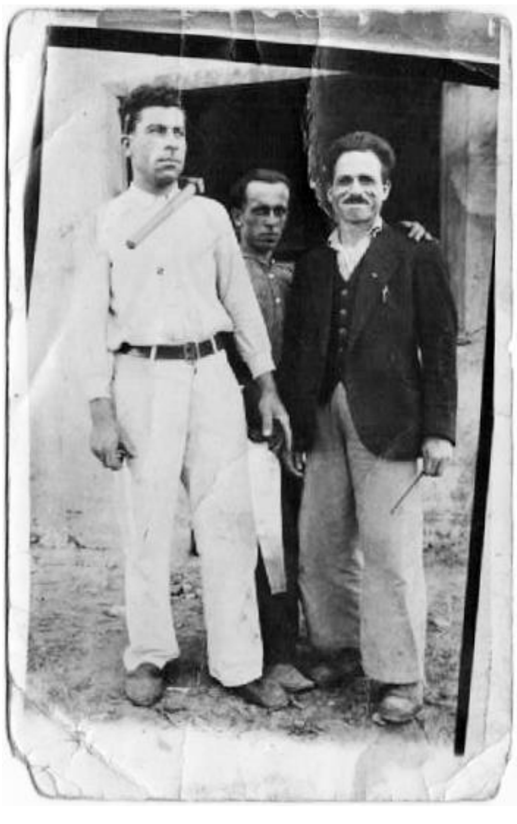
Elif Kendir-Beraha

30 September 2014

Dedication

I was very lucky to be around people who knew the value of well made objects and taught me to appreciate the love and labour invested in making things from a very young age. My late grandfather, Tahsin Kendir, was a master carpenter and an amateur musician who played the violin, *zurna*[1] and the musical saw. His enthusiasm for crafts was carried on in the family by my late father, Özmen Kendir, poet and bricoleur extraordinaire. Along with them, my primary source of inspiration and role model was my late mother Mübeccel Kendir, a traditional handicrafts teacher. She was the person who instilled deep respect for the process of making by showing me how to appreciate perfectly made things, and with her boundless patience, taught me that perfecting any skill takes time and hard work.

In loving memory of my parents Mübeccel and Özmen Kendir;



and my grandfather, Tahsin Kendir[2]

1. The *zurna* is a type of conical oboe. My grandfather had made his own from an apricot tree.
2. Three carpenters in front of a railroad construction, posing with their tools, Kayseri, Turkey, circa 1940. My grandfather is on the right hand side, holding a measuring stick.

Acknowledgements

Over the years many individuals have contributed to the development of this thesis. Without the support of RUIS scholarship scheme, I would not have been able to come to study at Royal Melbourne Institute of Technology and work on this thesis. I wish to thank the institution for generously providing me with free tuition and a living stipend during my stay in Melbourne. The travel funds provided by the university made it possible for me to present my research at several international conferences. I would also like to thank RMIT School of Architecture for employing me as a tutor for six semesters, offering a valuable opportunity to test some ideas in development through studio teaching.

The initial inspiration for this thesis came from the work and writings of Prof. Mark Burry, my primary supervisor. I feel very grateful for his support of this thesis and for his invaluable contribution to the insights developed in the research by providing me access to his work and his colleagues at the Sagrada Família Basilica besides acting as a primary respondent.

I am extremely indebted to my secondary supervisor Prof. Dr. Suzette Worden, who joined this journey at a moment of crisis, and continued to provide consistent support, encouragement and insightful critique way beyond the call of duty - both during the initial phases and throughout the challenging process of writing up the thesis.

I would like to thank all my respondents and sources of information during fieldwork, especially Prof. Mark Burry for taking time off from his busy schedule and opening up the design office at the *Sagrada Família Basilica* to inspection; Burçin Altınsay Özgüner, for sharing her insights both at the start of the study and later as a respondent; Sebastiaan Veldhuisen for inviting me to *Artoteek Den Hague* as artist-in-residence to pursue an experimental stone wall project. Ceren Balkır Övünç, Sinan Ilhan and Hayim Beraha were my collaborators in this project, working as amateur stonemasons. *The Stonemasons Training Institute* in Istanbul was a vital source of information for accessing most of my stonemason respondents.

Thanks to the Graduate Research Conference [GRC][3] series organized by RMIT School of Architecture and Design, I had the opportunity to show stages of my work in progress to a number of academics and practitioners. I would like to

3. The name has been changed to Practice Research Seminar [PRS] since 2012.

thank all my committee members from the GRCs, namely: Ranulph Glanville, Julieanna Preston, Kevin Murray, Dennis Shelden, John Frazer, Andrew Maher, Juliette Peers, Suzette Worden, Tom Kvan, Jeff Malpas, Mark Goulthorpe, Ashley Schafer, Tom Daniell, Andrew Burrow, Andrew Brennan, Jeremy Till, Charles Rice, Pia Ednie-Brown, Jondi Keane and Marcelo Stamm, for their valuable comments.[4]

Thanks to the people from Spatial Information Architecture Laboratory at RMIT, I have always felt at home during my stay in Melbourne. Margaret Woods, the former administrative coordinator at SIAL, singlehandedly created a convivial social environment at the research lab. Peta Carlin has been a dear friend and a kindred spirit both during and after my stay in Melbourne, encouraging me with frequent phone calls and with her intelligent comments on my interim thesis drafts. Peta's endless generosity and diligence extended to the very final stages of my thesis writing: after her exacting and attentive proofreading brought the thesis to its present standard, she helped further with the printing and submission of the final draft – I cannot possibly thank her enough. Dominik Holzer, another close friend, opened up my mind on a number of occasions by being the voice of reason. With Tim Schork, I was able share my interest in craft in a studio environment and teach about the implications of tools for design knowledge.

I'd also like to express my gratitude to a number of generous academics who took the time to read and comment on parts of my drafts along the way to offer their valuable insights: Prof. Dr. Uğur Tanyeli for providing a fresh historical perspective on a number of occasions; Prof. Dr. Peggy Deamer for sending me her research manuscripts before they were published, and Prof. Dr. Alberto Pérez-Gómez for offering his comments and pointing out very valuable historical and philosophical references during the later stages of my research.

Middle East Technical University, my alma mater, is the foundation of my academic background. I was lucky to be a student of Kemal Aran, whose influence has led to this thesis after almost twenty years. My master's advisor Prof. Dr. Emel Aközer, and Prof. Dr. Zeynep Mennan have been academic role models.

I am grateful to Prof. Dr. İhsan Bilgin and Assoc. Prof. Dr. Tansel Korkmaz, dean and vice-dean of Istanbul Bilgi University Faculty of Architecture,

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4. Some of these reviewers like Ranulph, Kevin, Andrew M., Juliette, Pia and Marcelo were kind enough to discuss my topic beyond the scope of these conferences, while Tom kindly agreed to become one of my respondents.

for their constant support and encouragement. Our common research interests make teaching there a pleasure. I am very lucky to be amongst many other like-minded people at Bilgi, who are not only colleagues but close friends. I should especially mention Ceren Balkır Övünç for her constant support and for being one of my closest friends throughout the years – along with Benay Gürsoy Toykoç, they came to the rescue with some graphics issues during the final stages of the submission process.

I am extremely grateful to my sister Şebnem Ateş, who stepped in at a crucial time to help with pressing family matters, allowing me the peace of mind necessary to work on this long research project. I'd also like to thank my extended family in Istanbul, Dora and Salomon Beraha – I couldn't have survived the last days of writing had it not been for Dora's exquisite dinners. My husband and closest friend Hayim Beraha has always been there for me during the ups and downs of this research. His unwavering enthusiasm for the topic made fieldwork a pleasure. Without his uplifting phone calls and frequent visits to Melbourne, I would have been in deep distress so far away from home. He called me every single day, boosted my morale when I needed it the most, and on my return to Istanbul to conclude my research, set up a wonderful home to work in tranquillity during a time of great personal distress. I cannot thank him nearly enough.

Last but not least, I would like to express my deepest gratitude to my late parents Mübeccel and Özmen Kendir, both of whom passed away in the final year of my PhD studies. Despite their individual battles with terminal illness, they have lovingly supported and encouraged me, acting as perfect role models with their stoical attitude towards life's misfortunes. It was their love, understanding, and unrelenting confidence in my abilities that thwarted my anguish during periods of self-doubt, and made it possible for me to continue with this research against all odds. This thesis is dedicated to their memory.

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Abstract

Previous studies of architectural practice have tended to treat the realization stage of the making of buildings as a mostly technical matter, with little potential for providing input for the design process. Despite the recognition of the importance of know-how involved in the construction site, the nature of this know-how and its impact on the generation of architectural knowledge is understudied. Based on the original fieldwork involving a series of interviews conducted with traditional stonemasons from Turkey; and practising architects from six different countries; this thesis examines how material interactions *in situ* shape design knowledge in architectural practice. The observation of a unique case of design collaboration from the *Sagrada Família* design office in Barcelona further illustrates the dynamics of these material interactions.

Making buildings is first and foremost a situated activity: it is on the site of construction that the abstract design concept comes into contact with the messy world of matter. In order to observe and analyse the interplay between material entities, physical environments and human actors in situ at the resolution stage of the design process, this thesis adopts a post-humanistic stance, where inanimate things as well as human actors are considered to possess agency. Using insights gathered from Actor-network theory (ANT) to direct the investigation, the thesis highlights the role of physical sites as active agents in the generation and accumulation of architectural knowledge.

Despite a renewed interest in the making of buildings with various techniques of architectural production featuring prominently in architectural literature, the actual on site interactions and their epistemological relevance to the design process are often ignored. In the data gathered for this thesis, the site is found to operate in the design process in three key ways: as *repository* – a provider of design knowledge coded within the existing built environment; as *resource* – a provider of materials and skills; and as the *observation platform* for the assessment of the built artefact unfolding in time, interacting with natural elements and patterns of use.

Although most of the work in this thesis centres on the accounts of the practice of human actors, the findings contest the notion of humans being completely in charge, and reveal the vital impact of a non-human actor, *the site*, that

literally and metaphorically grounds the design process by acting as a framework for the generation, assessment and handing down of architectural knowledge.

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Prof. Mark Burry

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SECTION I:

ARCHITECTURE, CRAFT, AND DESIGN KNOWLEDGE

"[...] I would like to contrast two different philosophies of design, or what amounts to the same thing, two different theories of the genesis of form. In one philosophy one thinks of form or design as primarily conceptual or cerebral, something to be generated as a pure thought in isolation from the messy world of matter and energy. Once conceived, a design can be given physical form by simply imposing it on a material substratum.

The opposite stance would be represented by a philosophy of design in which materials are not inert receptacles for a cerebral form imposed from the outside, but active participants in the genesis of form. This implies the existence of heterogeneous materials, with variable properties and idiosyncrasies which the designer must respect and make an integral part of a design process which, it follows, cannot be routinized." [5]

5. Manuel DeLanda, "Philosophies of Design: The Case of Modelling Software" eds. Jaime Salazar, Albert Ferré, Manuel Gausa, Ramon Prat, Tomoko Sakamoto and Anna Tetas, *Verb Architecture Boogazine: Authorship and Information* , no. 1 (2002), 132.

Introduction

The “making of” of things has always held a strong fascination for me: The many possible ways of interacting with different media and materials seem to be far more interesting than the finished artefact. However, having worked as an architect in professional practice producing design drawings and making models as a junior designer, it soon became obvious that for an architect, direct engagement with the construction of the finished artefact, the building itself, was optional within architectural practice, architectural design being predominantly dependent on a process of mediation. Indeed, what little experience I had of the construction site was based on the summer practice courses, the first of which involved the collaborative design and construction of a small two-storey brick house on our campus during my first year as an architecture student, and later, the site supervision of an actual campus building for the faculty of engineering, where I was responsible for assuring the details were realised according to the project drawings.

In my first experience of the actual building process, a whole summer of carrying bricks, mixing mortar, and designing by trial and error made me see artefacts in a new light: The corporeal reciprocity of the act of construction, as experienced through the resistance of the brick walls, the viscosity of the concrete mixture, and the clearing out of a small patch on the school grounds to build foundations put our first year architecture curriculum in context. In contrast to the fleeting impact of the theoretical courses, the knowledge gained from this simple act of building was visceral. Later, when I got involved in academia as a design studio tutor, I was able to observe the detrimental effect of the strict compartmentalisation of the architectural curriculum on students' design thinking. In my opinion, the studio needed to be the place of synthesis where insights developed in such subjects as structural design, material science, environmental design, or the history of architecture would be utilised to inform architectural design projects. However, this was almost never the case: Each domain of knowledge remained snugly in its compartment, leaving design as a form generating exercise conducted in a vacuum. Design ideas always seemed to be imported from outside the discipline, from areas like philosophy or literature, whereas constructional ideas were cast aside in favour of more “intellectual” points of departure.

Because of a deterministic understanding of the design process where unidirectional progress from an abstract idea to the concrete artefact is considered the norm,[6] points of creative inquiry within the realization phase of buildings are left largely underexplored in architectural theory. The failure to recognise the construction site as a cognitive infrastructure is coupled with the general lack of understanding concerning the feedback loops between the practical aspects of making buildings and design ideation. Although the recent developments in fabrication technologies have brought the realisation stages of the making of buildings and their inherent design potential closer to our attention, most of the current literature on the topic features evangelistic accounts of techniques and technologies rather than an analytical approach to the epistemology of making buildings.[7]

Established as an area of intellectual pursuit since the Renaissance,[8] architecture seems to have developed an uneasy relation with its trade roots along the way. As the discipline moves further away from the site of construction, the inherent hierarchy of knowledge within the discourse of architecture results in the negation of a vital heritage of building traditions, their ways of collaboration, and engagements with techniques and materials. Often, these areas are not deemed worthy of consideration except under strictly technical categories.[9]

Making buildings is first and foremost a situated activity: It is on the site of construction that the abstract design concept comes into contact with the messy world of matter. In this thesis, I argue that strict categorisations and the divorce of making from thinking inhibit the development of an *innovative* practice of

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6. Even though empirical studies from design practice indicate that design stages do not necessarily follow that order. See Bryan Lawson, "Process Sequence," in *What Designers Know* (London: Routledge, 2004), 14.
7. *Practice epistemology* in architecture is still very sparsely populated: Although there are landmark books by Donald Schön, Robert Gutman and Dana Cuff investigating the dynamics involved in day-to-day architectural practice, they do not address the final stages of building production as an area of investigation.
Donald Schön, *The Reflective Practitioner: How Professionals Think in Action* (New York: Basic Books, 1983).
Dana Cuff, *Architecture: The Story of Practice* (Cambridge, Massachusetts.: MIT Press, 1991).
Robert Gutman, *Architecture from the Outside In - Selected Essays*, eds. Dana Cuff and John Wriedt (New York: Princeton Architectural Press, 2010).
8. "Less precise was the classification of the mechanical arts, but they were always presumed to correspond to a greater degree of dexterity and lesser intellectual accomplishment. The first radical shift in this balance took place during the Renaissance period, particularly in Italy, when a consensus was built that architecture, painting and sculpture should be promoted to a status equivalent to the liberal arts. Thanks to the influence of Alberti, Da Vinci and Vasari, among others, these arts came to be perceived as meriting special consideration, and their social status was raised to a rank befitting the exercise of elevated minds and the education of noble persons."
Rafael Cardoso, "Craft versus Design: Moving Beyond a Tired Dichotomy," in *The Craft Reader*, ed. Glenn Adamson (Oxford: Berg, 2010), 321-332.
9. This hierarchical view of architectural knowledge seems to be deeply entrenched in some parts of the academia. During one of my preliminary interviews, a famous architectural historian referred to someone who "specialized in materials, as she wasn't bright enough to tackle with theory."

architecture. We need to get over the "tired dichotomy"[10] of craft versus design, and recognise the potentials of the dynamics involved in the creation of built artefacts in relation to design knowledge. Based on the original fieldwork involving a series of interviews conducted with traditional stonemasons from Turkey, and practising architects from six different countries; this thesis examines how material and social interactions *in situ* shape design knowledge in architectural practice.

Generating knowledge in architecture is an accumulative process that depends on the reciprocal interaction between the built artefact and its immediate environment. Even though creating built artefacts is the discipline's main contribution to the material culture at large, the knowledge component of this act remains tacit, acting as a backdrop to a more deliberate theorising. After the transient impact of the Arts and Crafts movement at the start of the twentieth century, the distinct separation of design and making of buildings has largely rendered the craft component invisible within architectural theory. However, with the advent of information technologies in architectural design, the link between designing and making has re-emerged, and the notion of craft has made a comeback as a topic of critical inquiry.[11]

The reappearance of craft in architectural discourse has been initiated by the publication, in 1996, of Malcolm McCullough's *Abstracting Craft: The Practised Digital Hand.* Since then, the use of the craft paradigm for celebrating computer-aided design and production in architecture has become commonplace.[12] The master builder figure has resurfaced as a role model for architects seeking to acquire more control over building production through the creative use of digital design and production facilities.

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10. "The question is no longer what to design, but why. Craft has provided viable answers to that, historically. Designers are beginning to understand these issues and to explore them, though perhaps unwitting as to their origins. Some time way back around the sixteenth century, craft and industry were synonyms, both capable of denoting the idea of skill. Now that the industry is in the process of reinventing itself, perhaps design and craft will become synonyms too: complementary aspects of the same ongoing process of shaping experience through the interaction between people and things." Cardoso, "Craft versus Design," 331.
11. On a different note, cultural historian Christopher Frayling proposes economic recession as the reason for the reemergence of craft within contemporary theory:
"Craft has again become fashionable in high places, just as it did during the last few recessions. In the boom times of the early 2000s, the public talk was of design: now it is more craft, a shift which mirrors the parallel move from 'the creative industries' to 'productive industry' and manufacturing."
Christopher Frayling, *On Craftsmanship: Towards a New Bauhaus*, (London: Oberon Books, 2011).
12. Among others, see:
Branko Kolarevic, *Architecture in the Digital Age: Design and Manufacturing* (New York: Spon Press, 2003);and Stephen Kieran, and James Timberlake, *Refabricating Architecture: How Manufacturing Methodologies are Poised to Transform Building Construction*(New York: McGraw-Hill, 2004).

Although craft seems to have turned into a hackneyed notion largely devoid of its previous political implications, a structural inquiry into its history in architectural practice still provides useful insights into the dynamic ecology of design knowledge. Within the context of architecture, craft has connotations of a regressive utopia, and is often regarded as an opposing force against latest technologies.

Nevertheless, I argue for a pragmatic and progressive understanding of craft knowledge in architecture. In order to do so, I juxtapose the practices of a group of traditional builders with a group of contemporary architects in order to understand the impact of the act of construction on their design thinking. The initial investigation of the practice of traditional builders as present day instances of the master builder figure reveals an important distinguishing characteristic: it is the active engagement with the specificities of the site of construction, which enables a reciprocal interaction by being open to different kinds of feedback from the specific contexts that set traditional building practice apart from its contemporary counterparts. Based on this initial insight, my central proposition is that *the site of construction, along with the architect and the builder, is an actor in the architectural design process that effectively influences the generation, accumulation and transmission of design knowledge in architecture.*

Craft traditions portray a strong sensibility towards the sustainable use of materials to hand and and the skills associated with them. Contrary to the common opinion, they can be inherently progressive in terms of their use of techniques and their sustainable interaction with the environment. Departing from these insights on craft knowledge, the implicit motive for my investigation is to discover strategies that foster innovation by sustaining reciprocal interactions between site, materials and available skills to inform a design practice that is becoming increasingly deterministic under the pressures of a techno-scientific culture.

The Myth of the Master Builder

> "...there is a particular way to understand and "use" history as a framework for ethical creation. Lacking a living tradition for architectural practice since the nineteenth century, we are in fact called to re-construct it, visiting and interpreting the traces and a document of our past, invariably with fresh eyes, to discover hitherto hidden potentialities for the future, like one recovers coral from the bottom of the ocean, or extracts pearls out of ordinary looking mollusks."[13]

Around the start of the 2000's, in the wake of the recent availability of fabrication technologies within the schools of architecture, numerous manifestoes by self-proclaimed progressive practices started to refer to the historical figure of the master builder as their architectural ancestor.[14] In these techno-evangelistic accounts, new possibilities offered by digital prototyping and fabrication were seen to be the precursors of a new golden age for architects in practice, where an increasing ability to design and produce construction details promised *extended control* over the realization of their design, ensuring that the finished product would approximate the original design idea as closely as possible.

The search for an ancestral figure during times of change is perhaps inevitable. However, the seemingly naive use of the master builder figure has inherent dangers for the practice of architecture. The positive connotations of the figure of the master builder – essentially a combined expertise in relation to aesthetics, structure, and materials – promise excellence in design, however, they also veil an absolutist claim for unilateral control in the production process.

Today, when we take a look at practicing architects, they invariably work with a group of external experts on their projects in order to ensure structural and material stability and safety in their built works. This involves close collaboration as well as the letting go of some of the vital decisions to the other parties involved in the design process. In a world of constantly changing material choices, prescriptive design is replaced by accommodating changes and a collaborative approach - in contrast with the implications of the master builder paradigm as an authority figure.

After years of operating in a vacuum of abstract representations, architects need to get reacquainted with the culture of creative collaboration. While new information technologies involving digital fabrication and prototyping utilized in building production expand the horizons of architectural intervention, the sheer complexity of projects with mass customized components necessitate new

13. Alberto Pérez-Gómez, "Hermeneutics as Discourse in Design," *Design Issues 15*, no. 2 (1999): 71-79.
14. See in particular: Kieran and Timberlake, *Refabricating Architecture* (2004).

strategies of collaboration.[15] In this context, the distinct implications of control observed in the current use of the master builder figure needs to be challenged with a genealogy of attitudes from alternative accounts of architectural practice.

Learning from Craft

The use of concepts as heuristic devices to further an understanding of the complex web of relationships within a given research area is a common approach in qualitative research. Models, stories, and metaphors can all be termed as heuristic in this sense.[16] In this research, I propose to use the notion of *craft as a heuristic device* to understand the impact of making buildings on design knowledge. The intention here is not to define the impact of craft in architecture nor to question its relevance for contemporary practice, but to use the theoretical discourse around craft knowledge as a framework to understand the complex nature of design thinking in architecture as affected by the act of construction.

A structural understanding of craft is not easy to achieve: craft knowledge resists being reduced into its subcomponents due to its tacit basis that not only involves technical know-how, but is also shaped by a shared understanding of rituals and customs. Therefore, the aim is to utilise the notion of craft as a conceptual tool to pull together a cluster of processes, attitudes and beliefs that instigate a continuing strand in design knowledge rather than looking for normative definitions, or the craft component within architectural practice.

Reclaiming the Site of Construction

There is a renewed interest in the making of buildings with various techniques of architectural production featuring prominently in architectural literature;[17] while the actual on site interactions and their epistemological relevance to the design process are often ignored. The building site in all its complexity is either reduced to incomplete abstractions after a few site visits during the site

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15. Paolo Tombesi, "On the Cultural Separation of Design Labor," in *Building (in) the Future: Recasting Labor in Architecture*, eds. Peggy Deamer and Phillip G. Bernstein (New York: Princeton Architectural Press, 2010), 117-136.
16. Juliet Corbin and Anselm Strauss, *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*, 3rd ed. (London: Sage, 2008), 68.
17. In addition to others cited previously, see: Amanda Reeser and Ashley Schafer, eds., "New Technologies:// New Architectures," *Praxis: Journal of Writing and Building*, no. 6 (2004); Branko Kolarevic and Kevin Klinger, eds., *Manufacturing Material Effects: Rethinking Design and Making in Architecture* (London: Routledge, 2008); Deamer and Bernstein, eds., *Building (in) the Future* (2010). See also: Albena Yaneva, *The Making of a Building: A Pragmatist Approach to Architecture* (Bern: Peter Lang, 2009) for a different theoretical standpoint employing an Actor-Network Theory perspective.

analysis stage in preliminary design development, or relegated to the specialist area of construction management within the current architectural curriculum.

In this thesis, I argue that the site of construction, from the immediate vicinity of the building site to the larger context of the built heritage within a specific cultural setting, should be regarded as a repository of design knowledge embodying a repertoire of distinct architectonic solutions that can be used as case studies for current design problems. The physical site as a continuum in space and time also brings about the consideration of heritage as a dynamic concept. In order to relate to built heritage in this way, it will be necessary to develop analytical tools to look for the essence of the architectonic solutions, rather than thinking about the past as a succession of stylistic episodes.

As Alberto Pérez-Gómez points out, our very distance from the past traditions of architecture enables us to find possibilities for the present.[18] In the absence of commonly accepted truths and norms, the sustained continuity of the physical site carrying the traces of its heritage will provide us with the strategies for an innovative design practice – one that has the rigour to come face to face with its past, while tackling present-day issues.[19]

The Ecology of Building Practice

Contemporary building practice features an array of different alliances, networks and modes of practice. Portraying diverse figures with different degrees of authority like design builders, heritage specialists within preservation councils, municipal architects, mass housing entrepreneurs, design architects in mega scale corporate offices and directors of boutique firms, it is a tough and amorphous area to study.

Kenneth Frampton links the presence or absence of craftsmanship in architectural praxis to the degrees of alienation experienced due to a division of labour that attends all forms of production.[20] For the purposes of this research, I have focused on non-corporate environments where the degree of alienation towards the work at hand is comparatively minimal. As a result, the study features insights from two distinct modes of building production: the pre-modern

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18. Pérez-Gómez, "Hermeneutics as Discourse in Design," 76.
19. Tentative suggestions for such strategies are discussed in Chapters 6 and 7.
20. Kenneth Frampton, "Intention, Craft and Rationality" in *Building in the Future: Recasting Labor in Architecture*, eds. Phillip Bernstein and Peggy Deamer (New York: Princeton Architectural Press, 2010).

vernacular practice, based on the empirical evidence from my interviews with traditional stonemasons from Turkey; and contemporary architectural practice, based on the empirical evidence from my interviews with architects from non-corporate offices across four different countries.[21]

In order to navigate through the contingencies and irregularities of these two distinct niches of building practice, I refer to theories of situatedness,[22] and expand their use by referring to design knowledge and building practice as interrelated ecologies. Further methods for conducting an epistemological investigation of the amorphous ecology of building practice are provided by a recent strand of contemporary theory defining practice as its main area of study instead of "social structures, systems or discourses". Commonly known as the 'practice turn in theory',[23] this particular theoretical stance brings together investigators from diverse areas such as science and technology studies, lab studies, Actor-Network Theory (ANT), and organisation studies.

This thesis contributes to the existing literature on building practice and on architectural epistemology by reframing the construction site as an active agent in architectural practice and by delineating the different kinds of feedback physical sites afford in the generation, accumulation, and transmission of design knowledge. By deploying an ANT perspective in the analysis of building practice, this thesis also underscores the importance of non-human actors in the design process, extending the theoretical repertoire of design thinking.

Overview of the thesis

This research and analysis assert that the building site is an active agent in the generation and sustenance of design knowledge. The study is divided into three sections:

In Section I, entitled "Architecture, Craft and Design Knowledge," I survey theory and literature surrounding the interrelated fields of architecture and craft,

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21. Turkey, Australia, Spain, and Japan.
22. In particular: James Jerome Gibson, *The Ecological Approach to Visual Perception* (Hillsdale, New Jersey: Lawrence Erlbaum Associates Inc., Publishers, 1986); Bruno Latour and Steve Woolgar, *Laboratory Life: The Construction of Scientific Facts*, (Princeton, New Jersey: Princeton University Press, 1986); Jean Lave and Etienne Wenger, *Situated learning: Legitimate peripheral participation* (Cambridge: Cambridge University Press, 1991); Edwin Hutchins, *Cognition in the Wild* (Cambridge, Massachusetts: The MIT Press, 1995); and Christopher J. Preston, *Grounding Knowledge: Environmental Philosophy, Epistemology and Place* (Athens, Georgia: University of Georgia Press, 2003).
23. Theodore R. Schatzki, Karin Knorr Cetina, and Eike von Savigny, *The Practice Turn in Contemporary Theory* (London: Routledge, 2001).

and propose a brief overview of the nature of design knowledge involved in these complementary areas.

Chapter 1 surveys theories of craft and architectural design in order to discuss the distinct ways of knowing involved in architectural and crafts practices. In investigating the commonalities of these knowledge practices, I point to the continuity between perception, cognition and abstraction to discuss how physical sites influence design thinking. The final subsection of this chapter proposes the notion of sites as *epistemic environments*, and surveys theories of situatedness by referring to concepts such as *situated cognition*.[24]

Chapter 2 reviews architectural literature pertaining to the roots of attitudes and roles at the intersection of architecture and craft. Starting with an account of the associations related to the notion of craft in architectural discourse, I move on to trace the lineage of the figure of master builder by selecting different roles attributed to architects according to their degree of involvement with building production. At the end of this chapter, I discuss different modes of engagement with the construction site, and point to the notion of the vernacular in architecture as a common notion of situatedness.

Chapter 3, which concludes Section I, is a discussion on methods, the theory informing them and the collection and analysis of data. In this chapter I explain the design of the field research, and indicate the challenges and opportunities arising from the use of grounded theory in conjunction with a number of secondary methods.

Section II, entitled "*In Situ*: Sites of Knowledge in Building Practice", starts with an overview of the fieldwork, and explains the unique characteristics of research respondents. Validating the selection of respondents on the basis of their similarities and differences, this introductory section presents the framework for analysis used to make sense of the original research.

Chapter 4, "The Workshop and Beyond," presents the findings from the first set of interviews conducted with traditional master stonemasons from Turkey. The findings are presented according to the different sites of knowledge production and associated knowledge making processes from the practice of the stonemason

24. For a thorough discussion on the situated nature of cognition and the impact of the environment on the generation of knowledge see: Christopher J. Preston, *Grounding Knowledge: Environmental Philosophy, Epistemology and Place* (Athens, Georgia: University of Georgia Press, 2003).

respondents. The main discussion underscores the impact of artefact mediated thinking in craft practice, and discusses the specific modes of interaction with the building site. The last subsection of this chapter, entitled "The Eternal Site" analyses the ways master stonemasons interact with their environment to produce and propagate building knowledge.

Chapter 5, "The Office," presents the findings from the second set of interviews conducted with an international group of contemporary architects. This chapter discusses the characteristics of this heterogeneous group, and points to the different ways architects deal with representations, objects and sites according to their individual roles and domains of expertise. The last section of this chapter, entitled "The Mediated Site" points to the use of the office environment as a site of knowledge production, and analyses architects' different modes of engagement with the building site through mediated interactions.

Chapter 6, "The Construction Site," early drafts of which were presented at two international conferences, *Tectonics*[25] and *Making Futures*,[26] is an exploration of the affordances of the construction site. In this chapter, I present and discuss a design meeting from the Sagrada Família design office in order to elucidate the affordances of the construction site in relation to design development. The relevance of the construction site as a common ground bringing architects and stonemasons together is underscored by the presentation of findings from both sets of interviews related to the issue of collaboration. The last section of this chapter, entitled "The Site under Construction," discusses the site of construction as an epistemic environment, and the basis of an innovative practice.

Section III, entitled "Towards an Ecology of Architectural Knowledge" includes an auto-ethnographical account from my own design practice and concluding remarks and suggestions for further research, where I discuss the epistemological basis of innovation in architectural design by bringing together various threads of this thesis - collaborative networks, materiality, embodied cognition, and the site as an epistemic environment - to sketch out some implications of these findings for the contemporary architectural practice.

25. Elif Kendir, "Tectonic Collaborations: Learning from the Construction Site," in *Tectonics - Making Meaning: Conference Proceedings*, Eindhoven University of Technology, 2007.
26. Elif Kendir, "Beyond Control - Promoting Craft in the Practice of Architecture" in *Making Futures: The crafts in the context of emerging global sustainability agendas Abstracts* (Plymouth: Plymouth College of Art, 2009), 20.

CHAPTER 1. Design Knowledge in Context

> "The built environment is a common repository of stored information. Developments having to do with forms and structures that are adaptive to human physical, sensory, and psychological needs are stored in pre-modernist built structures. This information represents the work of an enormous number of individuals, as well as collective efforts throughout the ages. It has the advantage of being accessible to everyone. Unlike information stored in books, which until relatively recently was accessible only to an educated class, information stored in built form is immediately accessible, and acts as a working memory for society." [27]

The main aim of this first chapter is to provide a comparison of two very distinct yet parallel cultures of knowledge concerning craft and design. In doing so, I survey related theories in both of these domains in order to understand the relevance of one domain for another and to assess the potential for overlaps between these theoretical standpoints. Putting design knowledge in context requires the consideration of two distinct types of knowledge traditions based on tacit and explicit means; and an analysis of the associated processes of generation and transmission of knowledge within these paradigms. By analysing tacit and explicit knowledge within the context of various social, material and cognitive strategies used by architects and craftsmen, this chapter proposes a theoretical framework for understanding the impact of building practice in the generation of design knowledge.

Following the argument explained in the introduction, this chapter seeks to establish a theoretical basis for active engagement with the site and to understand how the reconsideration of the site as an actor in the design process would impact the generation and transmission of design knowledge within the different domains of craft and architecture. The more common mode of thinking that favors the purely cerebral approach to making regards the site of intervention as a passive background. However, the alternative approach that acknowledges the specificity of each situation afforded by the unique characteristics of the materials at hand, and physical settings of making engages with the environment in a more deliberate manner. This chapter surveys relevant approaches from craft literature, along with design, perception and cognition studies that provide the theoretical framework for an alternative approach to the formation design knowledge as influenced by the act of making.

27. Francis Heylighen, "Collective Intelligence and its Implementation on the Web," *Computational and Mathematical Organization Theory* 5 (1999): 253-280.

1.1 Ways of Making / Ways of Knowing

Figure 1. Bathroom ceiling from Dolmabahçe Palace, Istanbul, 2006.[28]

"Give a mason bricks and mortar, and tell him to cover a space and let in light, and the results are astounding. The mason, within his limitations, finds unending possibilities; there is variety and harmony; while the modern architect with all the materials and structural systems available to him produces monotony and dissonance, and that in great abundance."[29]

In his essay "Philosophies of Design – The Case of Modelling Software" quoted at the start of Section I, Manuel de Landa contrasts two design philosophies: one that views designing as a cerebral act, where a predefined concept is imposed upon the material at hand; and another that acknowledges the inherent specificities of the design medium and engages with it through a dialogue from which the form emerges.[30] Although the distinction between these two philosophies of design is discussed within the context of the design tools in De Landa's article, acknowledging the impact of these two modes of thinking on the making of

28. Source: Photo by the author.
29. Jamshid Kooros as quoted by Bernard Rudofsky, in *Architecture without Architects: A Short Introduction to Non-Pedigreed Architecture* (Albuquerque: University of New Mexico Press, 1964).
30. De Landa, *Philosophies of Design*, 132.

buildings would lead to a more nuanced understanding of the basic difference between craft and design.

Studying architectural knowledge by employing craft as a heuristic device inevitably brings out the notion of personal knowledge as discussed by Polanyi[31] and points to the importance of the tacit dimension of the knowledge making practices involved in building production. Tacit knowledge is deployed through an interaction with the environment and other actors and is difficult to tease out in a vacuum: such knowledge is emergent in character and almost always becomes visible in action.

In *Thinking through Craft*, design theorist Glenn Adamson points out that the position of craft within the arts is complicated, arguing that just because every art object is made, and involves crafting of some sort, does not necessarily imply that they are about craft per se. According to Adamson, craft is also a "commonsense term", but the constellation of concepts that are tied to this seemingly straightforward concept makes it a fertile ground for speculation. He discusses craft within the context of art, and delineates its dynamic aspect.

> "Craft exists only in motion. It is a way of doing things, not a classification of objects, institutions or people. It is also multiple: an amalgamation of interrelated core principles, which are put into relation with one another through the overarching idea of 'craft'."[32]

Comparing craft with art, Adamson distinguishes the core principles of craft, and discusses them under evocative rubrics: *supplemental*, rather than autonomous; *organized around material experience*, rather than optically oriented; and most importantly, dependent on the result of *skilled* work. He also points out additional characteristics concerning craft's position within the contemporary social condition and discusses these under the headings of *pastoral* and *amateur*.

Adamson's approach to craft as a dynamic concept and his investigation of the processes associated with its existence is very revealing within the context of architectural practice. Although architectural practice is decidedly different form art practice, the making of buildings involving a much more constraining set of social and technical conventions compared to the making of artworks, Adamson's categories work well as guiding concepts for understanding the ecology of

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31. Michael Polanyi, *Personal Knowledge: Towards a Post-Critical Philosophy* (
32. Glenn Adamson, *Thinking through Craft* (Oxford, New York: Berg, 2007), 4.

architectural knowledge, especially in relation to the impact of skilled making on design thinking. [33]

Adamson's work provides a comprehensive and illuminating discussion on the notion of skill, indicating its contemporary relevance for arts practices (including architectural practice) by noting that skill is "most conspicuous in its absence."[34] He presents skill as "the most complete embodiment of craft as an active, relational concept, rather than a fixed category."[35] Relating the issue of skill to materials and to individual attitudes towards that material, Adamson refers to the art historian Michael Baxandall's study on limewood sculptors of Renaissance Germany. Although the subject of Baxandall's study is geographically and historically distant from the group of craftsmen I interviewed, some of the quotes from Section II will echo Baxandall's points related to the interaction between materials, craftsmen in a specific material and cultural setting.

Another important aspect of craft knowledge is the relationship between the makers and their tools, resulting in a specific type of artefact-mediated thinking. In *The Craftsman*, renowned sociologist Richard Sennett points to the characteristics of such thinking: In the section aptly named "Arousing Tools", he explains the nature of intuitive leaps, and how a state of arousal provoked by the limits of tools leads to a reformatting of sense perceptions, and starts a whole process of discovery, enlarging the mind's frame of reference, and bridging the gap between mind and body. His account of craft knowledge, with anecdotes from various disciplines including architecture is filled with pointers on where to look for areas of creative comparisons in using craft as a heuristic concept for understanding the nature of architectural knowledge.

According to craft theory, the decomposition and recomposition approach is a vital constituent of design understanding, where making and fixing become complementary parts of a continuum. When talking about an act of repair that changes the essential function of a tool, Richard Sennett refers to a "jump of domains."[36] According to Sennett, this jump expands the tool's previous

33. Adamson also refers to architecture in his skill discussion, and describes Frederic Jameson and Kenneth Frampton as proponents of two opposing standpoints on craft in architecture. Ibid., 87-101.
34. Ibid., 69.
35. Ibid.
36. Richard Sennett, *The Craftsman* (London: Allen Lane, 2008), 200.

applicability, while the very act of repair provides the designer with a deeper understanding of its application.

Figure 2. Thomas Jefferson Scribner, lumberjack, unionist, and master musical saw player, circa 1960.[37]

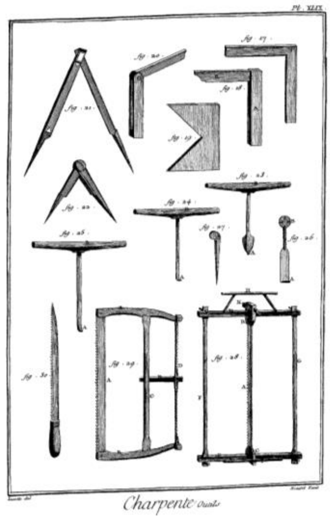

Figure 3. Carpentry tools from Diderot & D'Alembert's *Encyclopédie*.[38]

In addition to the act of repairing being an integral part of craft knowledge, "playing with tools"[39] can be pointed out as an alternative domain jump illustrating the non-deterministic relationship between the craftsman and his tools. Unexpected practices emerge from the dynamics of close contact between the tool user and his tools, revealing potentials hitherto undiscovered. This aspect of craft knowledge is especially brought forth by design theorists that discuss skill acquisition within the context of information technologies and the impact of playful engagement with tools as an essential component of the learning process:

> "Play serves learning through experimentation without risk. Play often lacks any immediately obvious aim, other than the pursuit of stimulation, but functions almost instinctively to serve the process of development. [...] some psychologists refer to the arena established by exploratory play as the "cognitive unconscious," and they hold that mature learning consists of making aspects of this cognitive ground fully conscious later on."[40]

A marginal example for the notion of playing with tools from an analogue field would be the musical saw, an instrument that is played by curving the blade of the saw to form an S-curve, and changing the curvature in order to change the notes. The point of inflection where the curvature of the saw changes is called "the sweet

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37. Source: Photo from http://www.scribnerfamilies.org/Images6.htm
38. Source: Plate from Denis Diderot and Jean le Rond D'Alembert, *Encyclopédie, ou Dictionnaire raisonné des sciences, des arts et des métiers*, (1751-1772), s.v. "Charpente – Planche XXXIV."
39. Malcolm McCullough, "Play," in *Abstracting Craft: The Practiced Digital Hand* (Cambridge, Massachusetts: The MIT Press, 1996), 221-242.
40. Ibid., 224.

spot" and notes are sounded by drawing the bow across the back edge of the saw at the sweet spot while changing the curvature of the saw. Originally a carpenter's tool, this makeshift instrument is a characteristic example of craft-based action depending on an emergent relationship between the maker and his tools – a relationship that is based on an intimate knowledge of the sweet spots that make any tool "sing."

Another take on craft knowledge by the art historian Pamela H. Smith investigates artistic and artisanal practices in relation to the development of scientific knowledge. Smith elucidates this interesting relationship under the title "Artisanal Epistemology" in her book, *The Body of the Artisan*, reframing practices such as observation and the imitation of nature as knowledge producing activities that prepared the groundwork for the empirical foundations of science.[41] Basing this discussion on art history and examples from the era of scientific revolution, Smith points to the situated nature of craft knowledge, and how artisans responded to their environment through bodily engagement.

In a highly evocative section, Smith compares craft knowledge to *chiromancy*, both practices involving the interpretive skills and attention towards the materials at hand.[42] The heightened sensitivity towards materials found in craft knowledge involves reading the traces of environmental processes from the irregularities in the material in order to deduct performative qualities. In this way, the craftsman reads the signs from the environment, while his body is engaged in a reciprocal interaction with the material at hand: Veins in wood[43] or stone directing the workmanship of the artisan is one such example.

Achieving such "deep knowledge"[44] of materials depends on the embodied experience and "a haptic way of knowing."[45] The polysensorial aspect of this

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41 . Pamela H. Smith, *The Body of the Artisan: Art and Experience in the Scientific Revolution* (Chicago: The University of Chicago Press: 2004).

42. In discussing artisanal epistemology, Smith refers to the writings of Paracelsus, who regarded chiromancy as the expertise of artisans:
"It is important to understand that the kind of expertise to which Paracelsus refers here is a deep knowledge of the behavior of materials, for example, that by which carpenters of his day knew how to choose, cut, and prepare wood panels, so that even after centuries very little warping or twisting takes place. [...] A person did not have to be literate to be able to do chiromancy; even a peasant could learn this knowledge of nature." Ibid., 86.

43. Adamson also refers to reading the signs from materials by referring to the work of art historian Michael Baxandall on the practice of limewood sculptors from the Renaissance:
"The typical cracking in a log of light hardwood like limewood is a radial pattern of splits running from its ends [...] The cause is uneven shrinkage in drying, and it is these lines one must read."
Michael Baxandall, *The Limewood Sculptors of Renaissance Germany* (New Haven: Yale University Press, 1980), 32; quoted in Adamson, *Thinking through Craft*, 75-76.

44. Smith, *The Body of the Artisan*, 86.

knowledge is usually reflected in the vocabulary of craftsmen, replete with anthropomorphic terminology and indications of sense memory in action. In contrast to a conceptual understanding of artefacts mediated through abstract references, this type of knowledge is generated as a result of an active work engagement. Chapter 4, where I present the findings from the interviews with traditional stonemasons from Turkey, provides an account of such anthropomorphic references as a characteristic property of craft knowledge.

As discussed previously, craft knowledge is acquired through the utilization of skills to interact with the material at hand. In this context, the acquisition of skills is a vital precursor to the formation of craft knowledge. In *Mind Over Machine: The Power of Intuitive Expertise in the Era of the Computer*,[46] Hubert and Stuart Dreyfus propose a phenomenological model of skill acquisition, where they explain how practitioners in different skill levels, from novices to experts, and other practitioners with different competence levels in between, learn and use knowledge. In the Dreyfuses' definition of expert performance, case based learning is the main route through which experts learn and make sense of their environment.

The Dreyfuses' definition of expert performance holds water in the practices of master craftsmen, who depend on their ability to learn from cases distributed in their environment to conduct and further their practice, as evidenced in the interviews with the traditional stonemasons conducted as part of the empirical research component of this thesis. A distinguishing characteristic of master craftspeople, case based learning is also an important aspect of design knowledge, employed by expert designers, who build on their skills of direct observation from their environment, while also depending on the deliberate study of relevant cases presented in literature. Case based learning, essentially an interpretive skill that develops through an engaged interaction with the environment, is an epistemological strategy that will be discussed in Section II of this study.

45. A survey of how ranchers from Montana accumulated their place-based experiences presents a compelling argument on the relevance of haptic knowledge in architectural design, as evidenced in the vocabulary of ranchers. See: Máire Eithne O'Neill, "Corporeal Experience: A Haptic Way of Knowing," *Journal of Architectural Education* (2001): 3-12.
46. Stuart Dreyfus and Hubert Dreyfus, *Mind Over Machine: The Power of Intuitive Expertise in the Era of the Computer*, (New York: Free Press, 1986).

1.2 Theories of Design Thinking in Architecture

> "Are some environments more conducive to thoughtful and creative outcomes than others? If so, then perhaps architecture could concern itself (again) with the orchestration of suitably mnemonic and cognitive environments: rooms, public spaces, landscapes and technospheres by which to think. Design brings the commonplace of creativity to light in that it presents as so many interventions into the environment. Thought is provoked anew, or set on a different course when an urban sculpture is unveiled, a façade is defiled, a bridge is completed, an office building is demolished, ancient foundations are excavated, or the scaffolding comes down to reveal a new building. By this reading we don't just think in order to produce designs, but design interventions in the environment provoke thought. Design is a way of thinking."[47]

In a rare example pointing to the epistemic significance of physical sites for design thinking, Snodgrass and Coyne refer to "environments to think by."[48] Their approach to design thinking based on the hermeneutical tradition points to the ubiquity of interpretation in architecture, where architects interpret "contracts, regulations, site conditions and the circumstances of the building users,"[49] while "contractors, building users and critics strive to interpret buildings."[50] In their analysis of the *process* of architectural design as interpretation, they refer to creativity as "commonplace,"[51] an emergent property of the designers' interaction with their environment. While they do not explicitly refer to case based learning, their acknowledgement of the impact of the environment on design creativity links their approach to theories of situatedness in cognition, and to Dreyfuses' definition of expert knowledge.

Another prominent design theorist, Bryan Lawson, in his cognitive approach to design knowledge, classifies site conditions as "external constraints," which sometimes "virtually determine the whole form of design."[52] In describing these external constraints, Lawson uses a study of architects where the subjects acknowledge the site as a "major form determining influence."[53] Lawson's comprehensive design theory gives a passing mention to the site as a system of references, but does not systematically analyse the cognitive process by which site occupies a central position in the architectural design process. In his more recent books, Lawson underlines the "highly situated nature of design,"[54] and provides a more detailed analysis of the types of precedents by discussing cognitive processes

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47. Adrian Snodgrass and Richard Coyne, "Creativity as Commonplace," in *Interpretation in Architecture: Design as a way of thinking* (London: Routledge, 2006), 82.
48. Ibid.
49. Ibid., 4.
50. Ibid.
51. Ibid., 71-82.
52. Lawson, *How Designers Think: The design process demystified*, 4th ed. (London: Routledge, 2005), 94.
53. Ibid., 95.
54. Bryan Lawson and Kees Dorst, *Design Expertise* (Oxford: Architectural Press, 2009), 130.

related to precedent based learning.[55] In the conclusion of his study on the content of design knowledge, Lawson refers to the "situated" nature of design knowledge, and links his discussion to Dreyfuses' model of expertise discussed above.[56]

From a different angle, Donald Schön defines a professional practitioner as a specialist who repeatedly encounters similar situations within a practice context. [57] These similar situations are referred to as "cases" and in response to this similar family of occurrences; the professional develops "a repertoire of expectations, images and techniques".[58] In time, the practitioner's response to cases become more automatic, and the knowledge pertaining to these situations becomes more tacit and spontaneous. While this has the benefits of specialization, that is, in depth knowledge and speedy response to problems within that area, it can have some negative consequences. Schön points to the possibility of developing "a parochial narrowness of vision", and a lack of holistic understanding of a particular situation based on a specific experience. As the practice becomes more routinized and automatic, important possibilities for providing creative and indigenous solutions to the cases at hand are lost.

A major characteristic that distinguishes craft knowledge from formalized disciplinary knowledge in architecture is that it is distributed among artifacts and practitioners. Cognitivist accounts of situated knowledge involve a differentiation between *embedded* and *embodied* knowledge,[59] indicating knowledge embedded within the artefacts, and the tacit knowledge embodied within the practitioner which is activated by the active involvement in the process of making. That is one of the main reasons why architects and builders have two very different ways of looking at buildings:

> "Architects think of a building as a complete thing, while builders think of it and know it as a sequence - hole, then foundation, framing, roof, etc. The separation of design and making has resulted in an environment that has no 'flow' to it. You simply cannot design an improvisation or an adaptation. It's dead."[60]

Although a procedural view of buildings is essential for developing a design approach that addresses the aspect of time as well as dealing with space, academic

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55. Bryan Lawson, *What Designers Know*, 96-104.
56. Ibid., 116.
57. Schön, *The Reflective Practitioner*, 60.
58. Ibid.
59. Andy Clark, "Reasons, robots and the extended mind," *Mind and Language 16*, no.2 (2001): 121-145.
60. Quote by Matisse Enzer, a contractor who has had a long collaboration experience with architects from Stewart Brand, *How Buildings Learn* (New York: Penguin Books, 1995), 64; quoted in Tim Ingold, "The Textility of Making," in *Being Alive: Essays on Movement, Knowledge an d Description* (London: Routledge, 2011), 212.

instruction of design based on the priority of space does not sensitize students to this important concept. Since basic attitudes towards architecture are inculcated during formal education, a procedural understanding of architecture can only be gained from practical experience that involves an active collaboration with builders. This fact, coupled with the uncritical adoption of the primacy of scientific knowledge in academia complicates the transmission of knowledge in architecture. As an academic discipline, it features the danger of "retreating into narrow specialisation" by the thrust of "expert culture." [61]

1.3 Feedback Loops in Design: Perception, Cognition, Translation

Philosopher and sociologist of science Bruno Latour refers to the process of visualization as the main distinguishing characteristic of modern scientific knowledge.[62] The means of visualization enables modern scientific knowledge to attain a higher position in the knowledge hierarchy, promoting progress and innovation; whereas traditional knowledge domains remain constrained within their respective boundaries. Latour's perspective posits visualisation as the deciding factor that distinguished modern knowledge making practices depending on abstractions from pre-modern craft knowledge with its situated and context specific knowledge base that acknowledges things that do not readily lend themselves to visualisation.

Dependence on visualisations has been a reality of architectural practice since the Renaissance. Itself an act of translation, architectural design as we know it is a product of sequential distancing from the site of construction, leaving the medium of representation as the main practice domain for most architects.[63]

> "The process of creation prevalent in architecture today assumes that a conventional set of projections, at various scales from site to detail, adds up to a complete, objective *idea* of a building. Whether or not the architect is effectively or legally responsible for the production of construction documents (working drawings), the assumption remains. These projective representations rely on reductive syntactic

61. "And it is precisely this proliferation of so-called expertise (e.g. structures, mechanical systems, digital visualisation and prototyping, theory and history, professional practice, construction management, value engineering, accessibility, sustainability and so on ad infinitum) that has divided the academy and splintered the profession to such a degree that any discipline of architecture is no longer recognizable."
R. E. Somol, "Operation Architecture," in Marc Angélil, *Inchoate* (Barcelona: Actar, 2004), 12.
62. Bruno Latour, "Visualization and Cognition: Drawing Things Together," in *Knowledge and Society: Studies in the Sociology of Culture Past and Present* 6, ed. Henrika Kuklick, (1986): 1-40.
63. "Even if an architect has no patron to underwrite an actual building, its design, represented in the drawing, can still be placed before a potential public and within an architectural discourse. This makes a greater variety of practices available to architects."
Edward Robbins, "The Social Uses of Drawing: Drawing and Architectural Practice," in *Why Architects Draw* (Cambridge, Massachusetts, The MIT Press, 1997), 30.

> connections; each projection constitutes part of a dissected whole. They are expected to be absolutely unambiguous to avoid possible (mis)interpretations, as well as functioning as efficient neutral instruments devoid of inherent value other than their capacity for accurate transcription. Professional architects generally see architectural drawing in this light."[64]

At the start of their book *Architectural Representation and the Perspective Hinge*, Pelletier and Pérez-Gómez propose the dichotomy of "transcription versus translation" in architectural design. What they refer to is the gap between the building as designed and the way it is eventually realized. Acknowledging this gap brings one closer to the notion of translation, which leaves an interpretive possibility for the act of construction as opposed to naively expecting the building to be an exact transcription of the project. Before moving on to the cognitive potential of the processes for manipulating this gap, the nature of knowledge work involved in craft and architectural practice should be acknowledged. Architects and craftsmen implement design intent via complementary means, and both groups are subject to the circularity between perception, cognition and translation.

They go on to note that the domain of operation for the set of projections used extensively in contemporary architectural design is a construct form the nineteenth century. By exposing the implicit scientific authority of these projections in determining the nature of the actual building, they trace the history of perspectival space and its dominance back to the techniques prescribed by Jacques-Nicolas-Louis Durand in the book *Précis des Leçons d'Architecture* in 1802 and 1813:

> "Although descriptive geometry promoted simplistic objectification, this projective tool is a complex product of a philosophical tradition and technological worldview that defines the European nineteenth century and leads to our own "world order". It is, therefore not something we can simply reject or leave behind."[65]

In *The Projective Cast: Architecture and Its Three Geometries*, architectural historian Robin Evans discusses geometry in relation to its claim to truth. In this work, he defines metric geometry as haptic and projective geometry as visual, and discusses the interrelations of the visual over the haptic realm. Of special relevance to this research is the section called "Paper and Stone" where he discusses stereotomy:[66]

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64. Alberto Pérez-Gómez and Louise Pelletier, *Architectural Representation and the Perspective Hinge* (Cambridge, Massachusetts: The MIT Press, 1997), 3-4.
65. Pérez-Gómez and Pelletier, *Architectural Representation and the Perspective Hinge*, 4.
66. In architectural literature, stereotomy is defined as the use of projective geometry to regulate the cutting of solids like stone and wood as structural members. It was "specifically a French concern" according to Pérez-Gómez. See: Alberto Pérez-Gómez, "Fotification, Mensuration and Stereotomy," in *Architecture and the Crisis of Modern Science* (Cambridge, Massachusetts: The MIT Press, 1983), 227. A historical account of stereotomy as a practice that was essentially an attempt on the part of architects to regulate the practice of stonemasons is provided in the next chapter.

"Great works of architecture were made of stone: heavy, solid, obdurate, and enduring. *Traits* were made of paper: light, thin, pliable, and expendable. No working traits have survived from the Gothic or classical periods. The only evidence of their existence is from written sources and printed books, lending fuel to the view that savants usurped the secret skills nurtured into existence by craftsmen. ...Stone, with the labour and the weight wrung from it, could almost look like paper. Seemingly, the trait had exported some of its own properties to the masonry it defined. Doing so, it demonstrated the victory of intellectual form over material substance."[67]

Architects lay claim to knowledge via abstractions, and projective geometry is one of the most powerful types of abstractions available for the use of architects. Evans talks about the potency of this medium in his essay "Translations form Drawing to Building",[68] to indicate that the distance between the medium of drawing and the medium of building enables a creative gap for the flourishing of design knowledge. He suggests that a "suspension of critical disbelief" is needed for the architects to be able to operate via the medium of drawing:

"Recognition of the drawing's power as a medium turns out, unexpectedly, to be recognition of the drawing's distinctness from and unlikeness to the thing that is represented, rather than its likeness to it, which is neither paradoxical nor as dissociative as it may seem."[69]

Evans then refers to drawing's "intrinsic limitations of reference", and gives James Turrell's rooms as an example to suggest that not everything architectural can be specified through the sole medium of drawing. Turrell's rooms, as Evans describes, are the result of direct observation and "countless experiments in situ"[70] – they cannot even be photographed or illustrated properly after their construction. These kinds of spaces, architectural spaces that defy visualization via conventional means, almost always feature a mode of working constantly *on site* during their realization, which I will discuss in the context of Gaudì's *Sagrada Família Basilica*[71] in Chapter 6.[72]

An essay by the famous architecture critic and historian Joseph Rykwert complements and extends Evans's argument. Rykwert reminds that any process of translation requires fluency in the language to which the translation will be made,

67. Robin Evans, "Drawn Stone," in *The Projective Cast: Architecture and Its Three Geometries*, (Cambridge, Massachusetts: The MIT Press, 1995), 217.
68. Robin Evans, "Translations from Drawing to Building," in *Translations from Drawing to Building and Other Essays* (Cambridge, Massachusetts: The MIT Press, 1986).
69. Ibid., 154.
70. Ibid., 159.
71. The name of the church has been changed from the *Expiatory Church of la Sagrada Família* to *Sagrada Família Basilica* after its consecration on November 7, 2010.
72. Robin Evans actually refers to Gaudì in his discussion of stereotomy, pointing to the evolution of his practice until he was able to go beyond projective geometry:
"In fact Gaudí tried to go beyond this. His later work was an attempt to escape from all design geometry, even this more sophisticated sort, which meant getting rid of projective drawing as a mediator."
Evans, *The Projective Cast*, 333.

rather than in the source language of the text to be translated.[73] This is relevant to any discussion concerning architectural knowledge as an act of translation from drawing to building: without proper building knowledge, the translation will appear as broken prose in the actual medium of the work of architecture as a built artefact.

The circularity between perception, cognition, translation and realization, and the impact of the physical environments on design thinking may be better understood through an example: Richard Serra's *Torqued Ellipses* series clearly demonstrates how perception of a particular quality of a physical environment leads to an artistic idea, which in turn is mediated through several means of representation until it reaches its final form.

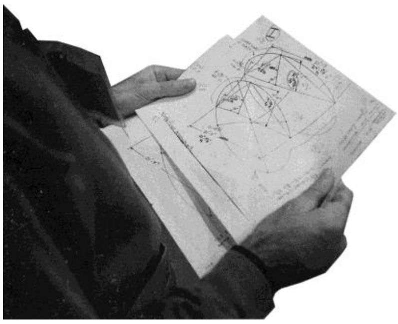

Figure 4. Construction drawings of the *Torqued Ellipses,* Richard Serra, 1997.

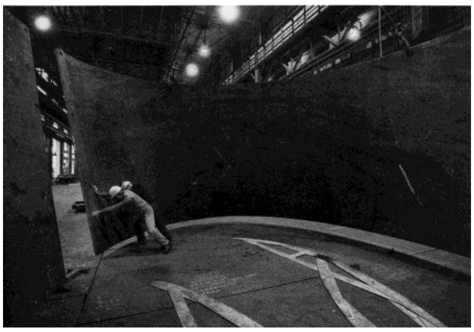

Figure 5. Installation of one of the *Torqued Ellipses* in New York, 1998.[74]

The genesis of Serra's project is based on a visit to Borromini's *San Carlo* in Rome, where his conception of the oval nave volume as a plastic spatial element led to the idea of reproducing a similarly affective spatial experience by torquing it in elevation.[75] Throughout this whole process, it is possible to follow the flourishing of an idea – starting with a bodily sensation of an actual space, followed by its abstraction as a mental image, to a selection of a specific material to maintain the traces of the forces acting in its construction.

73. Joseph Rykwert, "Translation and/or Representation," *RES: Anthropology and Aesthetics* (1998): 64-70.
74. Source: Both images from Michael Gowan and Mark Taylor (eds.), *Richard Serra- Torqued Ellipses*, (NewYork: Dia Center for the Arts, 1998)
75. Serra explains his creative process as a series of translations: First from the spatial idea to a sketch model that was simply made up of two wooden ellipses connected and held parallel by a dowel, at differing angles to each other, which he used to roll a sheet of lead around to determine the bounding surface; then through the use of a computer program and working with shipbuilders to fabricate the artworks in full scale.In this way, along with adding variations to the angles and the sizes of the ellipses, he was able to conceive some thirty models for large scale sculptures.
Richard Serra and Klaus Ottmann, "Interview with Richard Serra," *Journal of Contemporary Art Online*, 1998, http://www.jca-online.com/serra.html.

In preparation of the thesis argument which posits the construction site as an *epistemic environment*, the next section surveys theories of situatedness and analyses the dynamics of perception, cognition and translation within a physically situated context.

1.4 Dynamics of Epistemic Environments

Figure 6. View from the office of Steven Holl Architects with site models on the windowsill against a New York backdrop.[76]

This section surveys theories of situatedness: Following the analytical route opened up by Bruno Latour and Steve Woolgar in their *laboratory studies*,[77] I survey the impact of site on thinking and action by referring to the post-humanist stance and concepts of situatedness in Actor-Network Theory[78] (ANT from here onward); the notion of situated cognition;[79] environmental perception and the concept of affordance;[80] situated learning,[81] and the environmental philosophy of Christopher J.Preston.[82] All of these approaches argue that knowing emerges *in situ*, reject mind-

76. Source: Photo by Gudrun Hausegger from Elke Krasny, *The Force is in the Mind: The Making of Architecture* (Basel: Birkhäuser, 2008), 133.
77. Bruno Latour and Steve Woolgar, *Laboratory Life: The Construction of Scientific Facts* (Princeton, New Jersey: Princeton University Press, 1986).
78. Bruno Latour, *Reassembling the Social: An introduction to Actor- Network- Theory* (Oxford: Oxford University Press, 2005).
79. Edwin Hutchins, *Cognition in the Wild* (Cambridge, Massachusetts: The MIT Press, 1995).
80. James Jerome Gibson, "The Theory of Affordances," in *The Ecological Approach to Visual Perception* (Hillsdale, New Jersey: Lawrence Erlbaum Associates Inc. Publishers, 1986), 127-146.
81. Jean Lave and Etienne Wenger, *Situated Learning: Legitimate Peripheral Participation* (Cambridge: Cambridge University Press, 1991).
82. Christopher J. Preston, *Grounding Knowledge: Environmental Philosophy, Epistemology and Place* (Athens, Georgia: University of Georgia Press, 2003).

body dualism and accept emergent behavior that stems from the coupling of an embodied individual with socio-physical contexts.

In order to acknowledge the impact of physical environments on design thinking, it is necessary to take a brief look at the studies on the dynamics of the formation of knowledge within a situated context. Among the first theorists to work in this area, Latour and Woolgar, in their laboratory studies caused an important change of direction in science studies by ascribing agency to inanimate objects and discussing the ways in which they are coupled with human actors in the construction of knowledge. ANT approaches to building practice remain scarce in literature; however, the critical standpoint proposed by the posthumanist stance of the ANT is instrumental in understanding the nature of innovation in building practice. [83]

Of special relevance to this study is the systemic analysis of interactions between different kinds of actors proposed by the Actor-Network Theory. According to ANT, human and non-human entities are considered as actors as long as they leave traces of activity, and they form a heterogeneous network of relationships, from which meaning and understanding emerge. Developing the means for the analysis of network effects, ANT also provides conceptual tools for interpreting the environment. For instance, *blackboxing* is an ANT concept used to explain how "scientific and technical work is made invisible by its own success,"[84] which can also be used to understand knowledge embedded in artefacts.

In *Epistemic Cultures*, sociologist Karin Knorr-Cetina refers to cathedrals as laboratories: Basing their designs on their observation of earlier examples and transferring innovative designs from site to site, cathedral builders were using actual buildings as "instrumental prototypes:"[85]

> "It appears the builders observed in already built churches wind-pressure damage, cracking in the mortar of older churches, flaws in the original buttressing scheme, light influx, and, generally, how a particular design held up over time."[86]

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83. In an example from planning research employing an ANT stance to analyse the policies of sustainability and innovation in building practice, Yvonne Rydin points to the agency of physical sites enabling a negotiation and observation context for different actors involved in the planning process: "The site, through the intermediary of the pre-existing planning consent, was the *material expression of a valid land use*." (accent added)
Yvonne Rydin, "Use of Actor-Network Theory to Understand Planning Practice: actants, intermediaries, and low carbon commercial development," *Planning Theory* (2013): 17.
84. For an in-depth discussion on the issue see: BrunoLatour, *Pandora's hope: essays on the reality of science studies* (Cambridge, Massachusetts: Harvard University Press, 1999), 304.
85. Karin Knorr-Cetina, "Laboratories Come of Age: The Construal of Objects as Processing Materials," in *Epistemic Cultures: How The Sciences Make Knowledge* (Cambridge, Massachusetts: Harvard University Press, 1999), 36.
86. Ibid.

According to Knorr-Cetina, a system of surveillance based on travel between cathedrals and orally transmitted observations enabled designers to learn from past mistakes. In the absence of design drawings, direct interaction with building sites acted as laboratories, leading to a "sequence of "cures"classified today as architectural innovation."[87]

Cognitive anthropologist Edwin Hutchins states that he uses the metaphor "cognition in the wild" to evoke "a sense of an ecology of thinking in which human cognition interacts with an environment rich in organizing resources."[88] In a laudatory review of Hutchins' book, Latour recognizes this study as a continuation of the laboratory studies some twenty years ago and commends the book's revelation of the divide between two kinds of cognitive science: "the one that believes in laboratory experiments, mental state, and internal representation, and the other one [...] that claims to represent the real cognitive tasks in an organized and collective work site."[89] Latour stresses the importance of physical environments and their influence on the generation of knowledge: Interaction with the environment, on which expert knowledge is based,[90] is related to higher cognitive faculties, and the reason it has been relatively absent from theory is its complex nature.[91]

One of the first theorists to propose a systematic analysis of the dynamics of the mutuality of man and his environment, psychologist J. J. Gibson coins the term *affordance* in order to explain the mechanism of visual perception within a situated context. According to his theory, affordances of the environment are:

> "... what it *offers* the animal, what it provides or furnishes, either for good or ill. The verb *to afford* is found in the dictionary, but the noun *affordance* is not. I have made it up. I mean by it something that refers to both the environment and the animal in a way that no existing term does. It implies the complementarity of the animal and the environment. The antecedents of the term and the history of the concept will be treated later; for the present, let us consider examples of an affordance."[92]

He then talks about the ecological concept of the niches in the section called "the niches of the environment." This is an important definition - niche as a set of

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87. Ibid.
88. Edwin Hutchins, *Cognition in the Wild*, xiv.
89. In his review, Latour compares *Cognition in the Wild* by Hutchins to his earlier work on Trobriand islanders where Hutchins establishes the link between the islanders' reasoning and its relation to the land tenure system.
Bruno Latour, "Cogito ergo sumus! or psychology swept inside out by the fresh air of the upper deck...," review of *Cognition in the Wild*, by Edwin Hutchins, *Mind, Culture and Activity: An International Journal 3*, no. 1 (1996): 54-55.
90. Dreyfus, *What Computers Still Can't Do*, xiii.
91. Latour, *Cogito ergo sumus*, 55.
92. Gibson, *The Ecological Approach to Visual Perception*, 127.

affordances will be utilized in Section II in order to discuss the various different kinds of design knowledge within the practice ecology.

> "Ecologists have the concept of a niche. A species of animal is said to utilize or occupy a certain niche in the environment. This is not quite the same as the habitat of the species; a niche refers more to how an animal lives than to where it lives. I suggest that a niche is a set of affordances."

Gibson's argument is inherently ecological in the sense that he unites the vital links between our way of being and acting in the world and our environment. His account of perception has also been adapted to micro environments such as computer interfaces and designed artefacts, but much of his ecological argument got lost in translation. It is tempting to test the notion of affordance within the context of architectural design, where the mutuality of man and techniques affect the design outcome by enabling a two-way dialogue and how being separated from an environment distorts perception and the alienation from certain activities prohibit designers from perceiving the inherent potential of things, processes or activities. In this research, the relevance of Gibson's thesis for building design is tested by investigating niches from building practice and their respective sets of affordances for design thinking in architecture.

Building upon the foundation provided by Gibson, Christopher J. Preston discusses the epistemic potential of place in *Grounding Knowledge: Environmental Philosophy, Epistemology and Place.*[93] His standpoint, coupled with insights from Hutchins' discussion of situated and distributed cognition features an alternative approach to modernist understanding centred on the primacy of human agency and underscores the importance of the physical sites for the development, maturation and adaptation of cognitive skills.

It is important to understand the concept of the epistemic environment in its entirety: When laying down the groundwork for his environmental philosophy by referring to the existing theories of situatedness, Preston describes the dynamics of both physical and social environment. From among the social approaches, the notion of *situated learning*[94] is of special relevance to the present research. Cognitive anthropologists Lave and Wenger propose the concepts of "situated learning" and "legitimate peripheral participation" in order to explain learning as an aspect of participation in the sociocultural practices of a community.[95] They argue that

93. Preston, "Active Landscapes" in *Grounding Knowledge*, 73-99.
94. William F. Hanks, introduction to *Situated Learning*, by Lave and Wenger, 14.
95. Jean Lave and Etienne Wenger, "Legitimate Peripheral Participation," in *Learners, Learning and Assessment*, ed. Particia Murphy (London: Sage, 1999), 83-89.

learning is not solely based on deliberate instruction and explicit knowledge, but rather *emerges* from the participation in everyday activities of a community of practice.

Expanding the philosophical implications of situatedness, Preston discusses the epistemological significance of places by pointing to the different attitudes towards the physical environment in relation to the thinking mind. According to Preston, modernist views downplay embodied knowledge and the significance of a situated body is by referring to the physical surroundings as *extrinsic environments*. In what Preston calls a "radical departure" from this view, the enactivist approach acknowledges the notion of a situated body and proposes a new epistemology based on the organism-environment complex:

> "...modernist views assumed an extrinsic environment supplying a number of independently existing inputs that the organism proceeded to codify in the form of ideas or propositions and then returned to the environment as outputs in the form of behaviour and knowledge claims. The postmodern views deny that the mind can be processing pregiven inputs and returning them as outputs to a autonomous environment because those very inputs are already shaped by the peculiarities of the organism-environment complex."[96]

In the enactivist approach, "material and human agency intertwines to form particular reconfigurations of the natural order."[97] When arguing for the epistemological implications of place, Preston points to the continuity between perception and cognition, and the impact of embodied interaction on the development of thinking processes. In his account of "active landscapes," he includes a definition of cognition as "a matter of an organism's embodiment... of perceptual mechanisms, patterns of discrimination, motor programs and various bodily skills."[98] This continuity between perception and cognition leads to the conclusion that thought processes are not pure: Thinking does not take place in a detached mind; but is contingent on physical and social interactions.[99]

Continuing in the enactivist vein, the relationship between an embodied mind and the physical environment has been described as "the body's silent conversation with things" by David Abram.[100] In this conversation, physical environments are used as mnemonic activators that ground oral histories by acting

96. Ibid., 49.
97. Ibid., 50.
98. Mark Johnson, *The Body in the Mind* (Chicago: University of Chicago Press, 1987), 137, quoted in Preston, *Grounding Knowledge*, 56.
99. Aaron Cicourel, *Cognitive Sociology: Language and Meaning in Social Interaction* (London: Penguin Education, 1973), 74.
100. David Abram, *The Spell of the Sensuous: Perception and Language in a More-than-Human World* (New York: Vintage Books, 1996), 49.

as constant points of reference.[101] According to Abram, the participatory nature of perception in situ involves "the concerted activity of *all* the body's senses,"[102] and cognition *emerges* from the situated body's experience of the shifting landscape in a polysensorial fashion. This discussion, which underscores the importance of *synaesthetic*[103] preconceptual experience of the physical surroundings, makes a compelling argument for physical sites as powerful mnemonic devices and reference systems. According to Abram, as physical places lost their epistemic significance during the transition from oral to written culture, text and image have become the main mnemonic activators, flattening the experience of space and time.[104]

What is essentially a dialogue between the mind and the world is reduced to a monologue as the dominant thinking traditions strive to transcend the situated and embodied context of the mind in order to perfect abstract reasoning. Preston argues that the negation of the body as a situated being in conversation with the world that characterizes the dominant epistemological traditions is the reason behind an "exploitative attitude towards the earth."[105] As an alternative, he points to the accounts of Native American relations to place as the tentative confirmation of what lab studies theorists, ecological physiologists and some cognitive scientists already acknowledge:

> "...the materiality of the setting in which knowledge practices occur contributes something to the knowledge claims that are made. The physical environment is not just a site in which mind operates; it is a characterful place that influences the products of the mind. [...] Knowledge claims emerge out of a complex interaction between cultural activities, social values, individual idiosyncrasies, the presence of the sacred and the material arrangements of the physical environment."[106]

Furthering his argument concerning the impact of physical environments on our ways of thinking, Preston writes about "dislocating experiences," which are brought forth by a change of one's environment.[107] According to Preston, the exposure to "new and dramatic territories" causes a "shock to cognitive structures that have grown accustomed to something different." Through a personal account of his experience in Alaska, a completely different setting than his usual urban environment, he explains the subtle cognitive shift that he experienced within the

101. Ibid., 176.
102. Ibid., 59.
103. Ibid., 60.
104. Ibid., 183. Corroborating Abram's standpoint, Section II, the presentation of stonemason interviews will feature traces of oral culture and associated ways of interacting with the environment.
105. Preston, *Grounding Knowledge*, 74.
106. Ibid., 88.
107. Ibid., 89.

wilderness. It is in this context that he argues dislocating experiences might actually have an epistemic significance, by proving the fact that our perceptual skills adjust to landscapes around us:[108]

> "The shock that a dislocating experience causes to the particular combination of values, practices and perceptual habits to which we had adjusted can prompt a powerful revision of our entrenched ways of seeing the world."[109]

The utilisation of sites as reference systems is a strategy used by many mature designers: Renzo Piano, who has a strong craft background as well as a prestigious architectural practice refer to additional systems he uses while designing in addition to conventional plans. As an expert designer, he uses patterns and actively searches for them in his environment. He calls this process "creating references in the mind".[110] In his approach, he refers to actual artefacts and environments in terms of their epistemic potential for the design work at hand. A simple example he gives about this process is when there needs to be a street in a scheme he is designing, and he walks around in the city to look for precedents - in this way, he "find[s] references everywhere that help [him] define the scale and size of a scheme":

> "I know that one of the biggest mistakes architects make is that of **scale**. And that is something you never draw or make in a model. The only way to understand scale is by using a real reference. You think and you look and, for example, you find a small piazza and you see that it is 32 meters square and that is good for that kind of piazza at the scale you are thinking about. Even if it is a piazza from the fifteenth century, it is still a good reference."[111]

The theoretical perspectives briefly summarized in this chapter trouble the idea of design as a process in which designers singlehandedly manipulate information via representational tools in an abstract design space. The actual interaction between the designer and the site of design problem is not so easily objectifiable, and remains more complex than the procedural accounts of design practice would lead us to believe. Indeed, based on these perspectives it becomes possible to argue that all human activities are based on situated interactions, design notwithstanding.

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108. Ibid., 96.
109. Ibid., 89.
110. Robbins, *Why Architects Draw*, 130.
111. Ibid.

CHAPTER 2. A Craft Perspective on Architectural Practice

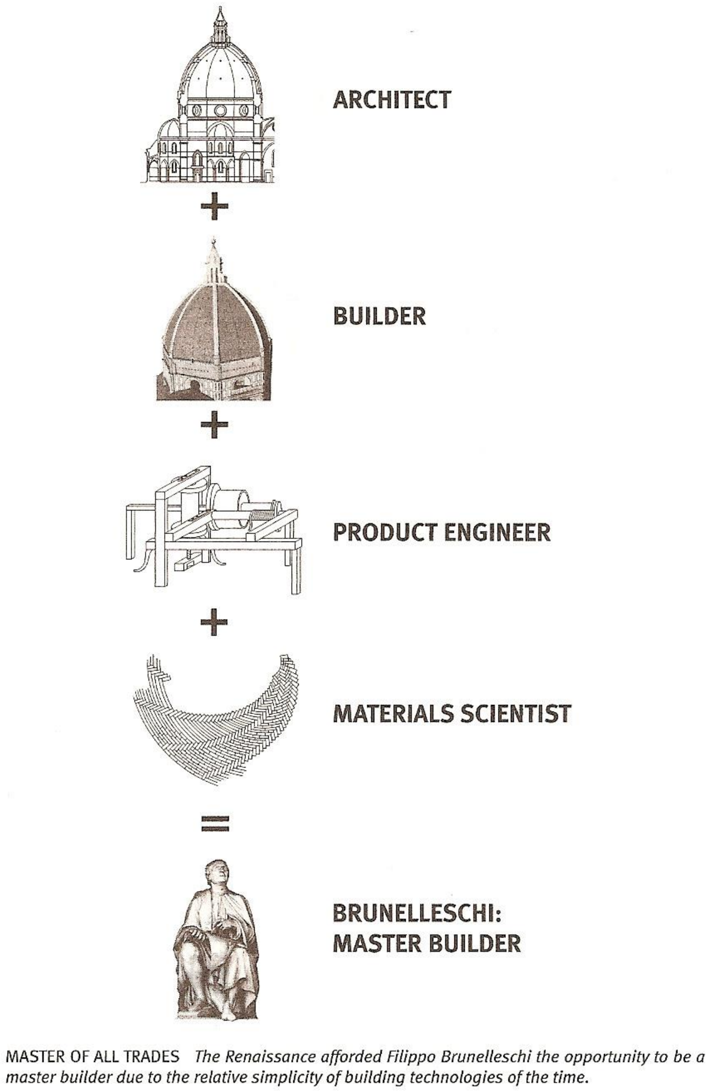

Figure 7. Diagram by Kieran and Timberlake showing Filippo Brunelleschi as a combination of architect, builder, product engineer, and materials scientist.[112]

> "...An architect must be a craftsman. Of course any tools will do. These days, the tools might include a computer, an experimental model, and mathematics. However, it is still craftsmanship – the work of someone who does not separate the work of the mind from the work of the hand. It involves a circular process that draws you from an idea to a drawing, from drawing to an experiment, from an experiment to a construction and from construction back to an idea again."[113]

112. Source: from Stephen Kieran and James Timberlake, *Refabricating Architecture: How Manufacturing Methodologies are Poised to Transform Building Construction* (New York: McGraw-Hill, 2004), 26.
113. Renzo Piano, "Renzo Piano Building Workshop 1964/1991: In Search of a Balance," *Process Architecture (Tokyo)*, no.700 (1992), 12-14, as quoted by Branko Kolarevic.

The notion of craft is once again popular in architectural discourse. However, a cursory look at the different contexts craft comes up in in the current architectural literature reveals opposing intentions. For instance, the quote from Renzo Piano from the start of this chapter is seen to be used in completely different contexts: one author, who uses this quote from Piano in two different articles, promotes unilateral control over the project site through the use of information technologies,[114] while the other, deploying a more comprehensive version of the quote, engages it as a means of resistance against the onslaught of technological determinism through establishing a dialogue with the building site.[115]

The omission is telling – especially in light of Kenneth Frampton's use of the quote which includes Piano's ideas on collaboration and teamwork that brackets the shorter quote at the beginning and at the end:

> **"Unless an architect is able to listen to people and understand them, he may simply become someone who creates architecture for his own fame and self-glorification, instead of doing the real work he has to do...** An architect must be a craftsman. Of course any tools will do. These days, the tools might include a computer, an experimental model, and mathematics. However, it is still craftsmanship – the work of someone who does not separate the work of the mind from the work of the hand. It involves a circular process that draws you from an idea to a drawing, from drawing to an experiment, from an experiment to a construction and from construction back to an idea **again. For me this cycle is fundamental to creative work. Unfortunately many have come to accept these steps as independent.... Teamwork is essential if creative projects are to come about. Teamwork requires an ability to listen and engage in a dialogue.**"[116] (additional contents of the longer quote indicated in bold)

Kolarevic, in choosing to quote Piano without his comments on the importance of teamwork and dialogue reveals how it is possible to adopt a more deterministic stance on craft: one that seems to equate craft with the manipulation of tools in order to *control* an iterative design process that is based on an abstract idea. Although this standpoint acknowledges that feedback from the construction site is important for an informed design process, the omission of listening and dialogue as essential components of creative work is indicative of an attitude that privileges the abstract idea rather than the specific context, a point of view which Frampton's engagement with the term counters.

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114. Branko Kolarevic, "The (Risky) Craft of Digital Making," in *Manufacturing Material Effects: Rethinking Design and Making in Architecture*, eds. Branko Kolarevic and Kevin Klinger (London: Routledge, 2008), 120; and Branko Kolarevic, "Between Conception and Production," *in Building (in) the Future: Recasting Labor in Architecture*, eds. Peggy Deamer and Phillip G. Bernstein (New York: Princeton Architectural Press, 2010), 67.
115. Kenneth Frampton, "The Owl of Minerva: An Epilogue" in *Studies of Tectonic Culture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture* (Cambridge, Massachusetts: The MIT Press, 1995), 383.
116. Ibid.

In preparing to establish a framework for the present study, I compare the notion of craft in pre-modern and modern contexts in order investigate how its implications have changed. Do we still refer to the same notion? Those changes might in fact be indicative of a greater transformation that affects the approach to knowledge in architectural practice and design. In order to understand an approach that is based on the concept of an emergent collective intelligence that feeds from the interaction between human and non-human actors in design as explained in the previous chapter, I survey sources from seemingly disparate areas like craft theory, vernacular architecture, studies concerning architect-builder relationships and the culture of tectonics, mainly because it incorporates a reading of architectural design that considers materials, construction techniques and ethnography.

Since the 1970s, extensive theoretical import from philosophy, linguistics and cultural studies has shaped the prominent architectural discourse, shifting the focus away from "the architect as the master builder" tradition where craft and construction were the guiding principles.[117] Contemporary architectural practice, however, seems to be experiencing a backlash against this tendency, undergoing a substantial paradigm shift in effect since the early 90s, wherein architectural discourse is now dominated instead by accounts of techniques and procedures of production, not unlike the manifestoes from early modernism.[118] Nevertheless, there is a significant difference between the technological evangelism of the early modernist manifestoes and current architectural discourse: While the former conceived of a universal architecture ideal being achieved by modern technological means, the engagement of technology by the latter is seemingly devoid, by and large, of any ethical considerations.

This research is based on two main bodies of knowledge – architectural history and theory regarding the ontological aspects of building techniques and technologies; and the highly heterogeneous field of craft theory. Standpoints concerning the possibilities and potential of the mutual interaction between design and making, that is, the ways in which actual building practice feeds back into the generation of design knowledge are reviewed under four rubrics across these two domains:

117. K. Michael Hays, ed., *Oppositions Reader*: Selected Readings from A Journal for Ideas and Criticism in Architecture 1973-1984 (New York: Princeton Architectural Press, 1998).
118. Among many possible others see: Sigfried Giedion, *Mechanization Takes Command* (); and Sigfried Giedion, *Building in France: Building in Iron, Building in Ferroconcrete*, trans. J. Duncan Berry (Santa Monica, CA: The Getty Center for the Humanities, 1995).

Subsection 2.1, "Architecture and Craft: An Overview of Associations," focuses on the changing attitudes towards the inherent division of labor in the creation of material artefacts. In the context of architecture, even though the separation of architecture and engineering has come under close scrutiny and there are significant efforts to provide a reciprocal interaction between these two professions, the separation between designers and builders has been more final due to the common understanding of the two parties as non-equal partners.

Subsection 2.2, "From Master Builder to Architect: A Genealogy of Roles," delineates different roles within a historical continuum associated with building practitioners starting from the role of the master builder to various roles played by contemporary architects, along with the different design processes implied by the assumption of these roles. The discourse around identities such as the craftsman, the architect, or the master builder determines the possibilities of reciprocal interaction between designing and making. It is important to gain an understanding of the definition of roles, especially within a historical perspective, as they are vital in shaping attitudes towards different actors in the building world and thus affect the generation and handing down of knowledge.

Subsection 2.3, "From Stereotomy to File-to-Factory: Engaging with the Construction Site," discusses examples of different modes of engaging with the construction site. Starting with the historical practice of stereotomy, architects' attempts to get involved with the craft aspect of building practice by means of abstract systems is contextualized against alternative examples from more recent building practice. In a critique of the search of unilateralcontrol over the construction site, these alternatives point to the possibility of a context-sensitive and situated practice that builds upon an economy of means.

Finally, subsection 2.4, "Situated Craft: Learning from the Vernacular," portrays making as a natural action in harmony with the environment and proposes the *vernacular* as a structural model for making within an economy of means. In architecture, this approach is linked to discussions ranging from Frampton's critical regionalism and Rudofsky's architecture without architects to historical accounts of pre-scientific building production. The consideration of crafts knowledge as an asset and a vital part of a culture's intangible heritage also relates to this naturalistic understanding where indigenous skills, available materials and unmediated relations to site are considered to nurture a sustainable evolution of artefacts.

2.1 Architecture and Craft: An Overview of Associations

In French, the words for art (*l'art*) and craft (*l'artisanat*) both share a common root in Latin: *ars*; the latter appearing at the end of the XIXth century.[119] In its origin, the term *l'art* encompasses all manual activities that are not related to agriculture – in the beginning there was no distinction between the artisan and the artist, and the mechanical and liberal arts were all classified under the same terminology in the XVIth century.[120] In the southern European countries the origin of these two terms are usually identical and comes from the Latin root *ars*: *l'arte* and *l'artigianato* in Italian; *il arte* and *il artesanado* in Spanish; *arte* and *artesanato* in Portuguese, and so on. However, in the northern European countries the etymologies become slightly more diverse, with the accent on the handwork: *Kunst* and *Handwerk* in German, and *Art* and *Handicraft* in English.

More recent implications of craft in architectural literature include standpoints ranging from a nostalgic longing for the dominant mode of making buildings in the archetypal version of the discipline to pejorative accounts of craft as a regressive force. Art historian Paul Greenhalgh[121] traces the etymology of craft in order to reveal the impact of an inherent knowledge hierarchy on its common usage. He argues that while craft as a term remains ambiguous, once acquiring a characteristic, it holds on to that connotation. He then points to "the ideological and intellectual underpinnings of craft constituency" as having distinct threads, characterized by its relation to topics such as decorative art; the vernacular, and politics of work, which have only recently intertwined:

> "It appears a matter of astonishment that, while the Professors of Literature have monthly increased their intellectual treasures, the Architects, Surveyors, Carpenters, and Masons, have been unnoticed, and passed by as unworthy of the instruction or assistance of those who are eminent in their respective professions."[122]

This classification of the underpinnings of craft is also relevant to the status of crafts within the current architectural discourse. Different critics and historians like Andrew Saint, Edward Lucie-Smith, and Brian Hanson provide commentaries on why the status of craft is of importance and how it may affect possible strategies: communication is supposed to occur between equals, and the degradation of one sphere decidedly severs the possibility of any exchange or collaboration that is *reciprocal*.

119. www.universalis.fr
120. Ibid.
121. Paul Greenhalgh, "The history of craft," in *The Culture of Craft*, ed. Peter Dormer (Manchester: Manchester University Press, 1997), 23.
122. Ibid., 27.

As for craft's relationship to the vernacular, Greenhalgh indicates the interest in this aspect started at the moment of its disappearance:

> "The vernacular was noticed only when other forms of living began to destroy it. The beginnings of vernacularism as a cultural phenomenon can be clearly identified in the writings of the Gothic revivalists in the early nineteenth century, as urbanism an industry took their inexorable toll on older forms of life. Its real significance in the present context dates from the last quarter of the century. It was of great importance to William Morris and the founders of the Arts and Crafts movement. The rural and handmade aspects of craft production arose at least partly as a result of the desire to return to the vernacular world."[123]

In the mainstream literature the Gothic Revivalists and the Arts and Crafts Movement are seen as skeptics and opponents in this professionalization process, and as advocates of a more positive and symbiotic relationship between architects and builders. Ruskin is usually presented as the pivotal theorist of the resistance to professionalization.[124]

Within the domain of architecture, any discussion of craft is closely affiliated with the legacy of the British Arts and Crafts, one of the most important proponents of which is William Morris:

> "Now if by any possibility the architects could get back the masons and workmen, and what I distinctly call the old scientific method of building walls and surfaces, the really reasonable and scientific method, architecture would to a great extent be on its legs again, and we need not trouble ourselves much about the battle of the styles, if buildings were built in that living manner from beginning to end; out of that the style would arise."[125]

Dissatisfied with the social impact of industrialization in the nineteenth century Britain, both Morris and Ruskin strived to re-connect with a more primordial mode of making in relation to architecture, and in general. In tune with their interest in finding meaning for one's own life through engaged work, they looked for inspiration and solace in nature, opposing the alienation caused by industrial production. According to Morris, what set craft apart from industry was its collective aspect as a shared experience.[126] As much as the results of this movement produced some of the most exquisitely crafted works of design, its utopian attitude towards the changing forms of production left a legacy of craft's association with "ineffectual utopians or hopeless Romantics, vainly attempting to turn back the hands of time."[127]

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123. Ibid., 31.
124. Peter C. Grosvenor, "Review of Architects and the "Building World" from Chambers to Ruskin: Constructing Authority." *Victorian Periodicals Review* 38, no. 1 (Spring 2005): 110-112.
125. William Morris, "The Influence of Building Materials in Architecture," *Marxist Internet Archive* (1891), http://www.marxists.org/archive/morris/works/1891/building.htm
126. Cardoso, "Craft versus Design," 329.
127. Ibid., 321.

In *The Culture of Craft*, art and design critic Peter Dormer discusses the Bauhaus, and the debates that ensued in relation to craft instruction. According to Dormer, shortly after its establishment craft became “a *salon de refuse* of low status.”[128] While its relevance in the context of practice is arguable, the impact of Bauhaus nonetheless persists in architectural education, the value of its basic design course enabling students to be introduced to notions such as form finding, material performance and embodied learning.[129]

In the phenomenological criticism of ocularcentric culture, craft is seen as a mechanism of resistance advocating for specificity and uniqueness. An example of this standpoint is observed in Frampton's understanding of craft and how he utilizes it in order to make his point in the *Studies in Tectonic Culture*: In this discussion that focuses on construction as a basic human activity, a line of resistance is defined starting with the act of construction that depends on an economy of means.

As I explained at the start of this chapter, craft often pops up as a catchphrase within accounts of contemporary practice based on the deterministic use of information technologies.[130] While some accounts are well rounded in terms of acknowledging the complexity of the concept,[131] other narratives of contemporary practice with hagiographic accounts of new production technologies[132] fail to go beyond using the term to loosely refer to extended control over production details in order to reclaim the lost authority of the architect over the production process. In the following section, I will argue that this simplistic use of craft as a catchphrase stems from the myth of the master builder figure within architectural discourse.

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128. Peter Dormer, introduction to *The Culture of Craft*, ed. Peter Dormer (Manchester: Manchester University Press, 1997), 4.
129. Adamson, *Thinking through Craft*, 83-84.
130. Branko Kolarevic, ed., *Architecture in the Digital Age: Design and Manufacturing* (New York: Spon Press, 2003).
131. Peggy Deamer and Phillip G. Bernstein, eds., *Building (in) the Future: Recasting Labor in Architecture* (New York: Princeton Architectural Press, 2010).
132. Branko Kolarevic and Kevin Klinger, eds., *Manufacturing Material Effects: Rethinking Design and Making in Architecture* (London: Routledge, 2008).

2.2 From Master Builder to Architect: A Genealogy of Roles

Figure 8. Statue of Filippo Brunelleschi looking at his dome, Florence.[133]

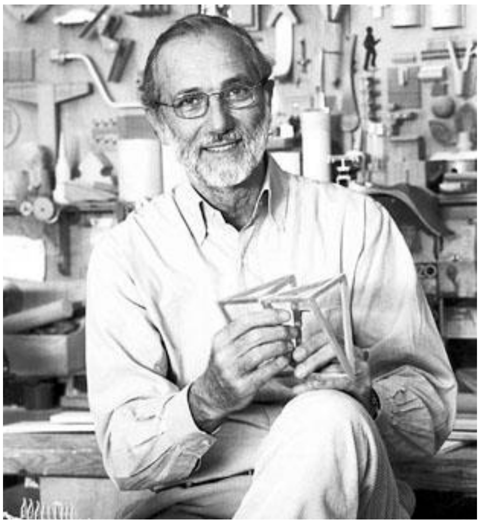

Figure 9. Renzo Piano in his workshop.[134]

> "The names of the "great master builders" of the past centuries may be known, although they are rarely the inventors of forms, functions and techniques which they used. The "great master builders" are almost invariably arrangers who produce something new, something never seen before, from innumerable known details. This kind of arranging requires talent, ideas, knowledge and, not least, methods which facilitate the arranging and make it effective. These methods or concepts are provided by theory and the art of design."[135]

This section focuses on the "master builder" myth and investigates its historical background in order to understand its current relevance and impact on architectural theory and practice.

Assuming roles is an often neglected part of professional activity. This appears to be even more so in design practice, where technical requirements and problem solving skills are at the forefront when considering the start of any design project. In architectural practice, the professional roles assumed by the practitioners are more often than not tacit, apart from the very visible distinctions between academics and practitioners, or say between the so-called visionaries and architects in the "design-build" sector.

In its current use of the term, architect encompasses everything from an architecture school graduate, to a registered member of the chamber of architects of a region, to the occasional unschooled architects who gain their architectural license

133. Source: *Encyclopædia Britannica Online*, s.v. "Pampaloni, Luigi: Statue of Brunelleschi, 1830."
134. Source: Photo by Gianni Berengo Gardin, © Renzo Piano Building Workshop, in *Museo Torino*, http://www.museotorino.it/view/s/d84dd60df96940139714 7764f133a145.
135. Frei Otto, *IL 37 Ancient Architects - What could the ancient master builders have invented: A Contribution to the History of Inventing Structures on the Road to Architecture* (Stuttgart: Karl Kramer Verlag, 1994), 141.

after a long period of apprenticeship. To complicate things even further, the "role" of the architect is far from being clear in terms of our professional identity. In *The Image of the Architect*, Andrew Saint provides a historical overview of the different attitudes associated with the status of an architect, and provides hints as to how these different roles and standpoints influence design knowledge.

This section also features definitions of “normal” practice and innovative practice, a distinction that came up in most of the architect interviews.[136] Architect respondents referred to active engagement with constructional issues as an important factor of innovation, however, engagement with the construction site is not the sole determinant of an innovative practice, with design-build offices pointed out as prime examples of “normal” practice in architecture.

Toker points to the paucity of research on the middle step between design and construction of Gothic architecture, which focuses on “how Gothic architects communicated their designs to the cathedral builders.”[137] He notes, however, that the term “Gothic architect” is inaccurate, as the medieval documents very rarely use the term; and instead mostly utilise “master” for the professional in charge of building construction. Toker refers to the specificity of current building documents, and notes that it is this very specificity that differentiates the contemporary architects from their Gothic counterparts: the documents contemporary architects produce are so specific that they do not need to be there in person to direct the building process. Even though Toker’s point is valid for most of contemporary architectural practice, exceptions matter in the case of *innovative* practices. Therefore the notion of specificity will be discussed in later chapters in order to understand the importance of exceptions to this argument.

> “It remains unclear exactly how a Gothic architect ran a building project. The term “Gothic architect” is itself both inaccurate and prejudicial. The usual medieval term for a professional in charge of building was “master” (*magister*, *maître*, *Baumeister*, *maestro*), and only rarely “architect”. Gothic masters functioned as both architects and builders. Still, they were not architects in the modern sense because their professionalism consisted in being able to both design and construct, while the professionalism of contemporary architects consists in their ability to draw up buildings with such specificity that they need *not* personally direct their construction.”[138]

Toker points to the significance of the distinctions among master, architect and builder for understanding the creative process behind Gothic buildings. He refers to the confusion concerning Villard de Honnecourt as an example, who, until

136. Section II features excerpts from architect respondents on this distinction in Chapter 5 *The Office*.
137. Franklin B. Toker, “Gothic Architecture by Remote Control: An Illustrated Building Contract of 1340,” *The Art Bulletin* 67, No.1 (1985): 67.
138. Ibid.

the nineteenth century, was recognised as the most famous Gothic architect, even though more current research portrays him as “a master mason, a carver, a metalworker curious about building, an administrator and even as a cleric dabbling in architecture.”[139]

In *Architects and the "Building World" from Chambers to Ruskin: Constructing Authority*, architectural historian Brian Hanson posits a basic dichotomy in Victorian thinking on the role of the architect:

> “...Only in theory was the architect able to indulge in a sense of being “above” building. In their published statements, Renaissance architects seemed, on the whole, to agree with the classical view that finished architectural form reflected the underlying, Platonic, truth of the world better than the crafts of the *banausoi*, who the Ancients had deemed undeserving of a political life.[17] In theory, then, if not in practice, the contribution of the artisan to a work of architecture was rendered virtually invisible.”[140]

The separation of the body and mind and the accepted dominance on mind over body pervades the theoretical scene since the time of Plato. However, it is relevant to point out certain historical points of inflection, where a purely visual medium like perspective drawing supersedes other means of engagement with the act of construction, instigating a further separation of mind and body in a designer’s identity. In *The Architect: Chapters in the History of the Profession*, architectural historian Spiro Kostof points to the re-emergence of Vitruvius’ treatise on architecture in the Renaissance period as such a point of inflection:

> “Architecture to Vitruvius was a “science”. Or rather, he was at some pains to explain that an architect had to have both theory and praxis. [...]Only the fully trained man, who understands what he wants to do and at the same time knows how to do it, will carry out his plans properly. This means that anybody embarking on the career of architect must be something of a scholar before he can design, let alone execute a building. Such views were well received in an age when new aesthetic ideals increasingly required from artists a certain amount of theoretical knowledge, say of anatomy, perspective or proportion.”[141]

During this period, the status of models as design tools remains illustrative – from the few remaining examples, it seems that they were only relevant as representational entities, valued for their symbolism and immediate presence. Since *De Re Aedificatoria*, Alberti’s famous treatise on architecture, the use of models as the embodiment of a pre-existing design idea remained common practice: surveys of such models from the Renaissance until the end of the nineteenth century prove

139. Ibid.
140. Brian Hanson, *Architects and the "Building World" from Chambers to Ruskin: Constructing Authority*, (Cambridge: Cambridge University Press, 2003), 67.
141. Spiro Kostof. “The Emergence of the Italian Architect,”in *The Architect: Chapters in the History of a Profession*, (Oxford: Oxford University Press, 1977).

their continued use as such.[142] In the present context, the domain of design models maintains interesting links with the practice of architecture: once architects start to engage in model making as a way of furthering design ideas, they seem to get closer to the domain of the body, and incorporate the haptic dimension in their designs.

> "Templates, either drawn from parchment or carved from wood, were used as guides for dressing the stone. But because of the complexity of Filippo's design, the stonemasons had difficulty understanding how exactly the stones were to be cut and then fitted together. The enterprising capomaestro therefore made other, less conventional models for them to follow. A number of these were made from wax and clay, and some he even carved from rape grandi, large turnips that the Florentines ate in winter."[143]

Ross's account of the extent of construction planning and design carried out by Brunelleschi continues with his design for a huge crane to lift the stones, unprecedented in a mechanical and technical sense, and other inventions which made the innovative shape and the large scale of the dome possible.

In *Building Construction before Mechanization*, architectural historian John Fitchen refers to the role of the contemporary contractor in order to comment on the nature of builders' involvement in past construction. As opposed to building construction before mechanization, contemporary architects generally define *what* is to be done, however, according to Fitchen, the execution of the work, the *how*, is mainly left to the discretion of the building team, which is reflected in the final cost.[144]

> "No medieval construction manuals exist on how to proceed with the building of a church, though some deal with equipment and template design. No guidelines were issued by the episcopate. Each parish was on its own. Clergymen with no experience had to plan for the future on the same basis as cathedral chapters. We are so accustomed to the widespread sharing of the knowledge on contracts, on the avoidance of pitfalls in building and on their financing that it is hard to conceive a time when this was not so. Around 1200 many communities were starting some of the largest projects they were ever to undertake, without any formalized way to share their experiences or caution against mistakes. Stories were doubtless spread about, and clergymen, like their masons, travelled to see how other communities solved their problems. Nevertheless, the variety of constructional strategies suggests that paucity of information stimulated much of the creative thinking which led to some of the most unusual solutions – and complaints." [145]

It is revealing to compare and contrast this argument with the current obsession about uninterrupted information flow – is architecture also plagued by the ills of information society where uninterrupted and vast amounts of data

142. Matthew D. Mindrup, "Assembling the Ineffable in Kurt Schwitters' Architectural Models" (PhD diss., Virginia Polytechnic Institute and State University, 2008)
143. Ross King, "The chain of stone," in *Brunelleschi's Dome: The Story of the Great Cathedral in Florence* (London: Chatto & Windus, 2000), 72.
144. John Fitchen, "The Role of the Builder," in *Building Construction Before Mechanization* (Cambridge, Massachusetts: The MIT Press, 1989), 10.
145. John James, *The Template-Makers of the Paris Basin* (Sydney: West Grinstead Publishing, 1989), 1.

sometimes work in a counterproductive way, hindering creativity in the early design stages? Speculation on the possible implications of the creative use of ambiguity and paucity of information should be made in order to answer this question with some degree of certitude.

In *The template-makers of the Paris Basin*, architect-builder[146] John James explains the use of templates and their vital importance in the construction of the cathedrals. According to James, templates were the basic element of the medieval system of transmitting information from management to workers:

> "In all ways these men demand our respect – for their organizational skills, their ability to cut and place intractable materials, and for the imagination shown in solving problems that we too would find difficult. They accepted - and indeed made a virtue of the fact – that a building was more a process than a project. Construction was a natural growth which might take more than a generation to unfold, an accumulation of historic events in stone that, like a living organism, evolved towards a common image of the Heavenly City, while at the same time reflecting something of each man's personal vision."[147]

James continues his account of medieval practice by asserting that "disunity was universal, and not offensive"; "junctions were an opportunity to modify [where] every incoming master was offered the opportunity to alter the design." All of these observations somewhat challenge our preconceptions about the mythical figure of the master builder, and put the once enigmatic nature of the Gothic into a more understandable perspective.

The feats of construction from the Gothic period have interested designers, historians and epistemologists alike. In a historical analysis of Gothic stone structures, civil engineer Jacques Heyman introduces his point of interest not as the visual aspect of the maintenance, but the actual structural behaviour of the so called stone skeleton. Beyond a technical analysis of historical masonry structures, Heyman's research provides vital clues on the nature of work conducted by the medieval architects, who were both architect and engineer.[148]

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146. John James emphatically refers to himself as an «architect-builder» rather than an architectural historian: «Between 1969 and 1977 I studied the history of the cathedral of Chartres, not as an architectural historian, but as an architect-builder, when I created the techniques known as Toichology for extracting the construction history from the stones themselves.»
John James, «Life Story,» Medieval Architecture, accessed June 3, 2012,
http://www.johnjames.com.au/johnjames-bio.shtml
147. James, *The Template-Makers of the Paris Basin*, 1.
148. "A byproduct of the structural examination of masonry is the light thrown on the activities of medieval architects. A Gothic cathedral was designed by a man who was both architect and engineer – or, of course, by a succession of such men, if the building campaigns spread over decades. The 'master of the work' had survived the long training of apprentice to journeyman to the career grade of master, and had been one of those few outstanding masters who were put to school again in the design office before finally achieving control of a major work. This educational path contrasts strongly with that of modern Western European practice, which is based on the Renaissance concept of the 'gentleman' architect, for

Some roles remained constrained to specific building cultures, influencing design thinking and the ways of executing design intentions, even if the existence of these roles are not immediately visible to people outside of that specific building tradition. One such role was that of the *appareilleur*[149] – roughly translated to English as a "technical architect." A role found mainly in Latin European building traditions, with detailed descriptions most notably appearing in French architectural literature from the 17th and 18th centuries,[150] the *appareilleur* was responsible for resolving the translation process from the abstract project to its realization on the building site. According to Viollet-le-Duc, medieval culture of construction is impoverished at the same time as the culture of the *chantier*[151] becomes irrelevant for the new role of the architect as a gentleman in operation since the Renaissance.[152]

The institution of the role of the *appareilleur*, as a "second-in-command," eventually removed the requirement of the constant on-site presence for the chief architect, making it possible to work on multiple projects at the same time.[153] In *Why Architects Draw*, anthropologist Edward Robbins points to the development of scale drawings and written contracts as "instruments through which the architects could frame a new relation to their projects."[154]

> "Since the inception of Western architecture in classical Greece, the architect has not "made" buildings; rather, he or she has made the mediating artifacts that make *significant* buildings possible. These artifacts - from words, to many kinds of inscriptions and drawings, to full scale mock-ups - and their relations to buildings, however, have not remained constant throughout the history. As late as the Renaissance, for example, the only drawings truly "indispensable" for building (from a technological standpoint) were

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whom considerations of history and aesthetics are divorced to some extent from those of engineering structure. If the building is complex, then the architect must work hand in hand with a technical adviser."
Jacques Heyman, *The Stone Skeleton: Structural Engineering of Masonry Architecture*

149. "APPAREILLEUR, s. m. (Architect.) est le principal ouvrier chargé de l'appareil des pierres pour la construction d'un bâtiment ; c'est lui qui trace les épures par paneaux ou par écarissement, qui préside à la pose, au racordement, &c. Il seroit nécessaire que ces sortes d'ouvriers sûssent dessiner l'Architecture, cette science leur apprendroit l'art de profiler, & de former des courbes élégantes, gracieuses, & sans jarrets ; il seroit aussi très-important qu'ils fussent mathématiciens, afin de pouvoir se rendre compte de la poussée des voûtes, du poids, de la charge, & du fruit qu'il convient de donner au mur, selon la diversité des occasions qu'ils ont d'être employés dans les bâtimens ; mais la plûpart de ceux qui se donnent pour tels, n'ont que le métier de leur art, malgré les cours publics qui leur sont offerts à Paris pour s'instruire."
Diderot and D'Alembert, *Encyclopédie*, , s.v. "appareilleur,".543.

150. One of the most colourful personalities from that period, architect and restorator sui generis, Viollet-le-Duc frequently refers to the role of the appareilleur in his writing.

151. French term for the construction site.

152. Eugène Emmanuel Viollet-le-Duc, *Entretiens sur l'Architecture* (Paris: Morel, 1863), 13; quoted in Anne Coste, *L'Architecture Gothique: Lectures et interprétations d'une modèle Gothique* (Paris: Centre d'études foréziennes, 1997), 81.

153. Robbins, *Why Architects Draw*, 15.

154. Ibid.

modani or template drawings, though these were considered important enough by their authors to be carefully protected from unscrupulous copying."[155]

Taking these accounts into consideration, I postulate that modes of interaction with the construction site act as a major factor in the evolution of design knowledge.

2.3 From Stereotomy to File-to-Factory: Engaging with the Construction Site

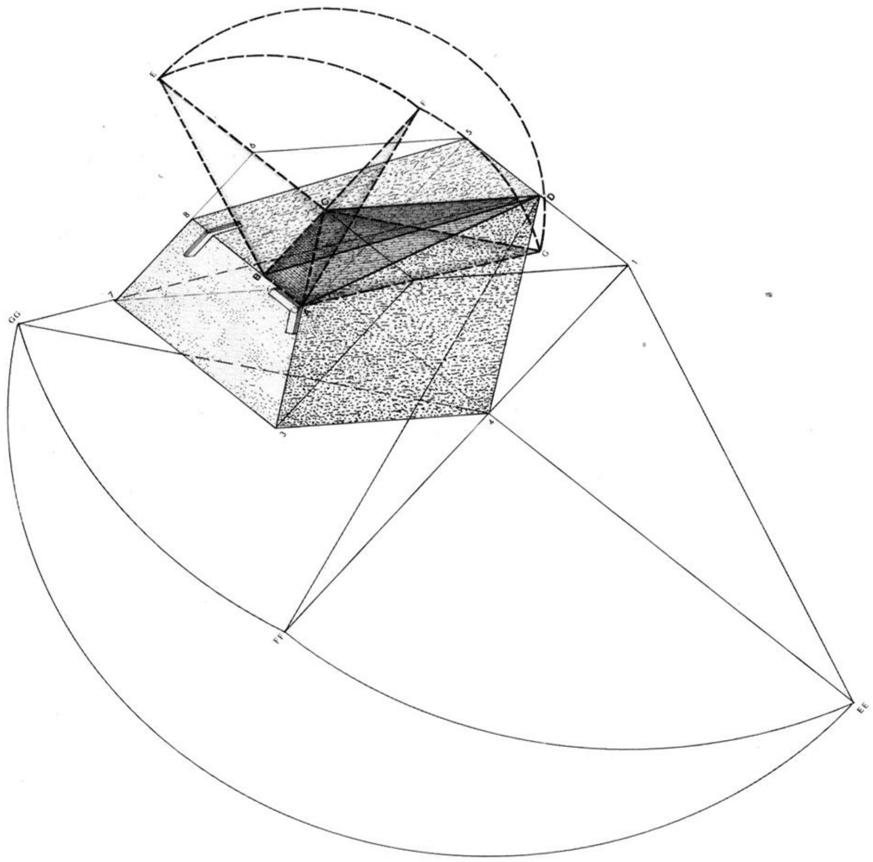

Figure 10. Diagram of the first 7 of 11 successive operations in Girard Desargues's universal method for stonecutting, drawn by Robin Evans.[156]

This section starts with a brief anecdote about a failed collaboration between architects and stonemasons. Stereotomy, a practice dependent on projective geometry for the cutting of solids, was an area of research for architects who sought to have a hand in the process of construction during the sixteenth and seventeenth centuries. While practising stonemasons had their own way of producing templates to cut complex shapes from stones in order to build "naked"

155. Alberto Pérez-Gómez and Louise Pelletier, "Translation vs. Transcription" in *Architectural Representation and the Perspective Hinge*, (Cambridge, Mass.: The MIT Press, 1997), 7.
156. Source: Image from Evans, *The Projective Cast*, 202.

stone structures, architects were dependent on the mason's understanding of structures and construction to realise their ideas.

In the eighteenth century, the French architect Desargues proposed a "universal theory" for stonecutting that "reduced the art of stonecutting to a set of methodical and universal principles":

> "Desargues thought that the architect should provide the craftsmen with precise stereotomic tracings to cut every piece of stone, just as he provided plans, sections, elevations. Architects should never allow the masons to invent these tracings since they had nothing more to go on than their own experience."[157]

Desargues' attempt to streamline the work of stonemasons was indicative of the inherent knowledge hierarchy between the domain of theory and practice, and this unfruitful dichotomy continues to this day. Historical accounts indicate that stereotomy and the trait were sporadically utilised in order to produce buildings out of the ordinary, but the fact that this approach was simply too complicated to adopt for stonemasons led to its demise after the 19th century.

Historical research on technical curiosities like stereotomy reveals the complex interaction between architecture, craft, and technology. Robin Evans defined stereotomy as being at the margins of the architectural profession. However, it was of great interest to certain influential theorists and practitioners with an interest in the actual construction of buildings like Viollet-le-Duc and Antoni Gaudí:[158]

> "Stereotomy was at the very edge of architecture. It was also at the edge of mathematical geometry, at the edge of technical drawing, of structural theory, practical masonry and military engineering. [...] It was on the edge of classicism and every other stylistic category – baroque, rococo, neoclassical, Gothic, and even modern. From within each category the art of stonecutting could easily be dismissed, since it had no central importance to any. It flourished only where definitions blurred, where one thing began to glide off into others, where structural theory met technical drawing, where neoclassical blended with rococo, where mathematical geometry came into contact with architectural composition, and so on."[159]

In her book, *L'Architecture Gothique: Lectures et interprétations d'une modèle Gothique*, Anne Coste discusses Viollet-le-Duc's observations on the political tendencies of an age and how they are reflected in architecture. Departing from a quote from *L'entretiens sur l'Architecture*[160] she focuses on his critique of the

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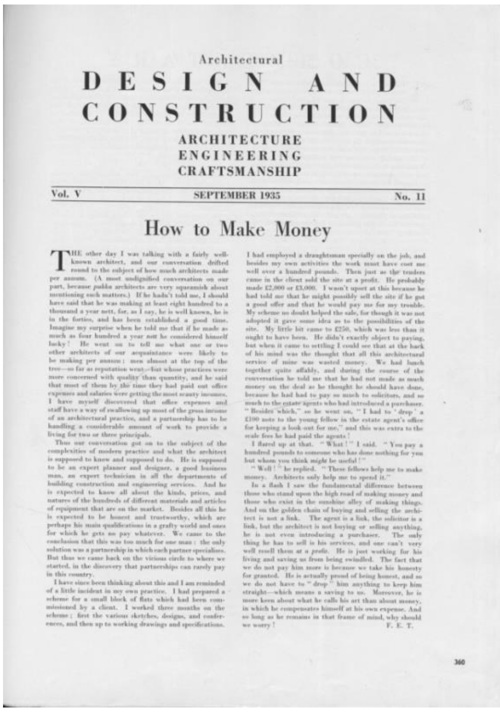
157. Alberto Pérez-Gómez, "Stereotomy," in *Architecture and the Crisis of Modern Science (*Cambridge, (Massachusetts: The MIT Press, 1983), .232.
158. Gaudí's interest in structural design and graphical analysis systems in the design of his structures will be elaborated in Chapter 6.
159. Evans, *The Projective Cast*, 179.
160. "C'est l'époque des reglements; la structure s'en ressent, elle est régulière, suivie, surveillée: le chantier est un gouvernement dans lequel chacun a sa fonction designée.»
Viollet-le-Duc, *Entretiens sur l'Architecture*, 13, quoted in Coste, *L'Architecture Gothique*, 81.

fourteenth century, on the construction site in particular, that had become overly regulated with a strict division of labor. This, according to Coste, led Viollet-le-Duc to believe that architecture lost its spontaneity. However, she also points out that Viollet-le-Duc was aware of the upsides of this situation.[161]

Figure 11. Louis I. Kahn puts his signature on a sample cycloid vault for The Kimbell Art Museum, 1970.[162]



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How to Make Money

THE other day I was talking with a fairly well-known architect, and our conversation drifted round to the subject of how much architects made per annum. (A most undignified conversation on our part, because *pukka* architects are very squeamish about mentioning such matters.) If he hadn't told me, I should have said that he was making at least eight hundred to a thousand a year nett, for, as I say, he is well known, he is in the forties, and has been established a good time. Imagine my surprise when he told me that if he made as much as four hundred a year *nett* he considered himself lucky! He went on to tell me what one or two other architects of our acquaintance were likely to be making per annum: men almost at the top of the tree—so far as reputation went—but whose practices were more concerned with quality than quantity, and he said that most of them by the time they had paid out office expenses and salaries were getting the most scanty incomes. I have myself discovered that office expenses and staff have a way of swallowing up most of the gross income of an architectural practice, and a partnership has to be handling a considerable amount of work to provide a living for two or three principals.

Thus our conversation got on to the subject of the complexities of modern practice and what the architect is supposed to know and supposed to do. He is supposed to be an expert planner and designer, a good business man, an expert technician in all the departments of building construction and engineering services. And he is expected to know all about the kinds, prices, and natures of the hundreds of different materials and articles of equipment that are on the market. Besides all this he is expected to be honest and trustworthy, which are perhaps his main qualifications in a grafty world and ones for which he gets no pay whatever. We came to the conclusion that this was too much for one man: the only solution was a partnership in which each partner specialises. But thus we came back on the vicious circle to where we started, in the discovery that partnerships can rarely pay in this country.

I have since been thinking about this and I am reminded of a little incident in my own practice. I had prepared a scheme for a small block of flats which had been commissioned by a client. I worked three months on the scheme; first the various sketches, designs, and conferences, and then up to working drawings and specifications. I had employed a draughtsman specially on the job, and besides my own activities the work must have cost me well over a hundred pounds. Then just as the tenders came in the client sold the site at a profit. He probably made £2,000 or £3,000. I wasn't upset at this because he had told me that he might possibly sell the site if he got a good offer and that he would pay me for my trouble. My scheme no doubt helped the sale, for though it was not adopted it gave some idea as to the possibilities of the site. My little bit came to £250, which was less than it ought to have been. He didn't exactly object to paying, but when it came to settling I could see that at the back of his mind was the thought that all this architectural service of mine was wasted money. We had lunch together quite affably, and during the course of the conversation he told me that he had not made as much money on the deal as he thought he should have done, because he had had to pay so much to solicitors, and so much to the estate agents who had introduced a purchaser. "Besides which," so he went on, "I had to 'drop' a £100 note to the young fellow in the estate agent's office for keeping a look-out for me," and this was extra to the scale fees he had paid the agents!

I flared up at that. "What!" I said. "You pay a hundred pounds to someone who has done nothing for you but whom you think *might* be useful!"

"Well!" he replied. "These fellows help me to make money. Architects only help me to spend it."

In a flash I saw the fundamental difference between those who stand upon the high road of making money and those who exist in the sunshine alley of making things. And on the golden chain of buying and selling the architect is not a link. The agent is a link, the solicitor is a link, but the architect is not buying or selling anything, he is not even introducing a purchaser. The only thing he has to sell is his services, and one can't very well resell them at *a profit*. He is just working for his living and saving us from being swindled. The fact that we do not pay him more is because we take his honesty for granted. He is actually proud of being honest, and so we do not have to "drop" him anything to keep him straight—which means a saving to us. Moreover, he is more keen about what he calls his art than about money, in which he compensates himself at his own expense. And so long as he remains in that frame of mind, why should we worry!

F. E. T.

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Figure 12. Editorial entitled "How to Make Money" in the September 1935 edition of *Architectural Design and Construction*.

In a more contemporary account of building practice, Gyula Sebestyén approaches the topic of the construction industry and its relation to craft from a somewhat deterministic position:

> "The craft of construction was traditionally based on empirical experience, learning by trial and error, success or failure. Its transformation into a modern industry required the application of science, as well as the inspiration of ingenious architects and engineers who were also great inventors or innovators such as Isambard Kingdom Brunel, Gustave Eiffel, Marie Eugène Freyssinet, Eduardo Torroja and Pier Luigi Nervi. [...] Without research, we would never have been able to construct skyscrapers or long-span bridges, develop plant for heating and air-conditioning or introduce new materials. The results of that research and technology are increasingly transformed into codes, regulations and standards and are finding their way to educational curricula."[163]

161. Ibid.
162. Source: Photo and the quote below from Marshall D. Meyers, "Making the Kimbell: A Brief Memoir," in *Louis I. Kahn: The Construction of the Kimbell Art Museum*, ed. Luca Belinelli (Milano: Skira, 1999), 17-23.
"Kahn worked slowly and continually made revisions to make what he sensed were improvements in the design. This caused delays in the work. [...] Also Kahn always produced his own construction drawings because he believed they were an integral part of the design, the 'how to do it'."
163. Gyula Sebestyén, "The evolution of knowledge," *Construction: Craft to Industry* (London: E & FN Spon, 1998), 73-117.

It is possible to expand the list of "ingenious architects and engineers" Sebestyén proposes by referring to a diverse range of architectural monographs: practitioners like Dieste, and Candela, Kahn, and Piano can be considered as role models, blurring the distinction between architects and engineers through their degree of engagement with the poetics of the construction site. All of these practitioners portray a sensibility towards the various potentials of sites, engage in a dialogue with their various characteristics and are innovators in the sense that they *translate* local building traditions through the use of abstract systems of analysis, crafting indigenous structural solutions and promoting an economy of means.

The list of role models in dealing with the specificities of the construction site can be extended further to include architects commonly referred to as having a "craft sensibility": Scarpa[164] utilizes local crafts traditions and depends on constant on-site interaction with the builders, as well as producing constantly evolving detail drawings; others like Otto research historical precedents while advancing abstract systems of construction. As a unique and somewhat pragmatic role model, Guastavino patents and exports a traditional system of construction, *la bóveda catalana* (the Catalan vault) to another continent, and changes the face of the infrastructure in various North American cities at the end of the nineteenth century.[165] These examples stress the importance of visualization and analytical systems to manipulate data for innovation and recognizing the design potential of the construction site.

In the accounts of practice of these building practitioners, engineers like Eladio Dieste and Rafael Guastavino, 'engineer-architects' simultaneously involved in the artistic and structural aspects of building practice, and architects such as Antoni Gaudí, Frei Otto and Viollet-le-Duc stand out, distinguished by their attitudes towards making, heritage and innovative practice. These characters are agents of innovation; they complement their practice with their research agenda

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164. "I remember he would work all night on moving a pencil line by one millimetre, which could only be ten centimetres on a natural scale. This has nothing to do with architecture - moving a wall by ten centimetres with a line means pretending not to know that the bricklayer will definitely not be so accurate. My father however was always on site with the labourers who worked in a totally different way from those today - present experience does not help in any way in understanding work form the past as it is impossible for us to completely comprehend poetry and works conceived in other centuries... Therefore in order to understand my father's adventures at the Querini, we have to see that he needed to rewrite in a modern idiom everything he had learnt to recognise as appealing, desirable and perfect..." Tobia Scarpa talking about his father in *Hortus Conclusus - Carlo Scarpa e la Querini Stampalia*, directed by Riccardo De Cal, (Venice:Fondazione Querini Stampalia, 2007), DVD.
165. John Ochsendorf, *Guastavino Vaulting: The Art of Structural Tile* (New York: Princeton Architectural Press, 2010).

and do not fall into the trap of regarding the body of architectural knowledge divided by expert categories relegated to their own spheres of influence.

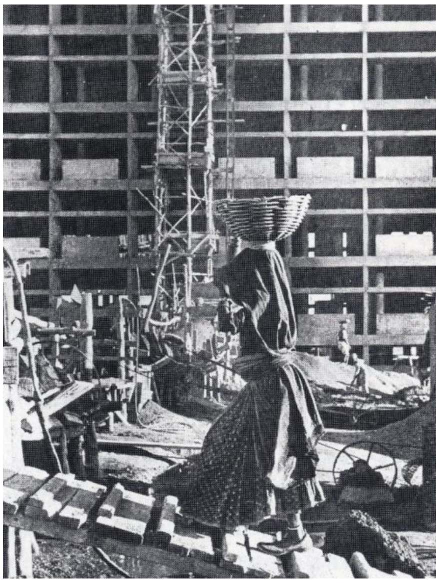

Figure 13. Site construction techniques, Le Corbusier, Chandigarh, 1952-6.[166]

Figure 14. Construction of a brick wall by a robot hand, Tobias Bonwetsch, Daniel Kobel, Fabio Gramazio and Matthias Kohler, Zurich, 2006.[167]

A common thread of all efforts to engage in the realities of the construction site is the theme of collaboration: Renzo Piano as quoted by Frampton in the beginning of this chapter testifies to the importance of teamwork. Modes of engagement with the construction site would be only relevant to a context-sensitive, sustainable and innovative practice if they acknowledge this aspect. Within this framework, an understanding of technology in terms of its contingency is of major importance. In a deterministic understanding of technology, local resources are pushed aside for the sake of following the latest trends in the construction industry. Providing a series of alternative approaches, the examples above illustrate the contingent nature of building knowledge, each relevant to their respective technological and cultural contexts.

In an essay on Eladio Dieste, aptly named "The Ecological Engineer"[168] John Ochsendorf describes Dieste's practice and points to the challenges and significant barriers to innovation he faced in the American construction industry.

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166. Source: Image from David Leatherbarrow, *The Roots of Architectural Invention: Site, Enclosure, Materials* (Cambridge: Cambridge University Press, 1993)
167. Source: Image from Digital Fabrication, last accessed February 2012, http://control.ee.ethz.ch/~digfab/
168. John A. Ochsendorf, "Eladio Dieste as Structural Artist" in Stanford Anderson, *Eladio Dieste: Innovation in Structural Art*, (New York: Princeton Architectural Press, 2004), pp.94-105

These obstacles against using his ingenious structural solution of reinforced brick shells were the result of a lack of practical training in structural masonry, and unsatisfactory codified calculation methods. Last but not least, the most important challenge was the reluctance of large construction companies to encourage "local solutions, which depend[ed] on local expertise:"

> "Structural artists have always seen themselves as public servants, building public works that are both affordable and beautiful, but Dieste took this concept further. For Dieste, a work of technology must answer a series of pointed questions: Does the solution use local resources? Is it just? Is it ecologically sensitive? Dieste built not only elegant structural forms but ones that considered the local community, the environment, and the wider social implications involved in their construction." [169]

As an important role model for engaging with the construction site, Dieste displayed a nuanced understanding of the social structure of the sites in which he practised. Going beyond mere traditionalism, he utilised the indigenous workforce as well as using abstract analysis to optimise ease of construction. His relevance for contemporary building practice stems from his privileging of processes rather than the finished product, a characteristic attitude within an environmental approach to building design.

These examples illustrate the impact of the recognition of the affordances of the construction site on design knowledge: The practitioners who respect artisanal knowledge and are open to the possibilities architectural heritage (both tangible and intangible) display an enriched research agenda that enables a more innovative practice. When the history of architecture is regarded as a collection of styles, these practitioners may remain at the margins of the dominant discourse based on the notion of progress and advancement; however, the results of their research and their creative collaboration with builders leave a legacy that continues the innovation trend in architectural knowledge which has made Gothic cathedrals possible.

I would like to resume this section by going back to a historical account of Gothic builders that analyzes their knowledge making processes in relation to the transformation of their roles and attitudes toward building production:

> "Yet if the social position of builders remained essentially unchanged, the character of their work underwent a rapid development in two important areas: the builders took closer control of the work site by giving artisans more specific instructions for more complicated projects, and they paid closer attention to one another, exchanging information and techniques with remarkable rapidity. In modern terms,

169. Ibid.

> they moved from being contractors to architects, in both their cohesiveness as a group and their desire for technical and stylistic innovation."[170]

Radding and Clark's account of Gothic builders underlines the impact of precedent based learning and skills of observation that develop through direct engagement with building sites as precursors to an innovative building practice. Once the natural working environment of the master builder, the experience of the building site is reduced to infrequent site visits in the contemporary practice of architecture. In comparison, Radding and Clark's overview of building practice reveals the use of the actual site experience as a negotiation platform and as a learning experience:

> "William of Sens brought the monks around to his ideas by taking them through the ruins of the chevet, so they could see for themselves the damage from the fire in detail, and by describing the building he planned – thus revealing a skill at dealing with patrons that architects have needed ever since."[171]

In addition to the use of the site as an observation and negotiation platform, Radding and Clark's account details the production and use of 1:1 scale templates on building floors under construction. Early Gothic builders used tracing floors, "on which master builders sketched profiles at full size"[172] and other convenient surfaces that could be used as templates since the 12th century. In the absence of explicit systems of instruction, the Gothic building site was effectively a cognitive environment where negotiations with patrons took place; apprentices and journeymen learned from the failures and successes of their predecessors, and *in situ* drawings and template production in full scale shaped the the building under construction.

This type of building production no longer exits in contemporary practice; especially not in the context of large scale and structurally challenging projects like the former Gothic cathedrals. However, it is still possible to learn from the situated nature of the construction site and its creative affordances by referring to a site under construction of a much different scale: the scale of the vernacular.

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170. Charles M. Radding and William W. Clark, *Medieval Architecture, Medieval Learning: Builders and Masters in the Age of Romanesque and Gothic* (New Haven: Yale University Press, 1992), 96-97.

171. Ibid., 98.

172. Ibid.

2.4 Situated Craft: Learning from the Vernacular

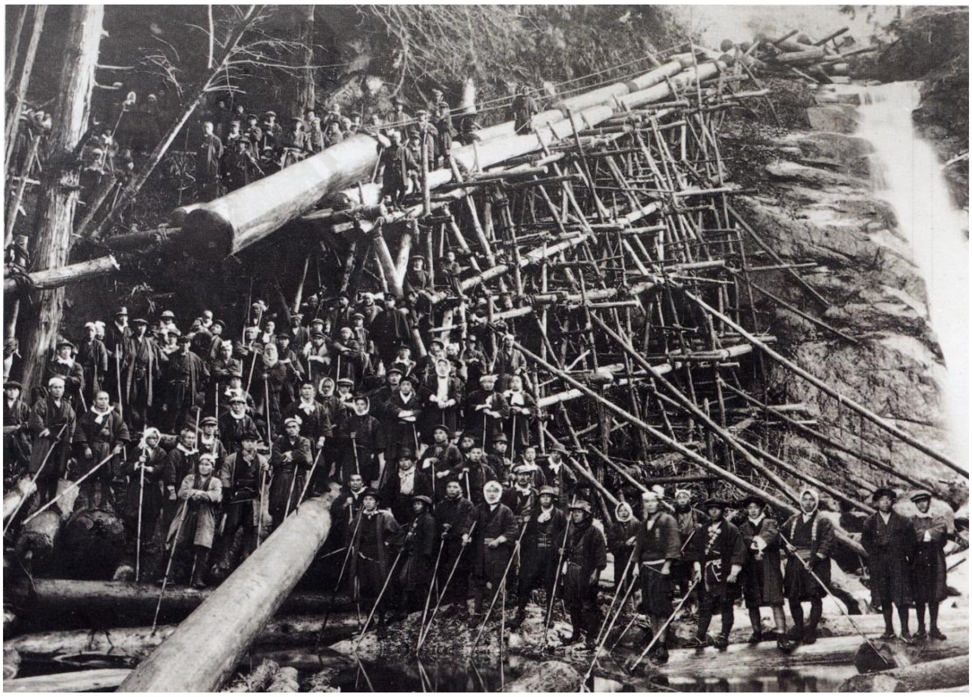

Figure 15. Lumberjacks transporting logs from the inaccessible Kiso mountains for the fifty-seventh renewal of Ise shrine, circa 1909, Ise, Japan.[173]

> "Every site, natural or man-made, is to some degree unique, a connected web of things and activities. That web imposes limitations and offers possibilities. Any plan, however radical, maintains some continuity with the preexisting locale. Understanding a locality demands time and effort. The skilled site planner suffers a constant anxiety about the 'spirit of place.'" [174]

The great Shinto shrine in Mie Prefecture in Japan is rebuilt every twenty years on adjacent sites since the first ceremonial rebuilding in the year 692.[175] The twin sites of the shrine are inherently epistemic environments, where ancient knowledge is transferred from generation to generation by means of a ritualised building process that acknowledges the dimension of time and reveals its ravages on the sacred building standing side by side with its successor, constantly under (re)construction. A way to look at what is happening at Ise is to see it as a form of "reverse engineering:" For the historian researching the stylistic evolution from Romanesque to Gothic, demolition of a building form each period is an invaluable source of information. It is the moment where the knowledge embedded within the

173. Source: Photo from Svend M. Hvass, *Ise: Japan's Ise Shrines, Ancient Yet New* (Copenhagen: Aristo Publishers, 1999), 100.
174. Kevin Lynch and Gary Hack, *Site Planning*, 3rd ed. (Cambridge, Massachusetts: The MIT Press, 1984), 5.
175. Hvass, *Ise*, 9.

structure becomes visible. John Willis Clark, one such historian admits that "the best instructor of all... is a building which is being pulled down".[176]

The site is a continuum in time with knowledge of past generations coded within the artefacts. In that sense, heritage preservation and restoration can be considered as a learning and teaching opportunity even for the non-experts in the field. Along with the figures like Frei Otto discussed earlier in this chapter, Viollet-le-Duc was a major proponent of the positive impact of proper restoration work on the general quality of the built environment, as it provides a necessary training ground for the preservation and development of building skills.[177]

In *Architecture Depends*, architect and critic Jeremy Till points to time as an important aspect of architectural knowledge, and invites designers to reconsider architecture through time rather than through space, by attempting to design through narratives.[178] Time in general and the effects of weathering in particular are hard to incorporate in the initial stages of design thinking via conventional means of representation. Till's call for a more time-conscious practice makes a more sense when I compare the stonemason and architect interviews with respect to each group's awareness of time: as will be seen in the next section, architects seldom refer to the aspect of time, and vital issues like material and structural performance are relegated to the status of technical concerns, leaving the creative inspirations of architectural design somewhat impoverished.

In fact, issues of material and structural performance lie at the core of architectural knowledge. An intimate understanding of how different materials act differently through time makes it possible to design something as important as the joints within a building. Contrary to what most contemporary architectural discourse would lead us to believe, details are not only important from an aesthetics point of view; they are not a luxury, but the determining factors that characterize a built artefact as it unfolds in time. Mostafavi and Leatherbarrow rightly point to the increasing number of building materials and components as the reason why many traditional details which ensured good weathering and climate performance are lost, giving way to the buildings that do not develop with time through weathering, but rather, simply break down:

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176. John Willis Clark, "On the Construction of the Vaults of the Middle Ages," *RIBA Transactions*, 1st series, vol. 1, pt. 2 (1842):3, quoted in Evans, *The Projective Cast*, 225.
177 . Eugène Emmanuel Viollet-le-Duc, *Dictionnaire raisonné de l'architecture française du XIe au XVIe siècle - Tome 8* (Paris: Bance et Morel, 1854-1868), s.v. "Restauration."
178. Jeremy Till, "In Time,"in *Architecture Depends* (Cambridge, Massachusetts: The MIT Press, 2009).

"Architecture made out of a greater number of mass-produced parts also changed the relationship between the architect and the builder by largely reducing the role of the latter's knowledge of traditional ways of building and relying upon construction procedures almost entirely prescribed by the architect. Independent of the architect's instructions for assembly, construction could not proceed. Insufficient instructions by the architect, and poor workmanship by the builder, were among the principal causes of material deterioration in buildings. The subordination of builder to architect in construction inverted their roles. Previously "gentleman architects" had relied upon the builder's knowledge when undertaking building projects. The elimination of the builder's traditional role exacerbated the difficulty of the assembly and of *anticipating the life of construction under the elements*." [179] [italics added]

Material knowledge in relation to time and performance is a vital part of an architect's constructional insight. Within the contemporary environment, it would be unrealistic to expect to develop such expertise in a variety of materials as a design architect, but it is crucial to be aware of the affordances of materials within time, and to consider weathering and long term performance right from the initial stages of design.

Craft knowledge is often associated with the vernacular: In its current use, the term denotes properties of belonging to a particular group or place; being native or idiomatic (in reference to a particular trade or profession). In language, the notion of the vernacular may refer to a dialect, or "everyday language specific to a social group or region."[180] In architecture, it is associated with using local materials and traditional methods of construction, "especially as distinguished from academic or historical architectural styles."[181]

Recognizing the vernacular in its expanded meaning requires observational skills vital to the development of an architect.The ambiguity around his exact role as a building practitioner notwithstanding, Villard de Honnecourt's notebook provides interesting clues that shed light on the habits and interests of 13th century Gothic builders. In his introduction to Honnecourt's notebook, Quicherat, a 19th century French archaeologist, points to the itinerant habits of the builders of that era, portraying Honnecourt as a well travelled person by referring to Honnecourt's note on the eighteenth page of his sketchbook, beginning with the proclamation "J'ai esté en molt de tierres.".[182]

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179. Mohsen Mostafavi and David Leatherbarrow, *On Weathering: The Life of Buildings in Time*, (Cambridge, Mass.: The MIT Press, 1993), 21-23.
180. *The Free Dictionary*, s.v. "vernacular."
181. Ibid.
182. Literally, "I have been in many lands," in 13th century Picardian dialect. Quicherat points to travelling as an essential characteristic of the learned individuals of Honnecourt's time: "De même que tous les hommes de son temps qui savaient quelque chose, notre architecte avait beaucoup voyagé. « *J'ai esté en molt de terres*,» dit-il en un endroit, et à l'appui de son dire, il invoque les monuments de tous pays réunis dans son album."

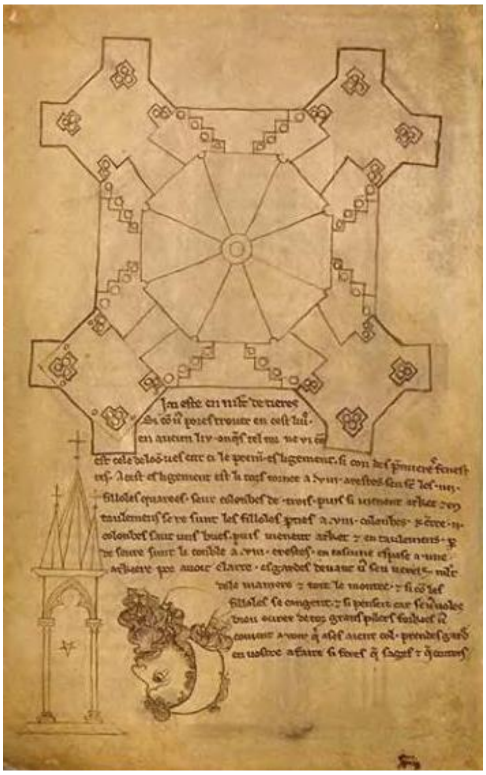

Figure 16. Page 18 from 13th century architect Villard de Honnecourt showing the plan of a tower at Laon Cathedral and detail of a turret.[183]

Figure 17. Sketch of a tile in the Valide Mosque in Istanbul by Le Corbusier, from his travel diary, *Journey to the East*, 1911.[184]

According to Quicherat, being well-travelled is a vital characteristic of a learned individual. He refers to Villard de Honnecourt's notebook when making his point, indicating the analytical drawings and notes on the monuments Honnecourt had visited. This example and others on itinerant builders from different historical periods point to sight seeing (or site seeing to be more in line with the purpose of this research) as an important research strategy for architects. Coming closer to the present day, one of the most famous examples of the impact of travelling on an architect's formation is illustrated by the *carnets*, or travel diaries of Le Corbusier. Initially deriving from the field work, this issue is presented in more detail in Section II.

> "In design, architects are always concerned with bounded settings. Consequently we tend to see the field around them as a background, the darkness needed in theater to show up our performances. Reflection on topography reorients design and thought to the world that is there independent of my knowledge and

Jules Etienne Joseph Quicherat, "Notice sur l'Album de Villard de Honnecourt, architecte du XIIIe siècle," *Révue archaéologique*, tôme VI (1849):65-80.
183. Source: Image from *Les Cathedrales et Villard de Honnecourt*, Analyse de document – Villard de Honnecourt, accessed February 05, 2011, http://classes.bnf.fr/villard/feuillet/index.htm.
184. Source: Image from Le Corbusier, *Journey to the East*, Ivan Žaknić (ed.), (Cambridge, Massachusetts: The MIT Press, 2007), 109.

experience of it, let alone my action within it. This prioritizing of the (undesigned) world, this reaffirmation of the town, no doubt weakens design as originating authorship. Nevertheless, the real prospect for an architecture of our time is still to be found within the horizon of the city, that spatial and material trace of reciprocal interests. The reverse, however, is not true."[185]

The idea of sightseeing and travel as research affords a change of perspective when looking at sites from a design point of view; the necessary precursor to any building to be realized, sites are rendered invisible by their very ubiquity in the architectural design process. In order to be able to learn from the vernacular, sites must be experienced through travel, and through engagement with everyday activities within those sites. This would lead to a reconsideration of the notion of the vernacular by acknowledging sites of different temporal and physical scales. Positing site as one of the main roots of architectural invention, David Leatherbarrow recognizes the creative potential of the site within the larger context of the vernacular: According to Leatherbarrow, "site in relation to the act of building is always a matter of invention," [186] and its reductive understanding as a mere background, or a bounded setting without connections to the larger context would not be able to use this potential.

> "The worst enemy of modern architecture is the idea of space considered solely in terms of its economic and technical exigencies indifferent to the ideas of the site. [...] Through the concept of site and the principle of settlement, the environment becomes *on the contrary* the essence of architectural production."[187]

Stewart Brand writes "the site is eternal" in all caps in *How Buildings Learn*: Natural features, property lines, and topography are constants in an everchanging multilayered physical setting. "...the house comes and goes. The cliff stays."[188] Brand notes. An understanding of the vernacular as the part of an eternal site unfolding in time would provide an alternative perspective on the relevance of situated thinking in architectural design.

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185. David Leatherbarrow, "Sitting in the City, or The Body in the World," in*Body and Building: Essays on the Changing Relation of Body and Architecture*, eds. George Dodds, Robert Tavernor and Joseph Rykwert (Cambridge, Massachusetts: The MIT Press, 2002), 267-287.
186. Suzanne Ewing, "Horizon in the Hamar Museum: an instrument in architecture and a way of looking at site," in *Constructing Place – Mind and Matter*, ed. Sarah Menin (London: Routledge, 2003), 298.
187. Vittorio Gregotti, address to the New York Architectural League, October 1982, quoted inFrampton, introduction to *Studies in Tectonic Culture*, 8.
188. Stewart Brand, "Shearing Layers," in *How Buildings Learn* (New York: Penguin Books, 1995), 12. In one of the very few books that deal with the life of buildings after their realization, Brand defines the site as one of the "shearing layers of change" along with structure, skin, services, space plan and stuff – all of which have different life cycles:
"Site: This is the geographical setting, the urban location, and the legally defined lot, whose boundaries and context outlast generations of ephemeral buildings."

CHAPTER 3. Design of the Study

An overview of theory and literature on the interrelations between architecture and craft points to a lack of empirical studies investigating the epistemological implications of actual building practice. Although current literature provides useful insights for understanding the ecology of design knowledge from a theoretical perspective, there is still the need to explore the specific circumstances of past and present building practices in order to understand how different actors involved in the building process generate, use and transmit knowledge.

In accordance with the methodologies adopted by the growing practice epistemology literature,[189] the empirical work in this thesis is carried out along the lines of a grounded theory approach, based on a comparative study of two groups of building practitioners - traditional stonemasons and contemporary architects from small scale practices. Interviews with the first group, supported by on site observations, were carried out in four cities across Turkey during 2006-2007, while interviews with the second group, conducted mainly during 2008-2009,[190] were carried out with practitioners across six different countries. These interviews were complemented by the case study of an atypical architectural practice, the design office at the *Sagrada Família Basilica* in Barcelona,[191] observed intermittently between 2006 and 2008.

This chapter provides an account of the methods employed in conducting and evaluating the empirical portion of the research, which could potentially allow it to be replicated within a different context. The remainder of the chapter consists of four parts: the theoretical framework, along with an overview of research activities and case selection; data collection; data assemblage; and finally, interpretation, analysis and the presentation of findings.

Bryan Lawson talks about four different ways to "uncover design knowledge."[192] His list includes sitting in solitude and thinking about design processes, a method he rightfully finds solipsistic; observing designers by giving

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189. Joseph A. Raelin, "Toward an Epistemology of Practice," in *Academy of Management Learning and Education* (2007):.497.
190. With the exception of the last interview that was conducted in 2011.
191. This practice was atypical in the sense that it involved a close collaboration between architects and stonemasons, along with many other building professionals, not generally encountered in conventional design practice.
192. Lawson, *What Designers Know*, 3.

them a design problem to solve, as in a laboratory experiment;[193] reading about what they have written on design, which, as Lawson notes, seldom gives a clue about the tacit knowledge used in design; and finally, asking designers how they design. In this research, I mainly utilised this last method, that is, I simply visited stonemasons and architects during a normal day at work[194] to ask them questions about their practice. Since a general inquiry on how they normally design would have expanded our conversation beyond the scope of this research, I made use of semi-guided interviews and focused the questions on specific facets of their practice.[195]

Adopting the grounded theory approach in my thesis, I derived evidence from historical and theoretical accounts of architectural practice as well as on-site interviews with practitioners. The themes delineated in the literature review are utilised as "sensitizing concepts"[196] to guide the research while investigating both primary and secondary sources. In accordance with my definition of design knowledge as an ecology, I point to two niches within this complex environment as the grounding core for the theoretical propositions discussed in the thesis:

The first niche features a group of traditional stonemasons from Turkey who are able to build structures ranging from simple rural houses to complex religious buildings without the help of an architect. This group was primarily selected to investigate the notion of the 'master builder' that frequently appears in current architectural discussions. The group also acts as a contemporary example for pre-scientific building production – these traditional stonemasons who effectively have full control over design and construction can be considered as 'living fossils' in relation to current building practice.

The second niche involves architects from small scale practices with a hands-on approach over the building process from various countries including Turkey, Australia, Spain, and Japan. They are linked to the first group through the extent of their control over the building process, their interest in materials or their

193. Ibid., Lawson indicates that this method was criticized by designers on the basis of the incorrect approximation of their conditions when designing.
194. With a couple of exceptions where I interviewed retired stonemasons, or architects outside of their work environment due to scheduling conflicts.
195. The questions covered issues like the collaborative networks and types of projects in which they have been involved, the process of selecting building materials, the use of tools, and on-site experience - i.e., issues from the realization phase of buildings that might have an impact on design knowledge. For a complete set of questions, see A.3 "Guidelines for Interviews" in the *Appendices*.
196. The term coined by Herbert Blumer in: Herbert Blumer, "What is Wrong with Social Theory". *American Sociological Review* 18 (1954): 3-10.
The use of sensitizing concepts will be explained in detail later in this chapter in the section concerning interview design.

active collaboration with traditional builders via their involvement in heritage projects.

3.1 Selecting Cases

Figure 18. Edward Burtynsky, *Iberia Quarries # 14,* Mármol Rojo Alicante, La Romaneta de Monovar, Alicante, Spain, 2006.[197]

> "According to the 2003 Convention, the intangible cultural heritage (ICH) - or living heritage - is the mainspring of our cultural diversity and its maintenance a guarantee for continuing creativity. The Convention states that the ICH is manifested in the following domains among others:
>
> - Oral traditions and expressions including languages as a vehicle of the intangible cultural heritage;
>
> - Performing arts (such as traditional music, dance and theatre);
>
> - Social practices, rituals and festive events;
>
> - Knowledge and practices concerning nature and the universe;
>
> - Traditional craftsmanship."[198]

Crafts identified with certain minority groups are rapidly becoming displaced or extinct due to socio-political reasons, or due to the changing methods of production. Recognizing the inherent dangers in the homogenization of the culture of production, institutional bodies like UNESCO attempt to safeguard the knowledge traditions from pre-modern modes of making by expanding the definition of heritage to include intangible cultural assets like traditional craftsmanship. These attempts indicate an obvious danger for the sustenance of such domains of knowledge, and even when these are protected under the legislation of heritage councils, the paucity of resources available for investigating their epistemological foundations lead to their dismissal as antiquated folklore, rather than as vital resources that are integral to our knowledge ecology.

The myth of the master builder was a starting point for the research: I set out to find anachronistic examples, "living fossils"[199] who still continued to work in

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197. Source: Photos and collage from Quarries, Edward Burtynsky, accessed September 2006, http://www.edwardburtynsky.com/WORKS/Quarries/Iberia/IBQ_14_A_B_C.html
198. "UNESCO Convention for the Safeguarding of the Intangible Heritage." *UNESCO Portal*, 17 October 2003, accessed April 2006, http://portal.unesco.org/culture/en/ev.php-URL ID=29911&URL DO=DO TOPIC&URL SECTION=201.html

a similar capacity as the much lauded master builders of the past. In accordance with the search for a contemporary analogy for the master builder figure, I decided on traditional stonemasonry as a case for comparison. Selecting stonemasonry as an area for exploration stemmed from a couple of decisive factors: first, as a traditional material still being used in contemporary built environment, stone provides a good example of the change in the way many "traditional" building materials are presently used; and second, there are still practising stonemasons in Turkey who are able to construct relatively complex geometries by using stone structurally, without the technical guidance of an architect. Another reason why I decided to focus on stonemasonry as a case study was because it involves both structural knowledge and knowledge on finishes – thus bringing a multiplicity of factors like the dimension of time and weathering into the discussion.

In fact, the reason to select stonemasons as a group to study was not the interest in stone as a material, but the characteristics of stonemasonry as a whole set of skills that would enable its practitioners to build a building from scratch without the intervention of an architect. Other building crafts, such as carpentry, could be similarly explored; however, it would seem that there are not many living descendants whose global skill set has remained intact. While carpenters are still heavily in demand for a portion of the building trade, due to forced specialisation, their skill set has become more fragmentary. In comparison, the stonemasons, even though there are some practitioners with more specialised skill sets; are more like living fossils in that they still have a whole variety of skills, and are more aware of the overall construction process.

The first set of interviews not only provided insights about the organisational culture, but also unearthed values and beliefs that were indicative of the progressive aspect of craft. Originality was a commonly cherished value, and the interest in new techniques and technologies showed that the group valued innovation. This initial observation helped articulate questions within the architect interviews, especially the group of questions about the on-site activities of the architects.

For my second set of interviews I targeted a more loosely associated group: I wanted to explore a group of architects associated mostly by the scale of their practices and the degree of their direct involvement with the actual process of

199. As my thesis supervisor Professor Mark Burry suggested, half in jest, when I first expressed my intention of interviewing traditional stonemasons during a supervision meeting.

construction. In doing this, I wanted to explore the impact of the size of a practice on the degree of direct involvement with the construction process and the ways in which this involvement is translated into architectural knowledge.

Alongside these two sets of interviews, I observed an atypical architectural practice, the design office of the Sagrada Família Basilica, as an "extreme/ deviant case".[200] Even though the practice circumstances of the design office at the Sagrada Família Basilica are vastly different from conventional architectural practices, it is by this very difference that it provides vital insights concerning the impact of the time, as well as observation and integrated collaboration on the innovative potential of an architectural practice.

Selecting Respondents

After deciding on starting the first group of interviews with stonemasons, I conducted some exploratory informal interviews in Australia and in Turkey, contacting *ISSI* (International Specialised Skills Institute) in Melbourne and *KOREFD* (Conservation and Restoration Firms Association) in Istanbul, and eventually decided to limit the geographical scope of the stonemason interviews to Turkey due to various reasons. One reason was opportunistic: I could have better access to contacts who could direct me to stonemasons with the skill base and body of work to qualify as expert respondents for my research in Turkey. Furthermore, being a native speaker of the language, I would be able to establish better rapport with this group of practitioners, who are usually rather taciturn and reluctant to talk about the specificities of their work. Taking these factors into consideration, I selected stonemasonry and stonemasons-builders in my home country, Turkey as a case study group to set off my research, with the assumption that they still possess a holistic understanding of structure, building and materials.

Given that these assumptions were based on an initial bibliographical survey on the changing definition of the roles of architects and builders, there arose the need for clarification, especially in terms of what I meant by a "holistic

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200. "When the objective is to achieve the greatest possible amount of information on a given problem or phenomenon, a representative case or a random sample may not be the most appropriate strategy. This is because the typical or average case is often not the richest in information. Atypical or extreme cases often reveal more information because they activate more actors and more basic mechanisms in the situations studied."

Bent Flyvbjerg, "Five Misunderstandings about Case-Study Research," *Qualitative Inquiry 12*, no. 2 (2006): 230.

understanding" of building. The criteria I set out to explore was a certain expertise in a structural type, in this case stonemasonry, an ability to oversee/ conduct a construction from start to end without any need of external consultancy, and a working knowledge of constructing templates.

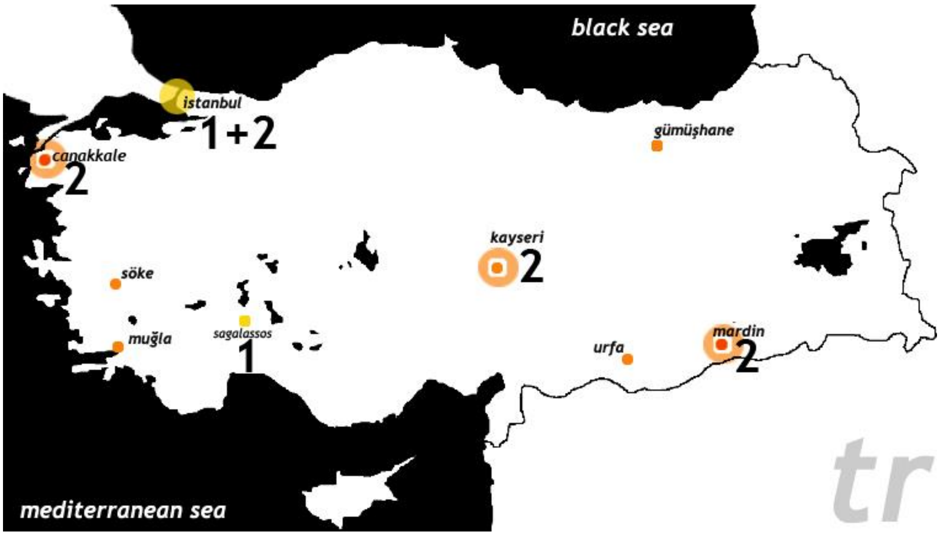

Figure 19. Map of the first set of interviews with traditional stonemasons.[201]

In the first phase of the interviews, I used a type of geographical chain sampling[202] based on the distribution of skills across Turkey. After an initial catalyst interview conducted on site during an archaeological excavation in Sagalassos,[203] and an initial contact with the heritage consultant and architect Burçin Altınsay Özgüner[204] about possible areas, I decided on four cities in Turkey - Istanbul, Çanakkale, Kayseri, and Mardin - where stonemasonry traditions are still alive. These cities, geographically distributed to cover different types of expertise belonging to different stonemasonry traditions, were actively influential in the search for the respondents and in the ways I conducted the stonemason interviews.

This first set of practitioners, hand-picked after a long period of initial interviews with archaeologists, historians of architecture, heritage consultants, conservation architects and government bodies and NGOs related to the conservation of building skills, helped me in formulating the main tenets of my argument on the affordances of making for design knowledge. The sheer number of

201. Source: Diagram by the author.
202. Deborah Cohen, and B enjamin Crabtree, "Snowball or chain sampling", *RWJF - Qualitative Research* (2006), http://www.qualres.org/HomeSnow-3816.html
203. A former Pisidian city in the inner Mediterranean region with stone architecture from Greek and Hellenistic periods. The archaeologists from the excavation team work with traditional stonemasons on the reconstruction of the ruins. For further information on the excavation see: http://www.sagalassos.be/
204. She has later agreed to become one of my architect respondents.

different people I had to talk to in order to reach "traditional" stonemasons that fulfilled my criteria was indicative of the fact that this was a group that was becoming rapidly extinct.

Figure 20. Map of the second set of interviews with practising architects.[205]

In the second phase of the field research where I interviewed architects, I used opportunistic sampling[206] approach as is common in grounded theory. Based on my initial analyses on the stonemason interviews, I was looking for architects from small scale practices, people from non-corporate environments with relatively more control over the entire design process. The interviews probed into how they experience their role as an architect in relation to the building process, and whether their interaction with the builders influenced them in their design phase. In contrast to the first set of interviews which were entirely conducted within a single country, Turkey, architect interviews featured practitioners from four different countries - Turkey, Australia, Spain, and Japan - across three continents.

The architects I invited for the second set of interviews were generally in directorial positions as I wanted to achieve an understanding of the decision making mechanisms involved in the realization phase of the project. These architects were either practitioners with whom I had a previous connection, or they were recommended by initial respondents during the catalyst interviews. I recruited participants with a formal letter of intent inviting them to participate in the research, after which I contacted them by mail and by phone to set an interview date.

In terms of the links between these two groups, some architects were selected on the basis of their practical experience with stonemasons; others were

205. Source: Diagram by the author.
206. Cohen, and Crabtree, "Opportunistic or Emergent Sampling", *RWJF - Qualitative Research* (2006), http://www.qualres.org/HomeSamp-3702.html.

selected on the basis of the practice traditions of their location ‾ like Japan, where there is a strong craft culture; while some others were selected due to their strong opinions about craft and what it might imply for contemporary architectural practice. From an epistemological point of view, this group relates to the group of stonemasons predominantly via the hands-on nature of their practice, with further overlaps and continuities within two groups elucidated in Section II.

To sum up, the second set of interviews is related to the first one in three different ways:

First, the interviews I have conducted in Turkey are related to the stonemason interviews in the sense that I interviewed some of my main contacts who helped me get in touch with the 'traditional' stonemasons in the first place. There were two main groups: heritage specialists, who work very closely with traditional craftsmen and who seem to have a deeper understanding of traditional methods and materials; and "designer" architects, generally without a distinct specialization who might or might not choose to work closely with builders depending on individual projects. They thus provided the missing link that tied my initial set of interviews with the "living fossils" to the present day, by making comparisons possible with the past within a similar location.

Next, the interviews I conducted in Spain were solely related to the specific case of the *Sagrada Família Basilica*, which in itself provides an uninterrupted continuity between traditional making and modern methods. I was able to interview an architect, Antoni Caminal i Homar, who was an example of a specific type of role, that of the *aparejador*[207] or technical architect; and my supervisor Professor Mark Burry, who was responsible for the design (often via reverse engineering of Gaudí's original material), leading the way towards the top end of the technological spectrum with the integration of computational design into the design process.

Finally, the interviews I conducted in Australia cover the architects that utilize the present state of the art computer technology, within a relatively tradition-free environment. During the course of my PhD, I was "embedded" within the Spatial Information Architecture Laboratory[208], which provided me with the unique insight into how young architects, as well as undergraduate and graduate research

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207. Spanish term for *appareilleur*. This notion does not have a satisfactory equivalent in English. It came up during my historical analysis and has been discussed in Chapter 2.
208. For an overview of the research activities conducted at SIAL, see the website hosted by RMIT University at http://www.sial.rmit.edu.au/

students deal with the issue of production with the aid of computer aided modelling and prototyping.

Characteristics of Research Participants

Excluding the short exploratory interviews at the start of my research, I conducted a total number of 23 detailed interviews with 12 stonemasons and 11 architects. My oldest respondent, from the stonemasons group, was 75 years old at the time of the interview and had recently retired. My youngest respondent, again a stonemason, was 25 years old at the time of the interview and was practicing both as a stonecutter and stonemason. In comparison, my oldest respondent from the architects group was 62 years old at the time of the interview, while the youngest respondent, a fellow PhD candidate, was 32 years old.

The median age for the stonemason interviews was 56; while the median age for architect interviews was 44.

Biological age is a determining factor for working stonemasons as the physical nature of their work makes it impossible for them to practice beyond a certain age, whereas for architects age is not usually a determining factor for their practice capacity. Therefore, the number of years in practice is more important in terms of being able to compare the two groups of respondents. The median number of years in practice for stonemasons was 32, whereas the median number of years in practice for architects was 10. For architects this period involved years in their own practice plus years as a junior architect in other offices.

Since the stonemasons included their apprenticeship period when declaring the length of their practice experience, the years in architectural education must be included for the group of architects in order to make the comparison more exact. However, unlike the apprenticeship period in stonemasonry, the nature of architectural education is starkly different from the practical experience of architecture, and the comparison would have been flawed if the years in education were counted as practical experience.

Figure 21. Young girls learning stonecutting, south-eastern Anatolia, Mardin, 2010.[209]

In the stonemason interviews, all of the stonemasons were males[210]. This is in no way surprising as stonemasonry, which involves heavy physical labour, has always been a male domain. However, due to the changes in the nature of stonemasonry work, and the increasing demand for stone as an ornamental rather than structural building material, I have observed an increasing number of women getting into the stonecutting branch of this formerly male dominated area.

Since my stonemason interviews, skills training institutes in Turkey have opened courses on the subject in world heritage cities like Mardin, where the use of stone - an abundant resource in the area - is encouraged by municipal heritage councils. The type of limestone found in the Mardin area is especially suited to ornamental work as the stone is temporarily soft when quarried, and only hardens after exposure to air and humidity, making it easy to work with within a certain time frame. This allows women to enter into the trade, however, they are not trained in the traditional sense, and the training does not involve instruction in the structural aspects of construction.

209. Source: Stills from a documentary called "Taşın Dili: Mardin" (The Language of Stone: Mardin), broadcast on *Iz TV*, a private Turkish channel, in 2010, http://www.iztv.com.tr/program.aspx?id=1483, accessed September 2010.
210. However, during my travels in the Western Anatolia, I was lucky enough to come across a female stonecutter in one of the contemporary stone veneer workshops. Since I was not interested in stone veneer production per se, I did not venture to interview the only female I came across who was working with stone.

Throughout the stonemason interviews, in accordance with the geographical sampling I made for contacting stonemasons practicing in Turkey, I had the chance to talk with people from different regions, although I deliberately refrained from asking about their specific ethnicity. Inquiring about an individual's ethnicity would have changed the nature of the interview due to the potentially sensitive nature of this information. In the architect interviews, which involved a sample of architects from different countries and with different nationalities, this issue never came up. Even during the interviews with expatriate architects practising in another country, the only issue raised concerning nationality was related to the differences in local building traditions.

Table 1. List of stonemason interviews.

NAME	TYPE	LOCATION	DATE
Ali Onur	*rural*	Çanakkale - Adatepe	23/12/2006
Mustafa Tümay	*rural*	Çanakkale - Assos	24/12/2006
Mehmet Özkavak	*urban -diversified*	Kayseri	13/02/2007
Ahmet Özkavak	*urban -diversified*	Kayseri	13/02/2007
Yusuf Kıdır	*urban -diversified*	Mardin	16/02/2007
Halis Göksu	*urban -diversified*	Mardin	17/02/2007
Elias Yaşlı	*urban -specialised*	Mardin	18/02/2007
Davud Çetin	*rural -specialised*	Midyat	18/02/2007
Ramazan Güdüloğlu	*urban -specialised*	Istanbul	23/02/2007
Mehmet Özcan	*urban -specialised*	Istanbul	23/02/2007
Mehmet Talı	*urban -specialised*	Istanbul	26/02/2007
Selim Özdemir	*urban -specialised*	Istanbul	26/02/2007

Table 1 shows the names and locations of the first group of respondents, indicating the dates and the order of the interviews. During the interviews, it became evident that the type and extent of the knowledge of each stonemason varied considerably. Even though I conducted a extensive survey of the available contacts during the preliminary interview phase to make sure that my respondents would qualify as autonomous builders, that is, that they would be able to build structures beyond a certain scale without the help of an architect, I realised that autonomous builders portrayed varying degrees of expertise in their skill sets as well.

In the table above, I make a distinction between rural and urban stonemasons, as there was a distinct difference in the extent of their design knowledge. The village stonemasons, referred to as 'rural' in the table, were able to build a single type of structure, generally a residential building of one or two storeys, and most had not travelled outside of their native villages. Stonemasons with 'diversified' skills were able to build a number of structural types in varying degrees of complexity. Finally, stonemasons with 'specialized' skills were focused on a dominant set of applied skills, specializing in stonecutting, tombstones or veneers, even though they claimed to have the necessary knowledge to build an autonomous medium scale structure without the guidance of an architect.

Table 2. List of architect interviews[211]

NAME	TYPE	LOCATION	DATE
Mark Burry	*institutional practitioner - FT academic*	Barcelona / Melbourne	09/11/2007
Antonì Caminal i Homar	*institutional practitioner-technical*	Barcelona	20/02/2008
Mehmet Kütükçüoğlu	*independent practitioner - PT academic*	Istanbul	24/02/2008
Burçin Altınsay	*institutional practitioner-heritage*	Istanbul	25/02/2008
Han Tümertekin	*independent practitioner - PT academic*	Istanbul	26/02/2008
Bruce Allen	*independent practitioner - heritage*	Melbourne	30/05/2008
Thomas Daniell	*institutional practitioner - PT academic*	Kyoto / Melbourne	08/06/2008
Tim Schork[212]	*independent practitioner - PT academic*	Melbourne	12/09/2008
Paul Minifie	*independent practitioner - PT academic*	Melbourne	04/02/2009
Alexis Şanal	*independent practitioner - PT academic*	Istanbul	24/05/2011
Murat Şanal	*independent practitioner-construction manager*	Istanbul	24/05/2011

Table 2 shows the names and locations of the second group of respondents, indicating the dates and the order of the interviews. Architect interviews provided a cross-cultural perspective on the contemporary building practice and although a very small sample, featured different modes of practising architecture. The selection, a result of opportunistic sampling, is skewed in terms of its inflated representation of practitioners that are also active in academia.

In the 11 architect interviews, 2 respondents were females, although this ratio is not indicative of the ratio of women architects in current architectural practice. Since my research was exclusively based on qualitative methods, I do not claim to have compiled a representative sample. In order to provide a clearer perspective, I must note that the percentage of female respondents in my architect

211. Abbreviations FT and PT in the table respectively indicate full-time or part-time involvement.
212. Tim Schork was not included in the final analysis, as the focus of the research moved towards the construction sites, and he was the only practitioner without construction experience at the time of the interview.

interviews (18%)[213], seems to be inflated in comparison to the percentage of registered female architects in the UK (12%), or in the US (9%)[214].

In contrast to the stonemason group located in a single country, the group of architects was geographically diverse, involving architects from four different countries - Turkey, Australia, Spain and Japan. All but one having practiced and studied abroad, these architects had shown professional competency within different cultural contexts.[215]

Researcher Construction

As the researcher conducting the interviews, I was an outsider in the case of stonemason interviews, and a novice insider in the case of architect interviews, my practical building experience being limited to a month long construction supervision practice during my bachelor degree, with my design practice mainly involving competition projects and small scale art installations.[216] As the data gathered from the interviews largely depended on the emergent interaction between the researcher and the respondent, it is important to provide my practice background in order to evaluate the context of this interaction.

I completed my undergraduate and master's degrees in Architecture at the Middle East Technical University in Ankara, Turkey. I have a second master's degree in Advanced Architectural Design from the Graduate School of Architecture, Planning and Preservation [GSAPP] at Columbia University, located in New York City. While my practical experience from the undergraduate period is limited to summer practices,[217] I also travelled extensively throughout Europe during this

213. Gender was not a primary concern in my research, and my sample of respondents was pragmatic rather than representational, so this ratio is purely given on an informative basis.
214. Garry Stevens, "Women in Architecture" in [WWW]
http://www.archsoc.com/kcas/ArchWomen.html
It is interesting also to note that these ratios change considerably when the criteria are slightly changed: In case of participation in the profession rather than registration or licensure, the ratio of female architects in the USA goes up to 24%. (Current Population Survey of various occupational categories in the USA, 2010).
In comparison, a 2008 European Architects Council survey shows the percentage of female architects around 47% in Turkey, while the UK result from the same survey is 26.5%.
215. This aspect is in no way representative of the current practice profile in architecture but rather, as I have indicated in the previous chapter, based on an opportunistic sampling of respondents based on the nature of their work, and their expression of interest in my research topics.
216. It was only two years after the end of the interviews that I received my first 'real' architectural commission to build two houses.
217. These practices involved working on a small scale classical archaeology excavation as a site surveyor , where I measured and drafted the remains on site; internship at a small scale architecture office specializing in institutional buildings, and construction site surveying of the new building for the engineering faculty for two months on METU campus.

period[218] and was able to develop a cross-cultural perspective on different schools of architecture within different building cultures.

After graduating in 1996, I briefly worked as a junior architect in two small-size architectural offices, mainly designing apartment buildings before moving to New York in 1997. During my graduate studies in New York, I was able to visit offices of well-known practitioners thanks to the design studios at the GSAPP. [219] As I was on a Turkish government scholarship to conduct my studies at Columbia University, I was required to start work as a teaching assistant at the School of Architecture, Yıldız Technical University [YTU] as soon as I concluded my studies in the US.

As seen from the extent of my practical experience, I can only profess an understanding of architectural practice by proxy, one viewed mainly through an academic lens. The rest of my experience until the start of my PhD candidacy at RMIT University in 2006 consisted of competition entries and small scale installations carried out during my assistantship at YTU, where I taught design studios at both undergraduate and graduate levels, along with theory courses including assisting in a graduate course in epistemology for master's students for two years.

Before embarking on the architect interviews, I was apprehensive that my recognition of the architectural jargon would make it difficult to ask more probing questions. Two of my architect respondents were people with whom I had previous work relations,[220] and my first respondent for the architect interviews was my thesis supervisor Professor Mark Burry. While I had a more formal relationship with the rest of my architect respondents, I felt the need to alienate myself from the jargon and rituals of the culture in order to get a better understanding of the knowledge making practices involved in everyday design work in architectural offices. As Grant

218. I was the national representative for EASA, European Architecture Students Assembly for three years during my undergraduate studies, where I had the chance to travel to different cities in Europe twice each year.
219. Steven Holl and Zaha Hadid being my studio instructors, some of the design studio meetings were conducted in their offices, making it possible for their students to see them at work in their own practice environment.
220. With Mehmet Kütükçüoğlu, I have co-tutored several graduate design studios, as well as collaborating on an architectural competition. With Tim Schork, I have co-tutored an upper pool design studio at RMIT. The interview with Tim Schork was later excluded from the analysis group due to a shift in the research focus that made construction experience an inclusion criterion. For further information, see *Appendix 3*, which lists individual characteristics of all interview participants.

McCracken suggests in his book *The Long Interview*, I needed to "manufacture distance."[221]

Taking McCracken's advice, I used the stonemason interviews to distance myself from the culture of architectural practice. Venturing into a part of building practice where all knowledge is tacit and embedded in artefacts made me more keenly aware of the tacit aspects of contemporary architectural practice, and the ways these are made explicit and handed over to younger architects.

In a way, these two sets of interviews were complementary: while architect interviews were challenging in the sense of manufacturing distance, stonemason interviews posed the problem of establishing rapport.[222]

3.2 *Collecting Data*

In one of my conversations with an architect who has extensively studied indigenous building skills and their relationship to the formation of the vernacular building patterns in Turkey, I was gently warned about the risk of selecting interviews as a research method when dealing with people whose main intellectual property was tacit, and therefore hard to fathom within the limits of a single interview. This architect, who was also a very much revered studio tutor and a professor of architecture in my old university was a person of few words himself, and had seemingly got on extremely well with the indigenous stonemasons and carpenters during his travels researching the Anatolian vernacular. The key to understanding the nature of their knowledge, he said, lied in spending time with them; spending time not talking, just observing them in their day-to-day existence, only then would I start to get a glimpse of the knowledge they utilised to conceive and construct relatively complex structures out of stone.

His warning would have been relevant had I set out to produce an ethnographical account of stonemasons in their environment. However, I was primarily looking for beliefs and attitudes within two different groups of building

221. "Investigators can manufacture distance in several ways. They can bring themselves to see with new detachment the categories and assumptions that organize their worlds. The classic method of doing so is to go off to another culture for an extended period of time and then return to one's own. Anthropologists who do this report that they return to a once familiar world with a profound sense of its peculiar and arbitrary character."
Grant McCracken, *The Long Interview* (London: Sage Publications, 1988), pp.22-24.
222. Even though the issue never came up during the interviews, I felt that my gender created an implicit barrier during the stonemason interviews, as stonemasonry is still a male dominated area. Apart from the few who had collaborated with (female) heritage specialists, most stonemasons answered my questions with a sort of amused condescension until I asked them specifically technical questions.

practitioners that would influence their individual kinds of knowledge making practices. Therefore, I used the interview method as a primary source of data to investigate the social and cognitive aspects of design understanding as expressed by practitioners. It is especially important to understand the inherent priorities, beliefs and self-proclamations of the respondents when discussing the socio-technical aspects of knowledge making practices in design, and the semi-guided interview method provides enough latitude for these aspects to emerge during the course of the conversation.

I conducted semi-guided interviews with the same number of respondents from each group with similar questions regarding the nature of their education and expertise, the role of collaboration, and their priorities in the building process. During these interviews several themes emerged, and determined the structure of the thesis accordingly.

Data collection techniques differed for the two groups of respondents. Being an outsider to the culture, observation played a more important part in the stonemason interviews. In order to achieve some complementary insight for the interviews, I travelled to Çanakkale, Kayseri, Mardin and Istanbul, staying on location from three days to about a week, and contacted and interviewed my respondents during 2006 and 2007. Apart from two retired stonemasons, each was interviewed during a normal day at work, and was able to show me their tools and how they work on the job at hand. In response to my questions, the stonemasons would sometimes draw sketches using a vast array of makeshift "sketch pads" - during the twelve interviews; sketches were drawn on my logbook, on the back of the interview guides, on pieces of stone with which the stonemasons were working, even on snow with a wooden stick.

Although my stays with the stonemasons were too short to get an insider's perspective on the nature of their work, I was able to supplement the recorded interviews with field notes and photographs. During all of the stonemason interviews, I was accompanied by another person, who helped me with additional photography or with establishing rapport with the stonemasons.[223]

223. Most of the time I was accompanied by my partner Hayim Beraha, apart from the interviews I conducted in Kayseri, where I was accompanied by my father Özmen Kendir. Hayim helped me a great deal with additional photography, while my father, having spent his childhood in Kayseri, acted as an icebreaker during the interviews conducted in the area.

In the architect interviews, I rarely used photography, and was almost always alone when interviewing them in their working environments.[224] The absence of photos in the architect interviews stemmed from my belief that architects are more used to making their intentions explicit, and even though there is almost always a great difference in the statements of intent with actual practice, I was able to draw from my prior observations in distinguishing such discrepancies and to use them as further material for my research.

Data collection techniques utilized in the case study of Sagrada Família Basilica [SFB] design office were different from the techniques utilized throughout the rest of the interviews. Over a three year period during my involvement with the Spatial Information Architecture Laboratory during 2006-2009, I was able to get first hand information about the research of Mark and Jane Burry on the ongoing construction of the project through their research presentations and through supervision meetings with Professor Mark Burry. I was also able to observe different people working on individual parts of the project just by the advantage of the proximity of our office spaces, and therefore had the opportunity of conducting informal conversations on their understanding of the design work at hand.[225]

These insights, coupled with the vast amount of research publications on the nature of the design work conducted at the Sagrada Família compensated for my relatively short visits to the actual technical office at the Sagrada Família construction site in Barcelona. I have visited the site three times - in 2006, 2008 and in 2010, after my return to Istanbul. I have met the chief architect and director of works Jordi Bonet i Armengol twice in the visits of 2006 and 2008, as well as having the opportunity to listen to one of his lectures in Melbourne during 2007. I used the extensive amount of photographs I took during my 2008 visit to the design office as the basis of my epistemological analysis of the practice, presented in Chapter 6. As well as enabling these visits, Professor Mark Burry kindly acted as an intermediary in order to accommodate mutual language difficulties during the interview with Antoni Caminal i Homar from the SFB design office.[226]

224. Apart from one instance where I had to interview architect Mehmet Kütükçüoğlu in a café rather than in his office, and another person was present at the table during the time of the interview.
225. One example would be my conversations with Barnaby Bennett, who was working on the modelling of the Rose Window in the west transept of the Sagrada Familia, during my stay in Melbourne.
226. This interview is included in the *Appendices*: See A. 5 "Sample Raw Transcript with Initial Coding".

Apart from these primary sources, I collected material from secondary sources like SFB project websites belonging to different stakeholders,[227] as well as scanning news and architectural publications in English and Catalan[228] concerning the ongoing construction process in order to achieve a clearer view of the public reception of the project within a larger social context.

Designing the Interviews

In designing the interviews, I employed concepts such as collaboration, innovation and materiality as "sensitizing concepts"[229] in order to tease out attitudes and beliefs concerning these aspects and how they affect design thinking in stonemasons and architects.

In order to make room for creative interaction between the respondent and the researcher, the interviews were designed to elicit responses to particular problems in practice. In both sets of the interviews, the respondents were carefully briefed about my position, identity and topic of research.[230] However, the questions were such that I acted as a potential collaborator during the stonemason interviews, and as a novice in practice trying to learn about the potential opportunities and challenges during the architect interviews. The interview guides for both groups were similar in structure and in the main thematic groupings.

The questions in the interview forms were grouped according to the main axes of research along which I set out to explore the epistemological basis of building practice. [231] These axes, outlined below, were same in both of the interview groups in order to facilitate later comparisons and arrive at a comparative understanding of two diverse groups of practitioners. Apart from the preliminary questions probing the demographic composition of the respondents, remaining questions were asked with the aim of inciting respondents to think aloud/think together with the researcher on the knowledge making processes inherent within the technical procedures of making a building. These axes included:

- Project profiles: extent and nature of types of work

227. In particular, see the website of prepared by the construction board of the Sagrada Familia: http://www.sagradafamilia.cat/; and the SFB research website at SIAL: http://www.sial.rmit.edu.au/Projects/Sagrada_Familia.php
228. Even though I cannot speak or write in Catalan, I am able to read and understand written material and have an intermediate level of listening comprehension of the language.
229. Charmaz, *Constructing Grounded Theory*, 16-17.
230. See A .1 "Consent Form" and A.2 "Plain Language Statement" in the *Appendices*.
231. See A.3 "Guidelines for Interviews" in the *Appendices*.

- Collaborator profiles: extent and nature of collaborative work
- Approaches to materials: criteria for selection and use of building materials
- Approaches to skills and processes: extent and the impact of skills on the nature of practice
- Approaches to technology: extent and impact of tools and technology on the nature of practice
- Approaches to challenges: Self imposed goals and objectives

The questions I asked to my stonemason respondents were:

1- Information on the Participant:

a. How long have you been practising your trade?
b. How and where did you learn it?
c. Describe your working environment.

2- Project Specifics:

a. What kind of projects have you worked on in the last 5 years?
b. What kind of areas are they located in (i.e. Urban, rural, metropolitan…)?
c. Has there been any institutional context for the projects that you have undertaken?

3- Collaborators:

a. Who are the collaborators in your projects?
b. Who is your primary contact during the construction process?

4- Materials:

a. What affects your choice of the materials?
b. How do you select the appropriate type of stone for a project?

5- Process:

a. Describe the process of a stone construction step by step.
b. How do you translate a design into the built form? Do you use drawings, mock-ups, models…?

6- Technology:

a. Describe your set of tools.
b. Do you follow the latest technology in your field?

7- Further Comments:

a. What would be a challenging project for you that you would want to get involved in? Why?

b. What do you think about the present state of stonemasonry?

Although similar in nature, the two sets of interview questions differed according to the characteristics of the respondent group in focus. In the initial set of questions, it was not always possible to follow the interview guides, and each interview proceeded along its own course according to the preferred topics of the stonemasons. Even when there were such diversions, the interviews turned back to the essential questions, so that I was able to get the necessary information on specific questions. The biggest challenge question was not easily translatable into Turkish, as there is not a direct translation of the word in Turkish, but after a lengthy explanation of the question it elicited a wide variety of creative responses.

The questions I asked to my architect respondents were:

1 - Describe your professional background and your current position. (Qualifications, work experience and current job description)

a. How would you define your area of expertise?

b. Describe your working environment. (On-site, office based… etc.)

c. What kind of projects have you worked on in the last 10 years?

d. How long have you been involved in your current project?

e. What, if any, is the impact of the local building culture on this project?

f. What, if any, is the impact of this project on the local building culture?

g. How would you describe the impact of this project on your design approach?

2- Who are your collaborators in the projects with which you have been involved?

a. Has the profile of collaborators changed over the past years? How?

b. Has there been cross-pollination between the skills and/or approaches between different actors in the design/construction process?

3- What kind of factors and considerations are involved in the selection of materials during the design process? (Structural concerns, local availability, symbolic aspects, longevity… etc.)

a. How do these material choices evolve during the construction process?

b. What are your observations on the use of stone in contemporary projects?

4- What were your observations on the construction sites of the projects in which you were involved? (Are they sites of conservation? Are they sites of invention? …)

a. Are the skills developed during the construction of your projects transferable?

b. Have the construction sites of your projects evolved over the past years? How?

5- Describe your set of tools.

a. What type of instruments do you use in your design process? Which instruments are becoming more prevalent? Which instruments are becoming redundant?

b. Do you follow the latest technology in your field? Does state of art technology in your field influence your design approach? How?

6- What is the biggest challenge in your current position?

The questions in the second set of interviews also evolved throughout the duration of the research. The most telling example was the question on the use of stone in contemporary projects, which I decided to omit after a couple of architect interviews. It was initially considered to be a point of comparison between the two sets of interviews, but as the thematic categories developed, comments on a single material yielded less relevant results.

One main difference between the questions in the two sets of interviews was in the details of the question groups. In order to elicit thinking on the impact of the construction site on their design approach, I asked questions with multiple choices of probable factors, like the impact of the local building culture on their design approach and the cross-pollination of skills between their collaborators and asked architects to think on these factors aloud during the interview, which produced interesting discussions. Finally, the biggest challenge question was an instrument to gauge the architects' main concerns related to their practice, and the answers, which are presented in Chapter 5, provide a general overview of contemporary architectural practice in relation to the exigencies of the construction site.

3.3 Data Assemblage

The data involved in this thesis consisted of over 30 hours of audio recordings of interviews, field notes, photographs and supplementary material like pamphlets from the skills training institutes and from the websites of architect respondents. I transcribed all but four of the 23 interviews myself, the exceptions being three stonemason interviews with overpowering background noise (as the interviews were conducted on site, the clanging of tools working on stone were audible throughout the interview), which I sent to a professional transcription office with software for deleting background noise; and an architect interview which was conducted in Catalan and English, which I sent to a native speaker to transcribe the sections in Catalan. I then worked on these four transcripts in order to check them against audio files and corrected mistakes and omissions. During this period, I listened to each recording in detail several times in order to check the nonverbal cues within the conversation, such as intonations, accents, laughter, and pauses in order to get a more nuanced understanding of the interaction during the interviews.

In accordance with the grounded theory approach, data collection and data analysis were not sequential - meaning that with each interview, the questions were evolving as I started analysing emergent relationships and areas of interest starting from the catalyst interviews. Even though I had a rough estimate for the number of interviews I wanted to conduct from the outset - 10 practitioners from each group -, I ended up interviewing more people on the basis of my initial analyses, in order to ensure that a variety of approaches were represented in the sample groups, and that each working category was "saturated".[232] Adopting the standard procedure in grounded theory methods, I then "fractured data"[233] by taking interviews apart on the basis of emergent categories and arranging interview excerpts as data sets according to subsections compiled under the three sites – *the workshop*, *the office* and *the construction site* – named according to the places where the two distinct group of building practitioners produce design knowledge.

3.4 Analysing, Interpreting and Presenting the Data

During the analysis of the interviews I was mindful of the possibility that interview respondents might at times involve accounts of their practice that do not necessarily fit with the actual practice itself. At this point, I should note that careful and respectful observation has been of utmost importance when conducting the

232. "Saturation means that no additional data are being found whereby the sociologist can develop properties of the category. As he sees similar instances over and over again, the researcher becomes empirically confident that a category is saturated. He goes out of his way to look for groups that stretch diversity of data as far as possible, just to make certain that saturation is based on the widest possible range of data on the category." See: Glaser and Strauss, *The Discovery of Grounded Theory*, 61.
233. Corbin and Strauss, "Grounded Theory Research,".423.

interviews. I was cognizant of the inadequacies and the occasional fallacy of declarative knowledge, and used direct observation according to the constructionist approach, which "treats interview talk itself as the topic of analytic attention".[234]

I studied all of the 23 transcripts several times and eventually separated them into thematical excerpts with relevant "memos."[235] Extensive memo writing made it possible for me to use concepts as the basic units of analysis. In writing memos, I employed Glaser's method of coding with gerunds,[236] where the focus is on the processes rather than phenomena. In this way, knowledge making practices are understood as dynamic processes based on the gathered data, rather than set procedures. During the memo writing phase, I used conferences and Graduate Research Conference presentations at RMIT as testing grounds for my emergent categories in order to fine-tune my analysis. These peer reviews provided valuable feedback on the analytical structure of the thesis.

Evaluation criteria

I have structured the thesis in order to conform to the criteria concerning the empirical grounding of findings. The analysis of findings featured in Section II are specifically focused on the impact of physical sites as actors shaping and grounding knowledge making processes in the practices of stonemasons and architects; and a major variation from the routine building practice model is investigated as a case study in Chapter 6. All three chapters in the following section are organized around key sites of architectural knowledge production in building practice; while subsections are titled according to the emergent concepts gathered from the interviews and are systematically related. Throughout Section II, the emergent concepts are linked to the theory and literature review from Section I, and Section III discusses the theoretical significance of findings.

Throughout the thesis, I have used direct quotations from the interviews, established labels for recurrent phenomena, and made use of vignettes from practice to discuss emergent concepts. Finally, I have taken the necessary measures

234. Silverman, *Interpreting Qualitative Data*, 113.
235. For a sample transcript with initial coding, see *Appendices*, A.7; for a sample detailed memo see *Appendices*, A.8.
236. Charmaz, *Constructing Grounded Theory*, 49.

to improve the validity of the research by employing deviant case analysis[237] as suggested by Silverman in order to "combat anecdotalism."[238]

Presentation of the Data in this Thesis

Ethics clearance for this research permitted potentially sensitive information like the real names of respondents, their ages and work affiliations to be disclosed, as the interviews were deemed to be "expert interviews."[239]

Audio footage from the interviews was not included in its raw form on accompanying media as ethics procedures at RMIT University placed limits on who could have access to the original data. A sample transcript is included in the appendices to provide other researchers with an idea of the nature of the interviews along with a list of memos created according to grounded theory procedures and thematically arranged in line with the types of knowledge discussed in the thesis. Excerpts from the transcripts to be used in the main body of the thesis were restructured utilizing the transcription symbols developed by Gail Jefferson, in accordance with the general conventions of Conversation Analysis. [240]

The following section features a thematic analysis of the findings from the fieldwork. Section II consists of three chapters titled *The Workshop and Beyond*; *The Office*, and *The Construction Site*, three distinct sites of design knowledge that engender specific types of network effects through the interaction of human and non-human actors. I discuss the findings from the interviews under these general titles, while conceptual categories emerging from the fieldwork are used as subsections within each chapter. Chapter 6, *The Construction Site* also features a "thick description"[241] of the design office of the Sagrada Família Basilica in Barcelona discussed as a deviant case[242] in order to support evidence gathered from the interviews.

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237. The case study of the design office of the *Expiatory Church of La Sagrada Familia*.
238. Silverman, *Interpreting Qualitative Data*, 238.
239. See "Qualitative non-sensitive interview" in *Finnish Social Science Data Archive*. "Informing Research Participants." 2008. http://www.fsd.uta.fi/en/informing_guidelines/index.html (accessed 2009).
240. See Paul ten Have, "Appendix A: Transcription Conventions" in *Doing Conversation Analysis* (London: Sage Publications, 1999), .215.
For the list of conventions utilized in this thesis, see section **A4**: Transcription Conventions in *Appendices*.
241. As initially suggested by Gilbert Ryle in his 1968 lecture "What is *le Penseur* doing?" and later adopted and developed as a method for ethnographical research by Clifford Geertz in "Thick Description: Toward an Interpretive Theory of Culture" in *The Interpretation of Cultures: Selected Essays* (New York: Basic Books, 1973), 3-30.
242. Bent Flyvbjerg, "Five Misunderstandings About Case-Study Research." *Qualitative Inquiry* (Sage Publications) 12, no. 2 (April 2006): 219-245.

SECTION II:

IN SITU: SITES OF KNOWLEDGE IN BUILDING PRACTICE

Introducing the Field

> "...the entire history of architecture is actually a struggle between *specification* and *culture* – a long, drawn out dialogue between the *implicit* and *explicit* ways of making. [...] At the one end of the spectrum is the complex realm of "culture" or "craft" – traditional "ways" of doing or making things, passed down from one generation to the next, that implicitly organize patterns of thought, behaviour, inhabitation and production at all levels. At the other end of the spectrum is a tendency toward uniqueness and specificity – a tendency that language and representation relentlessly promote – invention and innovation facilitated and even promoted by abstract systems of communication."[243]

The complex environment of building production features diverse ways of making buildings and associated modes of design thinking. Scott D. Francisco offers an axis of analysis for making sense of this complexity based on the degree of design deliberation – a spectrum of intentionality with explicitly communicated *specification* on the one end, and the tacitly coded *craft culture* on the other. In order to analyse the impact of the act of construction on design knowledge, juxtaposition, if not comparison, of these implicit and explicit ways of making is of vital importance.

As explained in the previous section, the empirical portion of this research involved conducting semi-structured interviews with two groups of building practitioners – namely, traditional stonemasons from Turkey, as representatives of the "craft culture," and architects from four different countries – Turkey, Spain, Australia, and Japan – as representatives of contemporary architectural practice that increasingly relies on complex specifications during the construction phase. The observation and "thick description" of a routine design meeting at the Sagrada Família Design Office in Barcelona, Spain complement the interviews, further illustrating some of the issues raised during the examination of these two case study groups.

At the start of each individual chapter, brief background information on the group of respondents or the case study under analysis is provided to contextualise the specific research group. The historical and critical accounts of professional backgrounds of the interviewed stonemasons and architects are intended to provide a proper understanding of the present state and evolving status of their professions, and to contextualize emerging patterns from the complexity of the research material.

The first group of respondents is an anachronism in contemporary building practice: highly skilled, rapidly becoming extinct, and still relatively autonomous,

243. Scott Francisco, "The Way We Do Things Around Here: Specification Versus Craft Culture in the History of Building," *American Behavioral Scientist* 50; No. 7, (2007): 971.

traditional master stonemasons from Turkey are relegated to restoration work, while their skills degenerate due to the lack of challenging projects that would require their contribution. Men of few words, this first group relied on the presence of their physical surroundings during the interviews – so much so that by the end of each interview, the immediate setting would emerge as an integral part of the conversation, providing the information that words failed to convey.

The interviews conducted with this group presented an initial insight concerning the importance of the site as an important factor in the generation and propagation of design knowledge. These insights shaped the second set of interviews conducted with an international group of architects to investigate the impact of the act of construction on their architectural practice and their design approach. Juxtaposing these two very different niches in building practice necessitated the use of similar axes in the interviews in order to facilitate comparison and analysis.

Although grouped together to represent the culture of specification in the contemporary architectural practice, architect respondents are by no means a homogeneous group: An international ensemble of practitioners with varying degrees of involvement with the construction site, architect respondents of this research play various roles within the contemporary architectural practice scene and provide a cross-cultural overview. One common characteristic in the group of architects is that all respondents are either founding partners, or work in directorial positions in their respective practices. Choosing to engage with the construction site is a directorial decision, and the selection of architects in such positions provided the necessary discussion platform for investigating the impact of such decisions on the design approach of an architectural practice.

The research includes small scale practices with office populations ranging from one to ten full-time employees.[244] In terms of expertise, the group predominantly featured "generalist architects,"[245] with the exception of a heritage expert and a technical architect. Lacking from the selection are corporate offices and the practices involved in large scale constructions or generic mass housing

244. These numbers indicate the number of designers employed by the practice, excluding secretarial or executive staff. At the time of the interviews, Tom Daniell's practice had one full-time employee, and Han Tümertekin's practice had ten full-time employees. Since the interviews, some practices, such as Mehmet Kütükçüoglu's office TeğetMimarlık, almost tripled in size, with a core team of twenty eight employees compared to nine at the time of the interview.
245. The term is used by Dana Cuff in her study of the architectural practice in the US. See: Dana Cuff, *Architecture: The Story of Practice*, 259-260.

projects: The specific issues surrounding these offices with complex organizational structures would have required different research paradigms. Comparing architects with different training, different objectives, different skills and different cultural and social contexts is already an ambitious undertaking that requires a specific axis of comparison, which, in this instance is provided by the different degrees and types of engagement with the construction site and its impact on design knowledge.

Finally, the inclusion of a design meeting from the Sagrada Família design office features a different organizational structure and brings a unique case of collaboration between architects and builders (including stonemasons) into the discussion. The following chapters analyse and discuss different cultures of building practice through the practices of these respondents in order to elucidate the impact of the construction site on the design approaches of different building practitioners.

The inclusion of the Sagrada Família design office has a dual objective: Besides providing a deviant case scenario within "normal" architectural practice, the work of stonemasons at Gaudí's Sagrada Família, when juxtaposed with the work of traditional stonemasons from Turkey displays a stark contrast in circumstance and in the means of production between these two groups. A brief analysis of this contrast and any similarities would help to elucidate the complex web of relations surrounding the issues of construction and design in contemporary building practice before moving on to the individual chapters in this section. In establishing a link between the practice of Turkish stonemasons, and the practice of Catalan stonemasons working for the *Sagrada Família Basilica* [SFB], three key factors come to the fore for the analysis of different niches in the contemporary building practice landscape:

1. <u>Historical contingency</u>: Turkish stonemasons are descendants of an autonomous Ottoman building corps based on a centralised military organisation,[246] with practitioners from diverse ethnic groups[247] working together on the construction

246. Maurice Cerasi, "Late Ottoman Architects and Master Builders," in *Muqarnas V: An Annual on Islamic Art and Architecture*, ed. Oleg Grabar (Leiden: E. J. Brill, 1988).
247. For a discussion on the ethnic diversity of the Ottoman building corps, see: Cerasi, "Late Ottoman Architects and Master Builders," 89-90. Cerasi ascribes the unity of Ottoman building culture to the cooperation of craftsmen from different ethnic groups:
"On construction sites, Turkish, Greek, Rhodopean, and Pontus carpenters, Albanian, Armenian, and Aegean masons, Arab and Turkish chisellers, Albanian and Walachian hydraulic craftsmen worked side by side.[...] The multiethnic and multiregional composition of the skilled labour recruited for the important building sites also favored the exchange of styles, techniques and skill, and perhaps even typological concepts."

sites. Many of these ethnic groups relocated after the fall of the Ottoman Empire, effectively causing a rupture in the continuity of tacit building knowledge. In comparison, stonemasons working for SFB are coming from a well-researched tradition of collaborative practice based on civil organization and a distributed guild structure, which has ensured the continuity of building knowledge in different locations, regardless of any change in the governing structure of their country.[248]

2. Cultural contingency: Although both groups ofstonemasons belong to the culture of the Mediterranean, arguably dealing with similar materials and site conditions with possible stylistic cross-breeding among the structural types used by both groups,[249] a major cultural difference sets their respective practices apart: Turkish stonemasons belong to the poetic oral tradition of the Ottoman period,[250] with the characteristic attitudes found in oral cultures still intact in their narratives, whereas Catalan stonemasons come from a tradition of written treatises theorizing building construction.[251] In present day, it can be argued that this tradition still continues with the well disseminated process reports on the completion of the *Expiatory Church of the SagradaFamília*.

3. Project context: The most important difference between the practices of Turkish and Catalan stonemasons is the specific project context of the Sagrada Família. In contemporary architectural practice, the completion of Gaudí's magnum opus is a unique example in many respects: With its "open source"

See also: SuraiyaFaroqhi, "Understanding Ottoman Guilds," in *Crafts and Craftsmen of the Middle East: Fashioning rhe Individual in the Muslim Mediterranean*, ed. SuraiyaFaroqhi and Randi Deguilhem (London: I. B. Tauris, 2005), 3-40.
248. S. R. Epstein, "Craft Guilds, Apprenticeship and Technological Change in Preindustrial Europe," in *The Journal of Economic History* 58, no.3 (1998): 684-713.
249. According to one theory, ribbed vaults may have originated in Islamic Spain, similarly the pointed arch, which has its origin in Islamic architecture, has travelled from Egypt and Tunisia into Moorish Spain. See: Jean Bony, *French Gothic Architecture of the Twelfth and Thirteenth Centuries* (Berkeley, Los Angeles: University of California Press, 1983).
250. For the implications of this non-western background on culture, see: Jale N. Erzen, "Islamic Aesthetics: An Alternative Way to Knowledge," in *TheJournal of Aesthetics and Art Criticism* 65, no.1 (2007): 69-75.
251. Craftsmanship and craft recipes used in the construction of buildings abound in Western building tradition. Even when only the Gothic period is considered, the number of written treatises by master builders far outnumbers the Ottoman building treatises.

codex left behind by Gaudí in the form of analytical models and photographs; a multicultural and transdisciplinary design team utilizing the latest information technologies; and a building site under construction since 1882, this project is a paradigm-changing learning opportunity for the Catalan stonemasons involved in the construction process. In comparison, traditional restoration projects undertaken by Turkish stonemasons barely sustain the demand for their building skills, let alone improve their skill base.

These differences in circumstance indicate the complexity of contemporary building landscape. Keeping this complexity in mind, I focus on *the site* as the physical framework that makes deliberate and incidental observation of unfolding events possible, enabling the generation, transmission and preservation of design knowledge. By using the concept of situated cognition and adopting the post-humanist stance of Actor-Network Theory as previously discussed in Chapter 1, I argue that the interaction between building practitioners and their immediate environment is conducive to a special type of cognition which makes physical context an active agent in the generation of design knowledge. In this approach, context is not understood as a fixed set of surrounding conditions, but a wider dynamical process of which the cognition of the individual is only a part. These physical settings are depicted as non-human agents that play a vital role in the production of design knowledge.

Although site is ubiquitous in the architectural design process, its epistemological potential is underexplored in existing theories of design. Far from being a passive background, the building site imposes order on the design process with its material[252] and immaterial characteristics.[253] In the data gathered for this thesis, the site is found to operate in the design process in three key ways: as *repository* – a provider of design knowledge coded within the existing built environment; as *resource* - a provider of materials and skills; and as the *observation platform* for the assessment of the built artefact unfolding in time, interacting with natural elements and patterns of use.

252.Material characteristics include size and orientation; topography; flora and fauna; geology; climate, and existing artefacts like buildings and infrastructure.

253. Immaterial characteristics include legislations;codes and regulations; patterns of use and existing communities of practice; along with the intangible heritage of a region including its customs, craft skills, oral histories, folklore, and so forth.

The following chapters present an analysis of how sites set out ground rules for building production and how they generate and propagate knowledge frames that shape design thinking across different social and physical contexts. Acknowledging the site of construction as a vital actor that shapes and guides design thinking provides a critical approach towards the common knowledge frameworks in the contemporary practice of architecture that takes the site for granted, treats it as a constraint, or as a mere topographical background. Stonemasons' conception of the site and the specificities of construction as the "primary generators"[254] of their building practice provides a change of perspective for reevaluating attitudes (especially ones concerning sustainability) in various strands of contemporary architectural practice.

In the following chapters, findings from the different stages of field research are analysed within the context of three main loci where design knowledge is produced and propagated: Namely, the stonemasons' workshop, the architects' office, and the construction site, where designers and builders collaborate in order to bring a building project to its completion.

254. Lawson uses the term "primary generator" to denote a central design idea. See Lawson, *How Designers Think*, 194.

Figure 22. Portraits from stonemason interviews, Turkey, 2006-2007.[255]

255. Source: Photos and collage by the author.

This chapter presents the findings from the interviews with traditional Anatolian stonemasons conducted in four cities from Turkey over a period of two years.[256] These interviews, although restrainingly brief compared to the depth and breadth of the knowledge making practices used by this anachronic niche of building practitioners, shaped the rest of my research. By pointing out the differences in cognitive strategies and practice attitudes employed by the present generation of traditional Anatolian stonemasons and those employed by contemporary architects, the interviews led me to question my preconceptions on the nature of design knowledge as affected by the act of construction. The tribe of Anatolian stonemasons of our day revealed compelling pointers for an innovative and sustainable building practice, even when their art is rapidly degenerating as a result of decreasing demand, lack of new apprentices, and changing means of building production according to rapidly shifting codes and regulations.

It could be argued that the practice of stonemasonry, based on the replication of existing structural and stylistic types, is too different to provide a useful model for the practice of architecture, which is based on designing novel solutions. However, most of the dichotomies posited between design and craft lose their significance when actual practices are examined. Based on a fixed set of solutions from a received tradition, the practice of traditional stonemasons still provides important insights towards the generation, evolution and handing down of design knowledge in architecture.

Before moving on to the individual subsections analysing the stonemason interviews, brief background knowledge on the practice of stonemasonry within the specific Anatolian context is needed. Anatolian stonemasonry, similar to its European counterparts in its incidental exposure to different sites, is an itinerant profession. Stonemasonry tradition is a major part of the vernacular architecture of Anatolia since the initial prehistoric settlements, several types of stone being found in abundance throughout the region.

In contrast to the transient existence of itinerant masons, stone as a material endures, showing the changing attitudes towards materiality, constructional transparency, and longevity. However, in response to the constant imperative to speed up the construction process, the use of structural stone in

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256. As explained in Chapter 3, the stonemason interviews were conducted during 2006-2007, in Çanakkale, Kayseri, Mardin and Istanbul in Turkey.

buildings is rapidly becoming a thing of the past.[257] In conjunction with the place of stone in history and the immense changes in current architectural trends, focusing on the use of stone as a building material provides ample evidence for revealing changing attitudes towards materiality in the building industry.

In most of the stonemason interviews, the respondents alternatively referred to their "stonemason ancestors," making proud references to a historical region from which this ancestral stonemason supposedly originated, or referred to their masters from a different ethnic group deemed to hold the secret of their craft. In western regions, the references were generally made to the proverbial "Rūm" (Ottoman Greek) master masons; while in the central regions the respondents usually referred to themselves as the "grandsons of Mimar Sinan,"a reference to the most researched 16th century Ottoman architect who was said to have come from Kayseri, in Central Anatolia; and in the south-eastern regions, the stonemasons reverently referred to their old Syriac masters, from a rapidly declining minority group, deemed to be the best in the craft of stonemasonry in that region.

Stonemasonry, a craft that still persists in Turkey, provides valuable insights as a social knowledge practice whose dominant mode of continuation is still via tacit means. The issues surrounding stonemasonry are often quite complex, and as seen from the discussion above, portray the changes that occur within the demographics of the area among many other factors. This tradition is still vivid in memories and myth if not so much in actual practice, and it is necessary to have some historical background information in order to be able to evaluate current practice.

> “The training and status of the Ottoman architect were in some ways strikingly different from those of architects in most traditional Islamic societies. In part these differences had to do with the bureaucratic centralization of construction and restoration of state and official monuments under the auspices of *hassa mi’marları ocağı* (Corps of Imperial Architects), a sort of ministry of public works headed by a professional architect with the title *ser-mi’maran-I hassa* or *hassa mi’marbaşı* (Chief Imperial Architect) and staffed by a number of subordinate architects and skilled workmen specializing in particular crafts. Different also was the education afforded members of the *hassa mi’marları ocağı*, who generally began their training as *acemi oğlans* or Janissary recruits specializing in a particular manual skill in the imperial palace or in the household of a high-ranking Ottoman official, with architects in particular receiving instruction in the science of geometry and surveying before being apprenticed to the ocak."[258]

257. In contrast to the diminished use of structural stone, stone veneers seem to be in high demand. Quite a few of the interviewees referred to this process as the ‘bastardization’ of stone.
258.CaferEfendi and Howard Crane, *Risâle-i Mi’mâriyye: An Early Seventeenth Century Ottoman Treatise on Architecture* (Leiden: E. J. Brill, 1987), 2.

Figure 23. Stonemason working, Assos, western Anatolia, 2006.[259]

Figure 24. Female stonecutter working, Assos, western Anatolia, 2006.[260]

259. Source: Photo by the author.
260. Source: Photo by the author.

In the Ottoman building tradition, architects and stonemasons belonged to the military corps.[261] *Risâle-i Mi'mâriyye*, (Book on Architecture) a seventeenth century treatise written by Cafer Efendi, an Ottoman scholar who was a close friend of the chief imperial architect of his time, sheds light on the main characteristics of the building practice during the Ottoman Empire.[262] Although too large a topic to be properly addressed within the confines of this study, it would be informative to note that there are arguments pointing to the centrality of the imperial corps of architects and builders as having a detrimental effect on the preservation of knowledge after the demise of the Ottoman Empire at the start of the twentieth century.[263] The epistemological rupture caused by the language reforms after the establishment of the Turkish Republic and the consequent change of the alphabet poses additional challenges for archival research within the already meagre body of work on the knowledge bases of guilds. However, there are some excellent monographs on individual architects that provide us with a perspective on the nature of work carried out by the builder's guild in conjunction with the realization of specific projects, and some peculiars of knowledge making practices during the Ottoman period.[264]

A brief research on the past and present extent of Turkish stonemasonry reveals a constellation of skills that include stonecutting, wall building, ornamental tracery, template making and various repair and maintenance skills. According to World Skills Institute, contemporary stonemasons may portray one or more of the skills listed under stonemasonry.[265] Historical background of the Turkish stonemasons indicates that the boundaries between skills such as *bennâ* (mason), *sengtraş* (stonecutter) and *neccar* (ornamental tracery maker) were very fluid, and at different times, Turkish stonemasons would perform under different capacities, not conforming to the traditional guild organization.[266]

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261. Crane, introduction to *Risâle-i Mi'mâriyye*, 2.
262. For an extensive historical study on this manuscript, see: Gül Kale, "Unfolding Ottoman Architecture in Writing: Theory, Poetics and Ethics in Cafer Efendi's "Book on Architecture"," (PhD diss., McGill University, 2014).
263. SeeSuraiya Faroqhi, "Understanding Ottoman Guilds" in *Crafts and Craftsmen of the Middle East: Fashioning the Individual in the Muslim Mediterranean*, edited by Suraiya Faroqhi and Randi Deguilhem (London : I. B. Tauris , 2005), p.17.
264. In particular, see Gülru Necipoğlu, "Institutional Frameworks of Architectural Practice" in *The Age of Sinan: Architectural Culture in the Ottoman Empire*, by Gülru Necipoğlu, (Princeton: Princeton University Press, 2005).
265. World Skills International, *Technical Description: Architectural Stonemasonry*, 2013. http://www.worldskills.org/WSC2013_TD08_EN.pdf.
266. Oya Şenyurt, "Onsekizinci Yüzyıl Osmanlı Başkentinde Taşçı Örgütlenmesi" (Stonemason Organization in theOttoman Capital of the Eighteenth Century), *METU Journal of the Faculty of Architecture* 26, no. 2 (2009): 104.

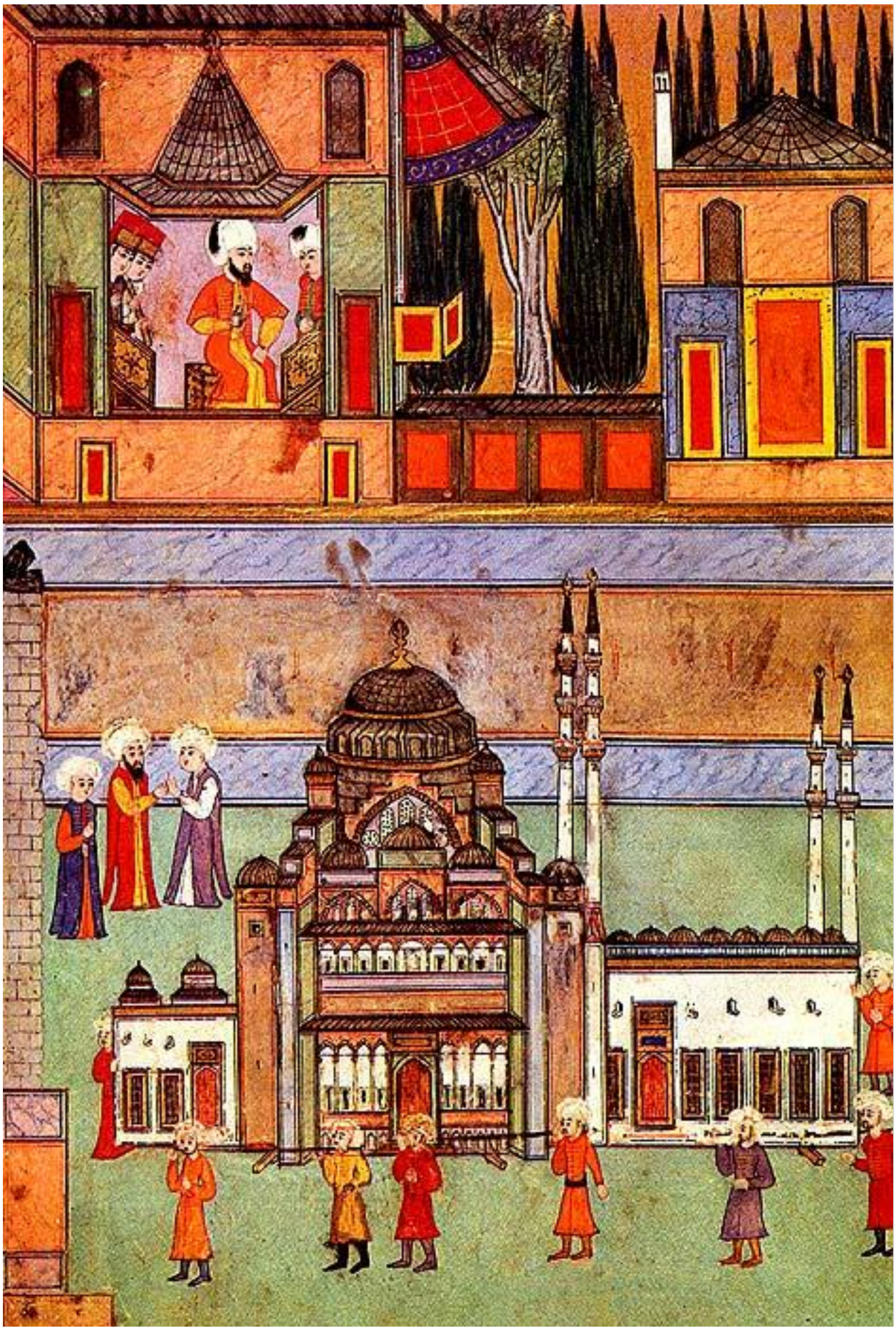

Figure 25. Miniature drawing of the procession of the architects' guild carrying a mosque model in the circumcision ceremony of Şehzade Mehmet, 1582.[267]

267. Source: Image from *Surname-i Humayun* (Imperial Festival Book) by Nakkaş Osman, 1582. http://www.discoverislamicart.org/database_item.php?id=object;ISL;tr;Mus01_A;49;tr.

The stonemasons had to oversee construction process starting from the sourcing of the stones from the quarries until their assembly on site, resulting in the acquisition of a variety of skills and a partial autonomy, unlike other craftsmen in the building industry:

> "The field of specialization in the internal organization of the stonemason craftsmen and indirectly the construction craftsmen had a nature of interlocked chains which include but also limit the areas of each other, so monopoly in the field of construction did not easily apply for craftsmen who were dependent on stone as a material."[268]

Maurice Cerasi argues that strong hierarchy, centralized structure, and an "*esprit d'atelier* rather than a military esprit de corps" were the defining features of the Ottoman building practitioners.[269] Up until the end of the seventeenth century, the centralized *hassa* (sultan's property and service) organization enabled a relatively small number of architects to control building sites "over the vast territories of the empire."[270] According to Cerasi, although they have different educational backgrounds, both architects (*mimar*) and master builders (*usta*, *maistores* or *kalfa*) were equally influential,[271] and at times autonomous, within the Ottoman building practice.He also notes that the continuity and dynamism of Ottoman architectural culture were ensured by the rural master builders in the absence of architects.[272]

Another defining aspect of the Anatolian practice of stonemasonry is the close relationship between the notions of art and craft: In Turkish, the distinction between the notions craft (*zanaat)* and art (*sanat*)[273] is qualitative.[274] Most masons use the word for art, *sanat*, to refer to craft that is perfected, and call a craftsman an artist (*sanatkâr*) when the person in discussion is deemed to have achieved perfection. Throughout the stonemason interviews in Turkey, I came across this qualitative distinction which provided important clues for understanding craft ethos in building practice. Craft is sometimes characterized as rule bound and

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268. Şenyurt, "Stonemason Organization in theOttoman Capital of the Eighteenth Century," 122.
269. Cerasi, "Late Ottoman Architects and Master Builders," 88.
270. Ibid., 87.
271. "In Ottoman urban culture two distinct crafts – that of the architect and that of the master builder (*maistores* in Macedonia and Epirus, *kalfa* in Anatolia and sometimes Bulgaria) – shared the responsibilities for the design and construction of all kinds of structures. Of the two, the architect was apt to be the more cultured and better integrated into official institutions; the master builder belonged to a socially broader sphere." Ibid.
272. Ibid., 90.
273. Etymologically they both come from the Arabic word "*sn*" which is related to industry, making, mastery, and skill. In Turkish, *sanat* (art) and *zanaat* (craft) were synonyms, coming from the Arabic words *sın'a / san'a*. They were used interchangeably until the start of the 20th century.In written sources, they first appear as *Sına'at* (AşıkPaşa, Garib-name 1330) and *zanaat/zenaat* (FilippoArgenti, Regola de ParlareTurco, 1533). See: *Nişanyan Sözlük: Çağdaş Türkçe'ninEtimolojsi* (Nişanyan Dictionary: The Etymology of Modern Turkish), s.v. "zanaat."
274. In discussing the history of craft within a western context, Paul Greenhalgh notes that some European theorists also argue that art is a quality rather than a category, assuming a position generally associated with John Ruskin. See: Greenhalgh, "The history of craft," 29.

hostile to innovation, however, throughout the stonemason interviews, valuing originality was a common attitude among the respondents, most of whom indicated the importance of coming to a certain level in their "art" where they were able to produce original patterns and structural solutions.

Throughout Section II, findings from the interviews are presented in relation to the sites where building knowledge is produced: For Anatolian stonemasons, these sites were the workshop, the building site, and the much larger context of the urban, rural or natural environment where their practice is situated.

The first part of the title, "The Workshop" points to a key site that is both a training ground and the production platform of traditional stonemasons. The first subsection, 4.1 "In the workshop: The taste of stone" discusses the apprenticeship period of the stonemason respondents and analyses how this period instills certain core principles with respect to materials and tools at hand. Although some of the stonemason respondents were not trained in a workshop,[275] all had connections with large or small scale stone workshops at some point as part of their practice, and have spent an apprenticeship period where preliminary recognition of materials is gained through the manipulation of the materials with the tools of the trade, along with the acquisition of the necessary observation skills.

The second part of the chapter title, "and Beyond" points to the remaining three subsections of the chapter: section 4.2 "Recipes for making buildings" presents some of the craft recipes used by the Anatolian stonemasons for making their building knowledge explicit, and discusses these recipes and anecdotes with respect to the notion ofbuilding site as resource; section 4.3 "On the road: The city as laboratory," moves beyond the immediate building site to present how master stonemasons utilize the urban setting as a reference system, underscoring the importance of sightseeing as a knowledge making strategy; section 4.4 "Learning by (un)doing explains how knowledge is transmitted via an active engagement with artefacts; and finally, section 4.5 "The Eternal Site" summarizes the main findings of this chapter and presents the notion of site as an observation platform unfolding in time.

275. Some of the stonemasons only worked on the construction site, carrying their equipment along, and pointed to the construction site as their training ground.

4.1 In the Workshop: "The Taste of Stone"

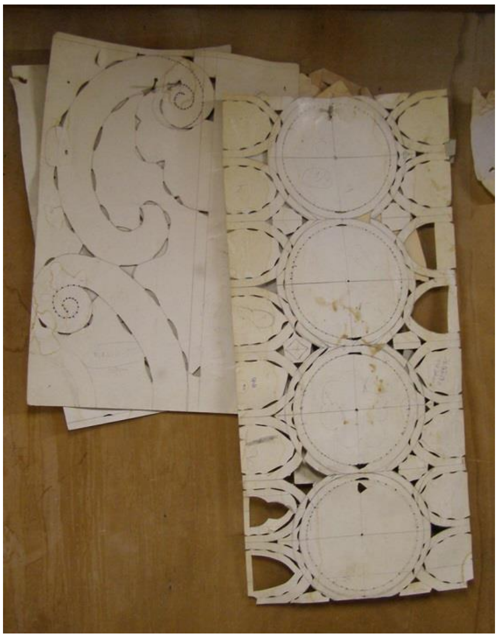

Figure 26. Cardboard templates for the ornamental tracery work at the stonemasonry workshop in Dolmabahçe Palace, Istanbul, 2007.[276]

Figure 27. Stonemason Ramazan Güdüloğlu finishing ornamental tracery of a balustrade for Dolmabahçe Palace, Istanbul, 2007.[277]

> "You have to introduce apprentices to this trade right after primary school, when they are no older than 12 years. That is when they are the most curious about their environment and are at their most receptive state. Older than that, they lose interest..."[278]

Selim Özdemir, a retired stonemason from Istanbul, points to the importance of young age as a precondition for a successful apprenticeship. For most of my stonemason respondents, this period started as soon as they finished their compulsory primary school education, and continued between five to seven years, "depending on the ability of the apprentice."[279] According to the accounts of stonemasons on their apprenticeship period, the workshop emerges as an observation platform where young apprentices learn a combination of skills, values and attitudes through "peripheral participation"[280] in the ongoing life of the workshop. As an educational environment, the workshop stimulates many senses: young apprentices get used to the loud clanging of the chisels on several types of stones, surrounded by stone dust and the smell of mortar being prepared, while they carry out daily chores like cleaning the workshop, and carrying tools, all the while listening to the anecdotes told by their masters.

276. Source: Photo by the author.
277. Source: Photo by the author.
278. Excerpt from SelimÖzdemir interview, Istanbul, 2007.
279. As indicated by Mustafa Tümay, a rural stonemason from Çanakkale, in Western Anatolia.
280. As suggested by Lave and Wenger in *Situated Learning*, previously discussed in Chapter 1.

Merleau-Ponty's description of the "body as a thing among things"[281] is evocative of the experience of the stonemasons within the workshop and later, at the construction site. Master stonemasons, in a continuous reciprocal interaction with the physical environment, make use of visual as well as non-visual cues in determining the material characteristics of specific stones. For instance, Özdemir refers to "sounding" the stones with a hammer or a mallet[282] to check whether they are hollow; as well as observing the size of the pores on the stone to estimate their strength.[283] This knowledge is not transferred directly by explicit instruction, but hammered into the body[284] of the young apprentice who has to learn through unmediated observation during his apprenticeship period. Such polysensorial stimulation of perceptive abilities at a young age sensitizes the stonemasons to non-visual cues in the environment that usually pass unnoticed by trained designers.[285] The stonemason narratives indicate that perception and bodily involvement with the material starts from the quarry, and continues until the selection and classification of stones according to their composition, which is also evaluated via bodily interaction.

The apprenticeship period of stonemasons involves a long and hard bodily labour period where the young apprentice has to observe the way the stones are prepared, and to grasp how to find the geometry from within the material by treating it according to its specific material properties, or to guess the structural performance of the stone according to where it was extracted from the quarry and be able to position it within the building in accordance with its veins so that it can provide resistance against weathering as well as learning how each specific type of

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281. Maurice Merleau-Ponty, "Eye and Mind," *The Primacy of Perception*, ed. James M.Edie, trans. Carleton Dallery (Evanston: Northwestern University Press, 1964).
282. A similar narrative is presented by Ross King in a historical account of the construction of the great cathedral in Florence:
"It was then sounded - that is, struck lightly with a hammer - as a test of its quality. If there were no flaws, the stone would ring like a bell, whereas a dull thud indicated a crack or some other defect, and it would be discarded. Another test of quality was the smell. Freshly cut from the quarry, limestone and sandstone smell of rotten eggs, and the stronger this sulphurous stench, the better the quality of stone." Ross King, "The Chain of Stone" in *Brunelleschi's Dome - The Story of the Great Cathedral in Florence* (London: Pimlico, 2001), 73-74.
283. Özdemir says that he can understand the quality of the stone from its visible characteristics: Surface stones tend to have greater pores and lesser strength, while stones deep from the quarry have a denser structure and more resistance.
284. According to RamazanGüdüloğlu, one of the master masons of Dolmabahçe Palace in Istanbul, the period of apprenticeship occasionally involved corporeal punishment.
285. In my interview with the young stonemason Halis Göksu from Mardin, he referred to the smell of the newly built reinforced concrete houses in the area, finding them vastly inferior to the area's vernacular stonemasonry, which, in his opinion, have much better indoor air quality:
"Concrete stinks. It affects your lungs like cigarettes." Excerpt from HalisGöksu interview, Mardin, 2007.

stone reacts to the process of dressing. This training is visceral and is based on a mutual interaction between two physical bodies - in striking contrast to the education of a student of architecture where the process of designing is characterized by abstract operations within an abstract design space, unless the student is specifically interested in producing physical models. The design studio versus the mason's workshop; practical geometry versus more abstract mathematics and coding; body versus the mind, no two niches within the design knowledge ecology could involve more contrasting characteristics. However, the similarities are almost as striking as the differences, and the attention to detail, obsession with precision, interest in novel structural solutions transcribed within traditional types are the encouraging clues indicating the possibility of an innovative collaboration as long as the gap created by the knowledge hierarchy is transgressed by both parties.

The workshop affords the opportunity to observe a single material under different guises. Young stonemasons gain an initial understanding of practical geometry by tackling with the physicality of the raw material, testing its characteristics against an abstract geometry composed of faces and right angles. According to my stonemason respondents, one of the first tests to assess a young apprentice's skill level and understanding is asking him to prepare an ashlar block from a piece of rock brought from the quarry.[286] This seemingly simple task involves many indicators of the necessary attitudes and degree of the apprentice's grasp of the basics: A steady hand; understanding of the material properties and their inherent geometry; the use of tools; and precision workmanship. It is only through corporeal engagement over a long period that this type of material knowledge[287] can be acquired.

Such material knowledge once belonged to the knowledge domain of stonemasons, a kind of tacit knowledge that is quickly eroded by the disappearance

286. Among others, Mehmet Özcan, one of the master stonemasond from the Dolmabahçe Palace in Istanbul, stressed the importance of the proper production of an ashlar block as n indicator of an apprentice's ability, and a necessary step to pass before being permitted to carry out more geometrically complex work.
287. "[Cyril Stanley Smith] claims that by the time Greek philosophers like Democritus or Aristotle developed their philosophies of matter, practically everything about the behaviour of metals and alloys that could be explored with pre-industrial technology, was already known to craftsmen and blacksmiths. For at least a thousand years before philosophers began their speculations, this knowledge was developed on a purely empirical basis, through a direct interaction with the complex behaviour of materials. Indeed, the early philosophies of matter may have been derived from observation and conversation with those "whose eyes had seen and whose fingers had felt the intricacies of the behaviour of materials during thermal processing or as they were shaped by chipping, cutting or plastic deformation.'"
Manuel de Landa, "Uniformity and Variability: An Essay in the Philosophy of Matter," in *Doors of Perception 3: On Matter Conference*, (11 11 1995).

of the vernacular stonemasonry tradition. In one of the conversations conducted during the exploratory period before embarking on the stonemason interviews, architect and heritage specialist Burçin Altınsay Özgüner compared making mortar to cooking, saying that the "feel" is very important. During this conversation she told an anecdote about an older mason who went so far as to taste the mortar in order understand its composition.[288] She also added that this type of understanding was long gone due to extensive deskilling on the market.

According to the iterative nature of traditional structural design process, the builder selects from several practical solutions based on past knowledge and experience, and the economics of construction, without the help of a theory of structures or means of structural analysis.[289] This dependence on previous experience in the absence of necessary analytical tools led to the development of care and concern about the tested challenges within the structure, like the composition of mortar. In the absence of abstract analytical skills, masons developed a more bodily involvement with the task at hand, a form of corporeal analysis based on a reciprocal interaction between the body of the mason and his building materials, the mason literally tasting the material in order to determine its merit.

For most of my traditional master stonemason respondents however, material selection involves constant learning, critical reflection and it is effectively at the foundation of their expertise, or, as they would refer to it in Turkish, their art:

> "Our hands saw various arts... "How?" You might ask... I mean ornaments, different experiences [...] We learned slowly. Even at this stage we need to learn. This vocation of ours is as deep as science. You perfect this motif, you come across another one. You make that, there comes yet another one... It is infinite. You shouldn't say, OK, this is it, I am finished."[290]

Within the last two decades, the notion of embodiment and the terms "embodied cognition" and "embodied mind" have steadily grown in cognition studies.[291] Although the use of body metaphors is not sufficient to corroborate the

288. I was one of the two architects who attended the international crafts conference *Making Futures: The Crafts in the Context of Global Sustainability Agendas* that took place in Plymouth in 2009. When I referred to this anecdote during my presentation, lots of participants from different crafts backgrounds expressed their surprise in hearing such a thing would be possible in building practice and referred to similar ways of working with materials from their own practices - apparently tasting metal in order to understand its composition was a common practice among metalsmiths andjewellery designers.
289. Robert Mark, *Experiments in Gothic Structure* (Cambridge, Massachusetts: The MIT Press, 1982), 11.
290. Excerpt from Yusuf Kıdır interview, Mardin, 2007.
291. Among many others, see: Francisco J. Varela, Evan T. Thompson, and Eleanor Rosch, *The Embodied Mind: Cognitive Science and Human Experience* (Cambridge, Massachusetts: The MIT Press,

embodiment thesis, an exploration of the body metaphors observed throughout the stonemason interviews extends our understanding of the tacit character of knowledge employed by craftspeople in general and by stonemasons in particular.

Table 3. Corporeal metaphors used by Turkish stonemasons when they talk about buildings.[292]

Nouns	Adjectives	Verbs
Dirsek/ elbow (for corner connections) *Yüz* / Face (same as in English) *Damar*/ vein (for grains of stones) *Hayat* / life (for buildings and stones) *Ayak*/ feet (for foundations) *Bilezik* / bracelet (for a transition element used in minarets)	*Sakat*/ lame (for a building) *Çürük* / rotten (for foundations) *Ham*/ unripe (for stones)	*Ayaktadurmak* / stand (on its feet) *Yaslanmak* /lean (same as in English) *(Kubbeyi) büzmek*/squeeze (a dome) *Devirmek* /topple (a surface) *Ameliyat etmek* / lit. to operate on (term normally reserved for medical operations in Turkish, but the stonemason used it when talking about the repair of an old building)

By no means a complete list of the terms encountered in the stonemason interviews, the table above lists some of the body metaphors used by my respondents. One of the most striking characteristics of stonemason interviews, the prevalence of body metaphors in the language utilized by stonemasons when talking about buildings and the act of construction reveals the vital role of corporeal engagement in the constitution of their design knowledge. It is through the use of such metaphors that the nature of the stonemason's building knowledge reveals itself, where a coupling of the body of the builder and the building under construction becomes evident in the language used. One of the minaret builders from Kayseri, Mehmet Özkavak, referred to the nature of their work on stones as *ameliyat*, a term generally used for medical operations.[293] This kind of unmediated interaction, based on a reciprocal relationship between two bodies is expressed by the use of anthropomorphic metaphors in the stonemason narratives.[294]

A comparison of their jargon with that of the architects when referring to similar issues concerning building and construction is helpful for developing an insight about the specificity of their perceptions of materials and structure. The use of body metaphors is suggestive of a certain understanding of the process of building, where both the raw material at hand and the building itself is seen as a

1991); and Gregory Bateson, *Steps to an Ecology of Mind: Collected Essays in Anthropology, Psychiatry, Evolution, and Epistemology* (Chicago: University of Chicago Press, 1972).
292. Here I was inspired bythe scope and methodology of Maire Eithne O'Neill's work, which I previously discussed in Chapter 1. O'Neill, "Corporeal Experience," 3-12.
293. "Biz taşın herşeyini yaparız; gerekirse doktorluğunu da yapar, ameliyat ederiz." ("We make everything with stone; we become its doctor and operate on itwhen necessary.") Excerpt from the interview with Mehmet Özkavak, Kayseri, 2007.
294. Pamela H. Smith refers to the use of biological metaphors in the language of artisans, pointing out the direct engagement of the body in artisanal practices:
"Artisans engaged in a bodily struggle with and against matter itself. Matter was not dead but alive, and it behaved in idiosyncratic ways, which artisans had to come to know – and master – through experience." Smith, *The Body of the Artisan*, 114.

body interacting with the body of the builder. This mutual interaction is one of the main differentiating characteristics of the technical know-how of the builders, and how they recognize the affordances of materials and structures in relation to their own body.

Architects also use body metaphors when talking about buildings, which seem to be similar to the metaphors used in daily conversation, like the "life" or "skin" of a building; and its rib, knuckle, groin, feet, and so on, for various elements of its construction. However, compared to the stonemason narratives, architects' use of body metaphors remain predominantly visual, unlike the action-based, visceral metaphors used by the stonemasons.[295] Body metaphors used by stonemasons stand out in stark contrast to the Ruskinian urge to "taste" stones,[296] which remains poetic and evocative of the sensuality of the materials rather than providing an insight into their structural or material performance.

The understanding of materials as living bodies also enables the traditional stonemasons to relate to their performative qualities by observing the ways they react with the elements of nature.[297] In most of the stonemason narratives where stones are described as living organisms, the polysensorial experience of Anatolian stonemasons effectively acts as the basis for material and structural knowledge, anchored and strengthened in their memory through a variety of senses. Although the use of multiple senses is a common characteristic of craft knowledge across cultures,[298] in the case of Anatolian stonemasons, the tendency to underline the sensorial qualities when giving a technical account of their practice may be more pronounced, owing to the long centuries of poetic tradition inherited from the Ottoman period.[299]

One of the main problems related to the changing conditions of the stonemasonry workshops in Anatolia is the problem of *deskilling* and its concomitant effects on building practice. In the present practice environment, it is a

295. Robin Evans, *The Projective Cast*, 208.
296. John Ruskin, *The Stones of Venice*, ed. Jan Morris (Toronto: Stoddard, 1989).
297. In Mardin, when stones are first quarried and brought to the workshop, there is a certain time window when it is possible to make the intricate ornamentations before the stone hardens in reaction to the atmosphere.
298. Within the general context of craft practices, Pamela H. Smith's use of the term "sensory investigation" to describe artisanal epistemology underlines the importance of polysensorial cognition. See: Smith, *The Body of the Artisan*, 55; within the specific context of stonemasonry DaliborVesely points to the use of rhymes by the medieval stonemasons to "stabilize the content of geometrical constructs." See: Vesely, *Architecture in the Age of Divided Representation*, 72.
299. JaleErzen, an artist, architect and art historian, talks about *synaesthesia* when discussing Ottoman aesthetics. See:Jale Erzen, "Ottoman Aesthetics," *PAROL Quaderni d'arte e di epistemologia*, http://www3.unibo.it/parol/articles/ottoman_aesthetics.htm.

huge challenge for the traditional builders to adapt to the dynamics of the building market where traditional expertise inculcated through rigorous workshop training is no longer in demand. In order to cope with this situation, traditional Anatolian stonemasons use their expertise in different ways - most of them adapting to new materials, or reverting to alternative modes of making. Currently, the majority of traditional stonemasons in Turkey can use only a small portion of their polysensorial expertise for producing ornamental patterns, working in specialised heritage projects or in technically challenging parts of traditional buildings like minarets.

As an epistemic environment, the workshop provides the cognitive infrastructure for learning to manipulate materials in order to produce artefacts. An essential component of this cognitive infrastructure is the display of specific tools and templates used in the practice of stonemasonry within the workshop. In learning the specificities of materials, tool making and tool use are of vital importance, shaping the nature and extent of stonemason's knowledge by enabling certain processes and restricting others.

The interviews indicated that traditional Anatolian stonemasons still use archaic hand tools, like chisels, mallets, cockscombs, plumb lines, compasses, rulers and set squares, along with cardboard, tin or wooden templates, while acknowledging the affordances of new technologies.[300] Many of the stonemasons noted that they either made their own tools according to the type of stone to be used, or got them made according to their specifications.[301] It is through the apprenticeship period in the workshop that the young masons learn to adopt and adapt tools, using them in a continuum of making and mending.[302]

Working with archaic tools within the workshop also involves getting used to the slowness of craft time, the time required to complete the work under construction affording contemplation:

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300. Some stonemasons indicated that they occasionally use power tools to carry out the rough work, later finishing the blocks by hand. Most of them also expressed great interest in CNC equipment used in stonemasonry, but pointed to the lack of demand and financial constraints as the reasons for not being able to integrate these technologies into their practice.
301. The youngest of stonemason respondents, HalisGöksu from Mardin told me that he gets his own tools made from repurposed spare car parts.
302. Isis Brook, an environmental philosopher, points to the importance of the continuum of making and mending as a strategy for sustainable production.
Isis Brook, "Make, Do, and Mend: Solving Placelessness through Embodied Environmental Engagement," in *Human-Environment Relations: Transformative Values in Theory and Practice*, eds. Emily Brady and Pauline Phemister (Dordrecht: Springer, 2012), 109-120.

"Craftsmen take pride in skills that mature. This is why simple imitation is not a sustaining satisfaction; the skill has to evolve. The slowness of craft time serves as a source of satisfaction; practice beds in, making the skill one's own. Slow craft time also enables the work of reflection and imagination - which the push for quick results cannot."[303]

Slowness of craft time is first experienced within the confines of the workshop, with the faith of young apprentices in this laborious process renewed through anecdotes told by the masters, underlining patience and diligence as necessary virtues.

At the start of this chapter, I referred to the practice of stonemasonry as an itinerant profession. Different from other craft workshops, the stonemasonry workshop need not be bound by a specific place, and can be temporary, in accordance with the commissions undertaken by the stonemasons. Indeed, only four of my twelve stonemason respondents were trained in a "stonemasonry shop," the rest being trained on site by their masters. In the present day, most stonemasonry workshops have been transformed into mechanized mass producers of ornamental stone components, with the exception of institutional stonemasonry workshops such as the stonemasonry workshop at Dolmabahçe Palace in Istanbul.[304] Even in the palace workshop, the main area of expertise was repairing of the ornamental components, the stonemason respondents displaying partial knowledge of required skills for an autonomous practice, the extent of their knowledge limited to stonecutting.

Although in the process of losing their impact as generators of building knowledge, the empirical data collected within the confines of this research underscores the importance of stonemasonry workshops as epistemic sites, vital in the preservation and furthering of a niche building practice and its associated modes of making.

303. Richard Sennett, *The Craftsman*, (London: Allen Lane, 2008), p.295.
304. The stonemasonry workshop at Dolmabahçe Palace is a subsidiary organization of the Department of National Palaces, with direct ties to the Turkish Grand National Assembly.

4.2 *In Situ: Recipes for Making Buildings*

> "...The spirit of the early craftsmen was throughout that of a medieval guild, rather than that of a scientific academy. In one craft after another we find the same formula repeated: the initiated may tell this to the initiated, outsiders shall not have it explained; and on top of this declaration of secrecy, the cryptic abbreviations and the use of a dead language remind us of medical prescriptions. We are emphatically in the world of practical men."[305]

The figure below shows master stonemason Yusuf Kıdır drawing a minaret on an ashlar block made out of Mardin limestone. He uses the drawing to explain details concerning the locking of stones, such as the pouring of molten lead in grooves on interlocking stones for enhanced structural performance. He was the first to admit that his grasp of theory was weak, but his tacit understanding of structural performance and traditional details is evident in his sketches, which he drew on the piece of stone with a Caran d'Ache pencil during the course of our interview.

Figure 28. Master stonemason Yusuf Kıdır explaining construction details, Mardin, 2007.[306]

In contrast to Yusuf Kıdır's understanding of material as evidenced by the structures he has built as well as the sketches he drew, another stonemason from a neighbouring town, Midyat stonemason Davud Çetin's demeanor, drawings and workshop was in stark opposition to the older master's environment. Owner of a stonecutting atelier with more than a dozen employees, Çetin seemed uninterested in structural details, even though he claimed to have worked in several monastery reconstructions around the area as the main contractor overseeing the stonemasonry construction. However, in opposition to the almost obsessive care for the thinness of the joints expressed by two other masons - Yusuf Kıdır as well as

305. Stephen Toulmin and June Goodfield, *The Architecture of Matter*, (Chicago: The University of Chicago Press, 1982).
306. Source: Photo on the right by the author, photo on the left by HayimBeraha.

Elias Yasli – who I interviewed in the area,[307] the photographs of reconstruction work he showed me from the recent restoration of a monastery in the vicinity showed poorly dressed stones, and thick courses of mortar joints in comparison to the original fabric of the historical structure. In addition to photographs from previous commissions, there was a sketch on his desk, showing a building facade, a poorly executed drawing showing only the stone ornaments to be applied. There were mass produced stone ornaments scattered around outside of his office, and a couple of primitive ornamental stonecutting templates made out of cardboard hanging on his office wall. The contrast between these three stonemasons living and practising in the same region was indicative of the rapid disappearance of structural skills due to the decreased demand for stonemasonry construction. The most telling evidence of the degeneration of skills was the facade sketch – an artefact of mediation that had taken the place of the templates.

Figure 29. Scenes from Davud Çetin's workshop, Midyat, 2007.[308]

Architects think with abstractions (like nurbs) or some *geometrical a priori*.[309] Masons think through typological elements, or "macro-modules:"[310] vaults, domes, walls, and such, with a vast palette of detailed solutions perfected through time are entrenched in their vocabulary. For architects, using such typological-constructional vocabulary in order to achieve complex geometries would require an analytical approach based on a kind of *reverse translation*. Many of my stonemason respondents noted that the "macro-modules" previously used by them are rendered obsolete as they no longer conform to the present day codes and regulations.

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307. Elias Yasli went so far as to tell me that even the thinnest piece aluminium foil (he said cigarette paper) should not fit in between the courses of dressed stone.
308. Source: Both photos by HayimBeraha.
309. DaliborVesely, "The Nature of Communicative Space," in *Architecture in the Age of Divided Representation: The Question of Creativity in the Shadow of Production* (Cambridge, Massachusetts: The MIT Press, 2004), 43-108.
310. Maarten Prak, "Mega Structures of the Middle Ages: The Construction of Religious Buildings in Europe and Asia, c.1000-1500," in *Technology, Skills and the Pre-Modern Economy in the East and the West*, eds. Maarten Prak and Jan Luiten van Zanden (Leiden: Koninklijke Brill NV, 2013), 142.

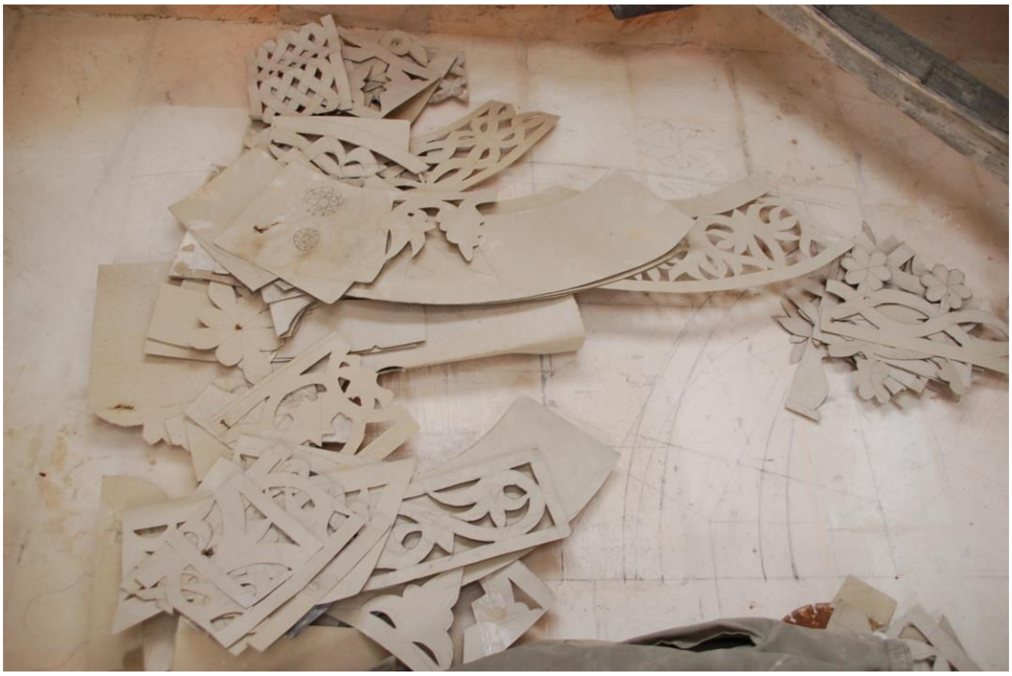

Figure 30. Stonemason templates from Midyat, Southeastern Anatolia, 2007.[311]

Figure 31. Stonemason Yusuf Kıdır working on Mardin limestone, 2007.[312]

311. Source: Photo by Hayim Beraha.
312. Source: Photo by the author.

Although the skills of construction employed by Anatolian stonemasons are invaluable as the intangible component of vernacular architecture, they are rapidly becoming extinct as a result of constantly shifting local building codes and specifications. Often, building codes have increasingly higher risk margins, and this interferes with the way craftsmen build.[313] One important exception to his condition is minaret building: Within the context of already risky structures like minarets, the standards conformed to by the stonemasons are even stricter than existing building codes in the area.

Ahmet Özkavak and his younger brother Mehmet Özkavak are highly specialised urban stonemasons from Kayseri, a city in Central Anatolia, known as *Caesarea* during the Roman Empire. In an area occupied by many different cultures and civilizations since 3000 BC, the built heritage of Kayseri features characteristic examples of Seljukid and Ottoman stone construction; however, similar to what has been happening in many major cities in Turkey throughout the past two decades,[314] Kayseri's historical fabric israpidly disappearing due to extensive urban regeneration accompanied by a pervasive mismanagement of cultural heritage.

In this fast-changing urban context, the Özkavaks travel around the area as much sought-after minaret builders as well as collaborating with archaeologists[315] and heritage architects on historic reconstruction projects. With the majority of the constructions realised during the summer months, they were able to participate in an extensive interview, which included a tour of their home town, Mimar Sinan, named after the famous Ottoman master builder, as well as a trip to their stonemasonry workshop. After the workshop visit, we continued the interview on the construction site of a mosque where they had recently built the minarets, and Ahmet Özkavak talked about techniques of template making for constructing stone minarets by drawing diagrams on the snow with a wooden stick.[316]

313. In one instance narrated by the rural master stonemason Ali Onur from Adatepe, Çanakkale, his ability to construct a stone staircase without using an additional beam underneath the stairs could not be used by the architect, as his construction technique did not comply with building regulations at that time, even though a staircase previously built by Onur in that manner proved to be safe and durable.
314. Marc Pierini, "Urban Transformation in Turkey," Carnegie Europe, June 20, 2013. http://carnegieeurope.eu/2013/06/20/urban-transformation-in-turkey.
315. During my preparatory interviews in search of traditional stonemason respondents, one of the architects that I interviewed during a visit to one of the archaeological excavations told me that archeologists like to work with stonemasons from Kayseri, as they still have intact knowledge of traditional stonemasonry skills, which provide invaluable help in the reconstruction of classical monuments.
316. I was there during January, the coldest month for the region, when it generally snows. Although that particular day was a sunny day, he invited me to come back during summer, after the start of construction season, so that I could see them in practice.

Figure 32. Stonemason brothers Ahmet and Mehmet Özkavak posing under the minaret they built, Kayseri, 2007[317].

317. Source: Photo by the author.

Constructing an Arch:

"You draw a line, mark according to the given measurement, find the midpoint, stick a nail in the midpoint and then put a metal string... A metal string is better than rope, rope sags... You draw the circle (with the help of the metal string). If you are going to construct the arch in Mimar Sinan style, you move each endpoint by 30 cm. If you are constructing a normal arch, you draw the circle like this, and then, if the arch is to be 20 cm thick, you draw another semi circle by offsetting it 20 cm, then you divide the area in between. For example, there will be a keystone in the middle, you take out the keystone and then divide the rest."

(Drawing an arch on the ground and showing on this drawing)

"If you mark the keystone first, the remaining parts will be determined accordingly. Let's say 170 cm. What will remain when you divide it into parts? In order for it to be beautiful, you mark 23, 24, 25 cm, not to exceed 30 cm. Let me describe to you. We draw like this, we have our point there. We have our string here. We mark here, here, here and here. We extend our string up to here. You will mark here. You need to see there exactly and pull the string. Look, there is the keystone. You will draw this when you see this from here like this. Always with this string. You mark the first points with the string and then draw like this."[318]

This description provided by the Anatolian minaret builder Ahmet Özkavak is illustrative of the limits of declarative knowledge in craft based practices, and in fact, any other practices that involve the making of artefacts: time and again, stonemasons indicated that they never give direct instructions to their apprentices, but rather encourage them to learn as if by osmosis. The construction of minarets is a rare and highly specialized skill. Ottoman stone minarets, with slim octagonal or round bodies constructed on rectangular bases can range from 10 meters up to over 70 meters in height. Given that most of Turkey is in an earthquake prone zone, minaret builders have extensive working knowledge of slender structures that are earthquake resistant. Stonemasons with minaret building skills travel extensively around their region, working on mosque constructions.[319]

> "Surviving fragments of building accounts indicate that the medieval mason was unfamiliar even with simple multiplication, which explains the prevalence of geometry in design rather than any form of geometric computation. Villard himself demonstrates extensive use of geometry in such matters as shaping the keystone of an arch or measuring the height of a tower from ground observation using similar triangles."[320]

Comparing this instruction with thirteenth century sketches by Villard de Honnecourt,[321] or the more detailed and mathematically validated instructions of

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318.Excerpt from Ahmet Özkavak interview, Kayseri, 2007.

319. For an overview of the engineering and architectural aspects of traditional Turkish minarets see: AdemDogangun et al. "Traditional Turkish Minarets on the Basis of Architectural and Engineering Concepts", 1st International Conference on Restoration of Heritage Masonry Structures. Cairo, 2006.

320. Robert Mark, "The Enigma of Gothic Structure," *Experiments in Gothic Structure* (Cambridge, Massachusetts: The MIT Press, 1982), 3.

321. Quicherat, Jules Etienne Joseph. "Notice sur l'Album de Villard de Honnecourt architecte du XIIIe siècle." *Wikisource: La bibliothèque libre.*1849. [WWW] http://fr.wikisource.org/wiki/Notice_sur_l%E2%80%99Album_de_Villard_de_Honnecourt_architecte_du_XIIIe_si%C3%A8cle (accessed 02 2011)

the gothic stonemason Roriczer from the fifteenth century,[322] eighteenth century treatises on stereotomy,[323] or the retrospective structural archaeology of Frei Otto from the twentieth century,[324] one sees a common thread, that of the lack of intimate material knowledge on the part of the reader. No matter how well versed the recipe writer or reader might be, explicit verbal description doesn't do justice to the task at hand, the need to observe and comprehend by actual practice would appear to be the missing ingredient.

Figure 33. Master stonemason Yusuf Kıdır drawing a sketch to show how to construct an Ottoman arch to the researcher, Mardin, 2007.[325]

However, it is still possible to discern the characteristics of rules expressed by the mason. He decides on the approximate size predetermined according to familiar typological elements, and constructs structural forms by means of practical geometry, which is qualitatively different from the abstract notions of ratio and proportion taught at the schools of architecture. Even though he cannot make his understanding of ratio explicit, his vast repertory of precedents makes him a connoisseur of structural performance and he is able to assess simple structural behaviour through his faculty of vision. This concrete precedent based knowledge is

322. Lon R. Shelby, ed., *Gothic Design Techniques: The Fifteenth-Century Design Booklets of Mathes Roriczer and Hanns Schmuttermayer* (Carbondale: Southern Illinois University Press, 1977).
323. For a nineteenth century example see: Charles Leroy, *Traité de Stéréotomie; Comprenant les Applications de la Géométrie Descriptive, à la Théorie des Ombres, la Perspective Linéaire, la Gnomonique, la Coupe des Pierres et la Charpente*,(Liège: Dominique Avanzo, 1845).
324. Frei Otto, *IL 37 Ancient Architects - What could the ancient master builders have invented? A contribution to the history of inventing structures on the road to Architecture*, (Stuttgart: Karl Kramer Verlag, 1994).
325. Source: Photo by HayimBeraha.

achieved by practical experience mediated through the body of the builder and involves a wealth of information about the strength of materials and performative factors due to prolonged interaction with the same material and structural type.

Stonemasons' declarative knowledge involves warnings concerning precision and call for specific attention to joints - areas of possible structural failure. Far from being purely technical, this type of building recipe features a tacit understanding of practical geometry, structure and materials expressed through stories or partially mute recipes. In the achievement of this knowledge, reverse engineering is another important aspect of learning: At least half of the stonemasons pointed to the importance of working within a heritage environment, where the dismantling of a building usually uncovers structural details embedded and invisible when the building was intact, corroborating the ANT approach underlining the impact of artefacts as non-human actors in knowledge making practices, an issue previously discussed in Chapter 1.

Shame on the master!

In Mardin[326]*, I interviewed a retired stonemason, Elias Yasli, who had been appointed the guard of a 900 year old Syriac Church*[327] *on the church grounds. We started the interview in one of the main chambers that was adjacent to the church, and then continued our conversation while walking around the church grounds. The younger stonemason Halis Göksu, who had initially introduced us to Yasli was also with us, along with another stonemason from the vicinity. In the course of the conversation, Yasli was generally talking to the younger stonemason, while showing us details that he deemed important. At one stage, we were talking about the courses in the stone walls of the church, and I showed Yasli a window that was different from the rest of the windows in the same level: in contrast to the other windows on the front facade which had arched lintels, this window had a wooden lintel. When I asked about the possible reason, Yasli said, with some vehemence, "That is the shame of the mason!" and offered no further explanation.*

Another story told by retired Istanbul stonemason Selim Özdemir during the course of our interview features elements of myth combined with codes of ethical conduct, the tale however is essentially a technical account about the minimum required time for the settlement of foundations. In the anecdote,

326. A world heritage city in the southeastern Anatolia region, in Turkey, Mardin is on the Turkish - Syrian border. With a settlement history dating back to the 4500 BC, the area is known for its stone architecture belonging to the Artuqid Dynasty period from the twelfth century.
327. Mort Şmuni Syriac Church, in Mardin city center.

Süleyman the Magnificent asks Mimar Sinan to build a mosque to his name to withstand the most powerful earthquakes and further his glory. Sinan waits for the foundations to settle for seven years: "…so that they are subjected to seven summers, winters, storms, rain and frost…"[328] In our interview, Özdemir noted that the anecdote was told to him by a local old man when he was working on the reconstruction of a different mosque. In giving this detail, he stressed that the length of time masons spend on location is vital to their practice as this time enables them to form bonds with the people of the city and learning local stories.

Elias Yaslı's comment on the church window makes a similar point to that of Selim Özdemir. Such anecdotes based on a combined knowledge incorporating structural, ritual and material knowledge result in a different understanding of aesthetics that is intertwined with ethics of practice. Similarly, Özdemir's colourful narration of a mosque construction is a characteristic example of the oral tradition inherited from the Ottoman building culture, where ideas were transmitted through narration[329] for educating apprentices and ensuring their compliance with the rituals surrounding building construction. These types of oral histories are complex mechanisms in which knowledge is transferred via a combination of technical information, values to be inculcated, and ethical warnings. As studies in organizational knowledge management show, this combination is vital for knowledge transfer, which not only includes technical content, but is also dependent on a minimum amount of social and motivational cues.[330]

At the end of the stonemason interviews, an important distinguishing characteristic of the stonemasons' building practice was found to be their way of interacting with the site. In this interaction, the site, along with the materials housed within its confines is allowed to become an active participant in design and determines knowledge frameworks to be used in the design process in a variety of different ways.

328. Excerpt from SelimÖzdemir interview, Istanbul, 2007.
329. Erzen argues that the poetic nature of Ottoman literature showed many characteristics peculiar to oral cultures, where narratives depicting sensory qualities took precedence over conceptual analyses: "Rather than through abstractions and generalizations, ideas were transmitted through narration." For a more detailed account on the impact of narratives in Ottoman culture, see: JaleErzen, "Ottoman Aesthetics."
330. In particular see: IkujiroNonaka, "A Dynamic Theory of Organizational Knowledge Creation" in *Organization Science* 5, no. 1 (1994): 14-37.

Figure 34. Retired stonemason Selim Özdemir showing examples of his work, Istanbul, 2007.[331]

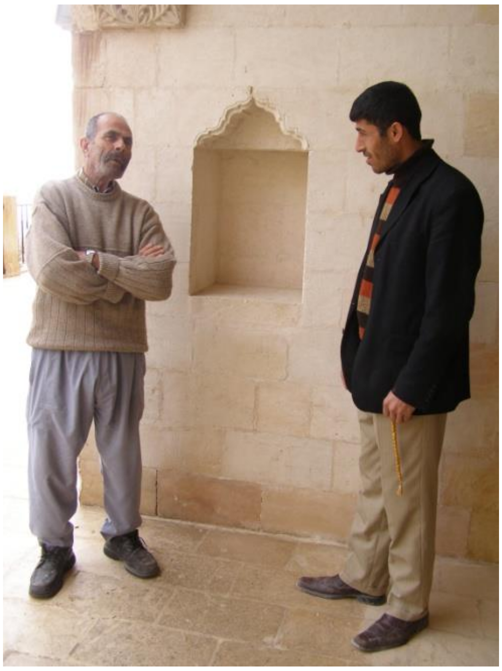

Figure 35. Retired stonemason Elias Yaşlı with younger stonemason Halis Göksu, talking about stonemasonry details in the Syriac Church, Mort Şmuni in Mardin, 2007[332].

Through the use of oral histories where site of the building is the main character in a multi dimensional story, the site becomes a narrative device for transmitting different facets of practice to younger practitioners. In this context, the site acts as an *abstract reference system*, in the manner of a practical guide that houses many precedents, and provides previous solutions suitable to local conditions while acting as a mnemonic device for practicing within the rules and regulations of a specific context. In this capacity, the site becomes a vital constituent in the handing down of design knowledge: through the transmission of tacit codes that belong to specific communities of practice, the site inculcates a design ethic in burgeoning practitioners and brings them in contact with the web of practice relationships.[333]

During the realization stage, the site acts as a *concrete reference point*, where the starting point of a building project has to be negotiated with the specificities of the site conditions. The actual point of origin of a building literally corresponds with a specific point on the site: usually the first corner of a building as narrated by the stonemason respondents. In most of the stonemason accounts detailing how to

331. Source: Photo by HayimBeraha.
332. Source: Photo by the author.
333. This process is called "legitimate peripheral participation" by Jeanne Lave and Etienne Wenger. Its theoretical background has been briefly discussed in Chapter 1 of this thesis. See: Lave and Wenger, *Situated Learning*.

make a building, this point of origin carried special importance, and the respondents repeatedly underlined the generation of the rest of the building's geometry from that initial starting point. This practical understanding of geometry, with real reference points on the building site, compared to the abstract points of origins of the design media used by architects provides a reminder of the tight knit relationship between the site and the project.

In a different capacity, the site acts as *resource*, providing the necessary building materials, enabling a building practice based on an economy of means. This is especially true in the case of rural stonemasons,[334] who refer to the stone of their area and other building elements gathered from the nature as the main ingredients of their work.[335] In its capacity as resource, the site provides experiential and performative clues to be read and interpreted by the designer, showing materials within their natural context.

The building recipes as told by stonemasons underline the importance of the assessment of the completed building as an important learning opportunity. The completion of the building reveals its structural and material performance as it unfolds in time, showing the relationship between the elements and the built artefact. In this sense, the slowness of stonemasonry construction makes it possible to understand the built artefact as a thing in becoming, instead of a fixed entity.

The interviews attest to the fact that both rural and urban stonemasons have an extensive range of structural and material solutions for building construction, and have perfected details in the single material of their expertise, but in the present practice context, their means of practice are severely limited by building regulations not attuned to the specificities of traditional stonemasonry construction.

334. This distinction is made in Chapter 3 of this thesis, when the list of the stonemason respondents is presented on page 73.
335. Many of the stonemasons referred to the local stones of their area, indicating that they recognized the specific behaviours of the local stones under specific climatic conditions. Most stonemasons also referred to the use of local plants, such as heather, as a reinforcing element in the foundations, or for insulation in the roofs.

4.3 Beyond the Workshop: The City as a Laboratory

Figure 36. The *Great Mosque* in Mardin, 2007.[336]

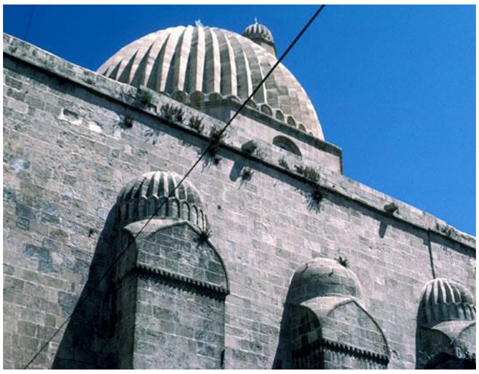

Figure 37. The *Great Mosque* from the southwest showing ribbed domes of the minaret, sanctuary dome and qibla wall buttresses, Mardin, 1984.[337]

> "- And indeed, this city, Mardin, is a source of inspiration for the architect."
>
> "- So, it's like a laboratory..."
>
> "- Aha! Congratulations, it really *is* like a laboratory. A museum, an open museum... [...] I don't want this beautiful art to die. Because it is a rare art – the greatest art, am I wrong?"[338]

Chapter 1 presented the dialogue between master designers and their immediate environment as a sign of expert performance and the highest level of skill, based on the phenomenological model of skill acquisition proposed by the Dreyfuses.[339] In this section, I argue that case based learning and the critical understanding of precedents distributed in the physical environment is also crucial for the development of architectural expertise. In order to elucidate my argument, I briefly discuss how precedents engender expert learning and how being immersed in an environment enables the development of a complex type of tacit knowledge by referring to stonemason interviews. This discussion brings up an undervalued strategy employed by burgeoning designers throughout history, and reframe *sightseeing* as an active learning experience vital to the maturation of design intuition.

In this respect, the format of the interviews was as revealing as the content of the conversations: In the twelve interviews conducted with traditional stonemasons, eight involved sightseeing walks, with building visits acting as the

336. Source: Photo by the author.
337. Source: Photo by Richard Brotherton from *Archnet Digital Library* at: http://archnet.org/library/images/one-image-large.jsp?location_id=14241&image_id=139759
338. Excerpt from Yusuf Kıdır interview, Mardin 2007. Note that even it is I, the interviewer, who has proposed the laboratory metaphor for the city, master stonemason Kıdır accepts it with such enthusiasm that I can absolve myself of imposing my frame of mind on the respondent.
339. Stuart and Hubert Dreyfus, *Mind over Machine*, 50.

backbone of the conversation. In the few interviews without this ambulatory format, the stonemasons showed samples of their previous work by referring to photographs, or by showing me around their workshops, all the while reminding me that nothing would actually replace seeing the real thing, and proposing itineraries with important buildings to be visited. This insistence on visiting precedents might seem to be a trivial detail in the stonemason interviews, however, by the end of the interviews, the coupling of indirect anecdotes with actual buildings emerged as an essential teaching strategy used by master stonemasons. In the stonemason interviews, the site was more than a mere backdrop; it acted as an active participant of the interviews, affording the peripatetic insight used by traditional master builders for centuries.

Throughout the stonemason interviews, all of the respondents invariably referred to their immediate environment to explain how they decide on the individual aspects of the buildings - as if selecting from a large repertory of patterns for each individual element of the building. This dependence on tradition might imply stagnation and lack of a creative approach, but in fact, all intangible and tangible processes within the life of the buildings and environments can act as precursors to architectural knowledge, if problems are adequately abstracted.

When the abstract aspects are distilled from the multiple clues within the environment, quite unexpected results can be achieved from the use of actual precedents. In this vast repertory, one can discern clues related to scale, size, proportions and interrelationships between components, the effects of which can be observed live within the urban fabric. It is experience and deliberate learning that enable designers to use the environment as a source of design knowledge.

In the quest for a more nuanced understanding of the life of buildings after the design phase, Yusuf Kıdır's reference to the city as a constant source of inspiration for architects is an important reminder: Even though the unmediated contemplative way the master stonemason relates to his environment would be hard to emulate for most novice designers, they would still benefit from an alternative way of finding inspiration besides their customary reliance on mediated sources like architectural publications.

Figure 38. Older stonemason with his former apprentice discussing construction details, Mardin, 2006.[340]

Figure 39. Author interviewing her former design tutor architect Steven Holl, Istanbul 2003.[341]

In the stonemason interviews, the reference to precedents were always an integral part of the conversation, the masons relying on the buildings in their immediate vicinity to make the points they wanted to make, or proposing routes for observing specific technical details embedded in key buildings of the city. In the image above, retired stonemason Elias Yaslı is discussing the notion of precision with us and Halis Göksu *through* the courtyard of the Syriac church, Mort Şmuni, where he is presently working as a caretaker. Every point he makes during the conversation is accentuated by referring to the details of the surrounding building. In opposition to the immediacy of the conversation in the stonemason interviews, where the man and his immediate environment is co-creating a knowledge space, my conversations with architects were usually less fluid, based on deliberate theorising and dependence on mediated sources like architectural publications, which I discuss in more detail in the next chapter.

One of the main revelations emerging from the stonemason interviews was the impact of the immediate physical environment on knowledge making practices. In the knowledge tradition of the stonemasons, which involves the use of the construction site as "an experimental laboratory in which the masons were able to see whether an innovation was successful,"[342] moving around is not just a pragmatic means of getting to the next work site. The peripatetic insight afforded by the constant interaction with different sites enable the traditional stonemasons to engage with the city on a more fundamental epistemological level by actively using the built environment as a repository of tectonic and spatial solutions to the problems at hand. This observation sensitized me to the potential of travel and

340. Source: Photo by the author.
341. Source: Photo from ElifKendir, "Idea and Phenomena: Interview with Steven Holl," *XXI* (November 2003).In the photo, Holl is talking about one of his built works by referring to an architectural publication showcasing his project with the author.
342. Turnbull, *Masons, Tricksters, and Cartographers*, 65.

sightseeing as deliberate knowledge making strategies. First hand experiences related to the ephemeral and time based aspects of architecture would unfold during these ambulatory "studies," and one would find the opportunity to come closer to the ancient knowledge traditions in architecture dependent mainly on active observation.

Some of the most important phenomena traditional Anatolian stonemasons observe within their environment are the effects of weathering. In most of the interviews, my stonemason respondents talked about how seasons, local climatic conditions, and patterns of use affect stonemasonry buildings according to the type of stone and the specific finish used in their construction. The stonemasons who work predominantly in restoration are especially aware of the affordances of the effects of weathering, and see this interaction between the building and the elemental forces that create the patina through the years as a welcome contribution to their design.[343]

Two of the stonemasons I interviewed were working in the stonemasonry workshop directed by the restoration office of Dolmabahçe Palace in Istanbul. All their work was related to the maintenance of this palace, the stones of which were being eroded due to the pollution generated by the constant traffic running by the palace grounds. In talking about their work, these stonemasons, Ramazan Güdüloğlu and Mustafa Özcan, frequently referred to time - not in the linear way we are used to, but in a cyclical way, talking about the endurance of different types of stones, and how often they needed to be replaced.

The cyclical relationship between the stonemasons and the palace unfolding in time also sensitizes them to similar phenomena in different places. The younger of the two palace stonemasons, Ramazan Güdüloğlu displayed a keen interest in different processes of weathering in other cities:

> "The stones in Mardin and Antep are these yellowish…very soft stones as far as I know. You will wonder how I know this. I made the *mihrab* ((niche showing the direction of the Qibla)) and the *mimbar* ((pulpit)) of the Great Mosque in Bingöl. They utilised those stones on the exterior. So I asked, and I'm curious since I work with stone here in the palace, I asked about the stone. They said it is Antep stone… I wondered if it would be too soft, but it had hardened in time, as the sun struck on the façade…"[344]

343. Authors of one of the most insightful books on the notion of weathering, Mostafavi and Leatherbarrow point to this creative opportunity:
"Is it possible that weathering is not only a problem to be solved, or a fact to be neglected, but is an unevitable occurrence to be recognized and made use of in the uncertainties of its manifestation?" Mostafavi and Leatherbarrow, *On Weathering*, 16.
344. Excerpt from Ramazan Güdüloğlu interview, Istanbul, 2007.

Figure 40. Practice map of Mustafa Tümay, a rural stonemason from Assos, Western Anatolia.[345]

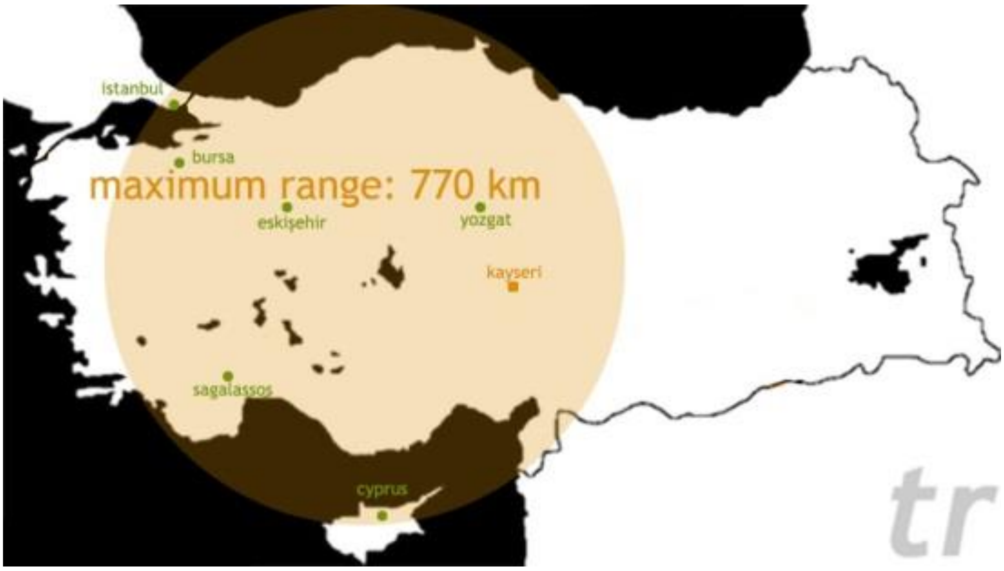

Figure 41. Practice map of Mehmet Özkavak, a specialised urban stonemason/ minaret builder from Kayseri, Central Anatolia.[346]

345. Source: Graphics by the author based on the interview data.
346. Source: Graphics by the author based on the interview data.

Many other stonemason respondents referred to the aspect of time in their narratives, a series of cautionary tales coupled with technical requirements. Their conversations featured a combined understanding of place, time and construction rituals, which resulted in a tacit indigenous material knowledge that exceeds simple technical understanding. In the case of rural stonemasons, who lived and worked in the same setting during the course of their life, their understanding of time and materials was enmeshed with their physical environment, providing a prime example of situated learning. The modest village stonemason Ali Onur, who indicated that he has never left his village to construct a house somewhere else even when he had been repeatedly invited, talked about the effects of weathering on the buildings along with the effects of time on his own body. This intimate understanding of the finality of one's own life and the natural cyclical progression of time gave this modest stonemason's knowledge the distinct character of true indigenous knowledge, intimately connected and in line with the natural environment.

In accordance with my initial predictions, narratives concerning weathering constituted a considerable part of the stonemason interviews. Since an integral part of their knowledge was related to the lifecycles of different types of stones and how these age and react to their surroundings, their insights concerning weathering in new buildings in their vicinity – bland concrete buildings characteristic of the contemporary urban environment – were also developed in terms of their thermal performance and structural stability. Probably the most distinguishing factor that makes stonemason's knowledge so different from the architect's was that they did not see buildings as finished artifacts, but as aging organisms, responsive to their environment. Most material topics, like the specific qualities of local stones, were discussed in relation to environmental factors – seasonal and diurnal changes like frost conditions, and the ages of the quarries from which the stones in question were extracted.

Although time and weathering did not come up in most of the architect interviews, there was one illuminating conversation with heritage architect and conservation specialist Burçin Altınsay Özgüner, who referred to the notion of weathering as argued by Mostafavi and Leatherbarrow as the main influence in her practice. For all architects dealing with aspects of construction, in or outside of heritage contexts, acknowledging weathering is crucial in understanding the design affordances of how buildings persist against the passing of time.

4.4 *Learning by (Un)doing: Strategies of knowledge transfer*

Figure 42. A pantograph used by stonemasons for replicating missing stones at Sagalassos archaeological site, Antalya, Turkey, 2006.[347]

> "Knowledge can be transmitted in a variety of ways. It can be by word of mouth. It can, as Bachelard suggests, be 'frozen' into the technique, [...] being materialised in the form of portable templates. It can also be transmitted through education and the establishment of a tradition. A tradition may or may not include theories and texts but always includes training, development of skills and the knowledge and observation of other structures and solutions."[348]

In cognitive psychology, procedural knowledge is usually defined as dependent on "learning by doing."[349] As discussed in Chapter 1, this knowledge is not easy to articulate and differs from declarative or explicit knowledge, being based on experience rather than didactic teaching or rote learning. During the stonemason interviews, the notion of "learning by doing" took on a new meaning: The interviews with traditional Anatolian stonemasons revealed that a considerable portion of their tacit knowledge was dependent on the act of *undoing* – the dismantling of existing buildings.

Learning by undoing, one of the main learning strategies of traditional Anatolian stonemasons, also corroborates the ANT approach that regards finished artefacts as *black boxes*.[350] According to ANT, a finished building reveals little of the knowledge making processes involved in its construction, and therefore is accepted

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347. Source: Photo by the author.
348. Turnbull, *Masons, Tricksters and Cartographers*, 77.
349. Robert J. Sternberg, *Cognitive Psychology*, 5th ed. (Belmont, California: Wadsworth, 2009), 303.
350. As previously discussed in Chapter 1, *blackboxing* is an ANT concept used to explain how "scientific and technical work is made invisible by its own success." See: Latour, *Pandora's hope*, 304.

as a black box. However, a building being pulled down is a great instructor,[351] displaying its process of construction in reverse for those who are able to use this opportunity as a learning experience. The traditional process of learning in building practice has depended on an active engagement with the maintenance, preservation, and demolition of buildings.[352] For stonemasons, working within a tradition is always a learning experience, as it is for architects, especially ones sensitive to working within heritage conditions. This issue is expressed not only by practitioners, but also by historians of architecture.[353]

During the interview with the master minaret builder brothers from Kayseri, older brother Ahmet Özkavak validated his expertise on traditional ways of construction by underscoring the fact that they had dismantled a great number of buildings.[354] The reconstruction work undertaken by stonemasons ranged from the repair and restoration of late 19th century Ottoman buildings to the reconstruction of Roman temples at archaeological sites.[355] In many of the stonemason accounts, the cognitive impact of deconstruction and reconstruction of historical buildings came forth as an important aspect of the traditional Anatolian stonemasons' learning experience.

The deep cognitive impact of restoration work on young stonemasons is best illustrated by Halis Göksu's account of the restoration of a room in an old Syriac monastery in Mardin:

> "HG - In '94, we built a room in the monastery, one with a stone vault, not a flat concrete ceiling. In the olden times they made all vaults in stone. It was a cross vault, with crossing arches from either side. They made it only out of stone. [...] And the stones were 120 centimeters long, 75 centimeters high and 30 centimeters wide. They were huge stones. So many kilos... The (monastery building) was really old; it had at least a thousand years of history. In those times, men were strong, they could lift such huge

351. Clark, "On the Construction of the Vaults of the Middle Ages," 3.
352. This issue, which came up in a number of architect and stonemason interviews under different guises will be discussed further as a part of the argument on the cognitive relevance of the site under construction in Chapter 6.
353. Among many others, see: Radding, *Medieval Architecture, Medieval Learning*; and Otto, *Ancient Architects.*
354. Özkavak said: "Biz çok binalar söktük." ("We have dismantled a lot of buildings") in response to one of my questions on the specifics of minaret building, and whether they were still using lead as a connector between ashlar blocks. In indicating his interest in historical systems of construction, Özkavak also referred to their travel to one of the most famous mosques by Mimar Sinan in Edirne, the Selimiye Mosque, with its slender minarets in which there are three intertwining spiral staircases made of stone. Excerpt from Ahmet Özkavak interview, Kayseri, 2007.
355. The photograph at the start of this section was taken at the archaeological excavation of an ancient Roman city of Sagalassos in the inner Mediterranean region in Turkey. I visited the site as part of my early exploratory interviews, searching for traditional Anatolian stonemasons. That was how I was able to come into contact with my respondents from Kayseri, who had worked in that excavation. The architects working as a part of the archaeological team referred to the masons' extensive knowledge of geometry, and how easily they adapted to devices like pantographs that were previously unknown to them, thanks to their extensive experience in reconstruction work.

stones, but now, if someone tells me to build an ashlar vault out of blocks of such magnitude, I would not carry them.

In the room ((we rebuilt)), some stones were broken down, some were rotten, some had fallen down, only half had remained intact. The stones on the (side walls) had also slipped out of place. Once part of (the room) goes bad, either the stones move, or the keystone moves, the stones on the sides also gradually slip out of place. So what did we do? We used thick poplar logs; we built pillars for each of them, each of the stones, and opened up the vault from the top. (*Pointing to the drawing while he describes*) For example, we open here, where the vault is, we split the vault open, took out the stones, and we see them from the top. So we went back to its initial construction. Once we had supported all of the stones with poplar logs, we opened the top to take out the keystone. We then let the remaining stones fall to take them out, leaving their places empty. Then what did we do? We sent a commission to the workshop to send this amount of stone. They sent them, but we were unable to lift those stones in place. Then we asked for a winch from Istanbul, one that works with electricity, and set it up on the roof. On the roof that was next to the room we were rebuilding. ...and hoisted the stones from below with the help of that winch. We were not able to find that kind of winch around here, ones that were able to lift stones that big, so we commissioned one from Istanbul, it was the year '94 if I'm not mistaken... So we hoisted up those stones, took the dimensions of the keystone, for instance 30 centimeters from below and 40 centimeters from the top, and brought the new stones to those dimensions. Then we glided the stones over the poplar logs, brought them in place and aligned them. Of course we used formwork, used the poplar logs, nailed wooden planks over them, and arranged the stones on those planks until we got an exact fit. We built an entire row in this way.

HB - How did you tie the stones?

HG - Now when we put them there, they locked in place from below. When there was a gap of 1 to 0,5 cm. we put ((extra)) stones. [...] After two or three days, we dismantled the whole framework. Then what did we do? We erected scaffolding, went up there and finished all the stones by taking out the extra parts. We made them into arches, so that ((the room)) looked as if it was newly constructed.

HB - It is lucky that the keystone was not displaced too much; otherwise it might have been more challenging to reconstruct the room...

HG – (*Showing on the drawing*) ...these stones on the sides had not slipped so much, but those at the top had, so I took them all out. They were displaced for more than 15, 20 centimeters, ((the displacement was)) almost 75 to 80 centimeters.

EK - Was this in '94?

HG - Yes, in '94.

EK - So you were 12 years old...

HG - Yes.

EK - Did you work with your father then?

HG - There was my father, my older brother, my oldest brother – we were working as a team..."[356]

This lengthy excerpt from the interview with my youngest stonemason respondent reveals the strong impression restoration work has made on the mind of a young stonemasonry apprentice. Göksu, 25 years old at the time of the interview in 2007, described the dismantling and reconstruction of an ashlar stonemasonry vault in great detail and with sustained enthusiasm. Towards the end of the story, he

356. Excerpt from Halis Göksu interview, Mardin, 2007. There were three people present at this interview: Halis Göksu (HG), Hayim Beraha (HB) and myself (EK). As explained in Chapter 3, Hayim Beraha assisted during some of the interviews by taking additional photographs, and occasionally got involved in the conversation by asking additional questions.

reverts from the first person plural to the first person singular, indicating his strong association with the story. In reality, at twelve years of age, he would probably only have carried out simple chores on the construction site, but his peripheral participation in the action seems to have nevertheless left an indelible mark on his mind, preparing the foundations for future instruction in his trade.

Stonemason testimonies on working in heritage buildings also revealed the challenges of "learning by undoing." After counting several religious and institutional building he has worked on, Yusuf Kıdır talked about the challenges involved in working on heritage projects:

> "Restoration work is more challenging for us... because we are prisoners (.) Prisoners of its art ((techniques used in the building)). This mosque I am working on right now is brand new. I can give it whatever form I like, nobody can contest. But when we are talking about restoration work, I am a prisoner. For this reason, it is harder for us. In terms of proportions, in terms of patterns, we are prisoners in every sense; you cannot go outside of it."[357]

This excerpt from the master stonemason reveals a highly skilled faculty of analysis that regards the building itself as an epistemic environment. These kinds of observational skills are vital for the development of an expert performance in design, where the designer does not regard her work as a routinised process, but is receptive to the clues provided by her immediate working environment. This is also how craftspeople hand down the tacit aspects of their craft – by utilising built artefacts as carriers of knowledge embedded within their structure, which can only be revealed through active work on the body of the artefact. With a long history of providing the epistemic artefacts for the construction of knowledge, architecture can benefit from the epistemic implications of site.

In the group of twelve stonemason respondents, only one produced texts in order to disseminate his ideas: Selim Özdemir, a master stonemason based in Istanbul not only teaches at the skills training institute, but contributed to their publications on one occasion. Acutely aware of the precarious state of traditional stonemasonry in Turkey, Özdemir uses alternative means of communication to hand down his mastery. However, within a distinctly oral culture, he remains the exception to the rule.

357. Excerpt from Yusuf Kidir interview, Mardin, 2007.

4.5 *"The Eternal Site"*[358]

> "Masonry as knowledge tradition, while not having any secrets, did differ in two important ways from other organised trades [...]. Firstly, they seldom practised their profession in one place; the job did not come to them, they went to the job. This exposure to new sites and the work of others was a constant spur to innovation. Secondly, the construction site was essentially an experimental laboratory in which the masons were able to see whether an innovation was successful. Talk, tradition and templates provided for a distributed, heterogeneous design process strongly analogous to the scientific theory building."[359]

One of the most revealing moments during the whole interviewing process came up when I asked Yusuf Kıdır, the master stonemason from Mardin, about the most challenging aspect of his work.[360] He referred to his experience of fifty-two years, which puts him in a position to tackle almost any challenge that comes his way, saying that it would be more relevant to talk about what satisfies him the most:

> "Do you know what ((I like most))? It is to sit opposite the building and watch it after it's been completed. That is the greatest pleasure. To this day – and I have been working for more than fifty, fifty two years – I have not been able to build a house of my own... I have not been able to do it, it just did not happen. But still, thankfully, I am content with my life. If I was young again, I would still pick this profession."[361]

Kıdır tells us that the satisfying moments of his work are the periods of contemplation, the act of watching the finished artefact following the completion of construction, the process of deep contemplation following the end of hard physical labour. That is when, he said, he could actively assess the result of his labour in its completed form, among the other artefacts in its immediate vicinity. His response was seemingly simple, but with profound consequences for the understanding of the way situated cognition works. Contemplating the finished work is not a passive period of rest – it is an active sequence of the tacit knowledge work carried out by the builder: While the body of the master mason is resting, his cognitive faculties actively assess the finished artefact in relation to its immediate environment.

Considering the vast difference between the scope and type of their work, one can ask whether the practice of traditional Turkish stonemasons has any relevance for contemporary architects. The findings of the field research show that this anachronistic niche in building practice still provides useful pointers for an

358. Brand, *How Buildings Learn*, 12.
359. David Turnbull, "Talk, Templates and Tradition: How the Masons Built Chartres Cathedral without Plans," in *Masons, Tricksters and Cartographers* (London: Routledge, 2000), 65.
360. In Chapter 3, I had pointed out the difficulty of translating the notion of "challenge"in Turkish. In the stonemason interviews, I reframed this question to ask what the biggest difficulty; or the most engaging problem that tests their ability would be in their practice.
361. "En cok ne biliyor musun? Isi bitirdigim zaman karsisina oturup seyretmektir.En buyuk zevk odur. Bugun elli sene, elli kusur sene, elli iki senedir calisiyorum, kendime bir ev yapamadim…-Yapamadim, olmadi. Amma gene de, cok sukur, hayatimdan memnunum. Genc olsam bugun gene bu meslegi secerdim." Excerpt from Yusuf Kidir interview, Mardin, 2007.

innovative architectural practice through the recognition of the design affordances of the construction site. The stonemasons' engaged dialogue with the construction site reveals the site as a domain replete with diverse cognitive, pragmatic and creative potential. This lies in opposition to the conception of the site as an inert background by cotemporary architects, their site analysis studies conducted at the start of a project, more often than not resulting in an abstraction of extant conditions. While these analytical studies are a necessary means in coming to terms with the site and grasping its reality, the site is commonly regarded as a limited piece of land rather than as an integral part of a larger environment.

The interviews with traditional Anatolian stonemasons depicted in this chapter show the different ways the building site affects the generation, transformation and transmission of design knowledge. In their reciprocal interaction with the building site, traditional Anatolian stonemasons let the site influence their design in three key ways: as a *repository* of design information; as a *resource* of materials and skills; and as an *observation platform* acting as a testing ground through time.

In its capacity as a *repository* of design information, the site provides abstract and concrete references in the form of building codes and regulations embedded within artefacts. In contrast to the architects' deliberate study of these reference systems through mediating documents, stonemasons utilise information encoded within the site, deciphering information on patterns of use, indigenous responses to local conditions, and local regulations through the study of precedents.

The study of precedents as a design strategy involves *active sightseeing*: As suggested by Turnbull, traditional stonemasons' exposure to new sites hones their observational skills that are necessary for an innovative practice, similar skills being degraded in architects due to their reliance on mediated information.

Another distinguishing characteristic of the stonemasons' use of precedents to extract design information embedded within the artefact involves *learning by undoing*: By dismantling or deconstructing existing buildings during restoration work, traditional Anatolian stonemasons actively engage in a dialogue with the precedents, reverse engineering the performative and structural solutions encoded within an otherwise mute building, reactivating its epistemic potential through unmediated interaction.

As discussed in the first section of this thesis, theories of design thinking in architecture also point to the use of precedents in architectural design as a common strategy among designers.[362] An illuminating way to think about precedents comes from Kevin Lynch and Gary Hack, where they discuss prototypes and stereotypes as two kinds of precedents that are often utilised in building practice.[363] Lynch and Hack note that common stereotypes are unavoidable, however, "the danger lies in using them unthinkingly."[364] The interviews in this chapter feature a variety of common structural or typological stereotypes used by the traditional Anatolian stonemasons. Their contribution to the development of architectural knowledge lies in their engagement with the specific nature of each problem within a different location, and the criteria they select to employ based on their multi-dimensional interaction with the immediate and larger physical and social context.

In its capacity as a *resource* of materials and skills, the site imposes an *economy of means*. The interviews with the traditional Anatolian stonemasons show that the material knowledge of the masons is necessarily based on this principle: Their accounts of the building process depict nature as a resource to be nurtured not exploited, advocating the sustainable use of the resources by favouring local skills and local materials. Contrary to architect's material knowledge, their expertise is not based on material samples, but on active bodily engagement with the material itself, and on a visceral recognition of their affordances. This recognition of material affordances, a direct result of a reciprocal bodily interaction with the raw material, involves knowledge of materials as a part of the physical environment, with performative characteristics in line with the local conditions.

Finally, in its capacity as an *observation platform*, the site reveals the impact of elements as the built artefacts unfold in *time*. The site, in its eternal persistence, shows the effects of weathering and structural and material performance through time. The traditional Anatolian stonemasons recognize the state of flux in sites, and actively assess the buildings as they persist in time, learning valuable lessons on material and structural performance as affected by natural elements.

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362. Bryan Lawson, *What Designers Know*, 99.
363. "Forms that are a model to be emulated become prototypes. Those that are used very often are stereotypes. [...] Our heads are full of such customary forms, and we know something about the situations for which they are appropriate. People who do not call themselves designers use them repeatedly, making minor adaptations to fit to any current situation. Avowed designers review the literature for previous solutions, follow the fashions of the day, and *use common stereotypes without being conscious of them.*" Lynch and Hack, *Site Planning*, 129.
364. Ibid., 130.

CHAPTER 5. *The Office*

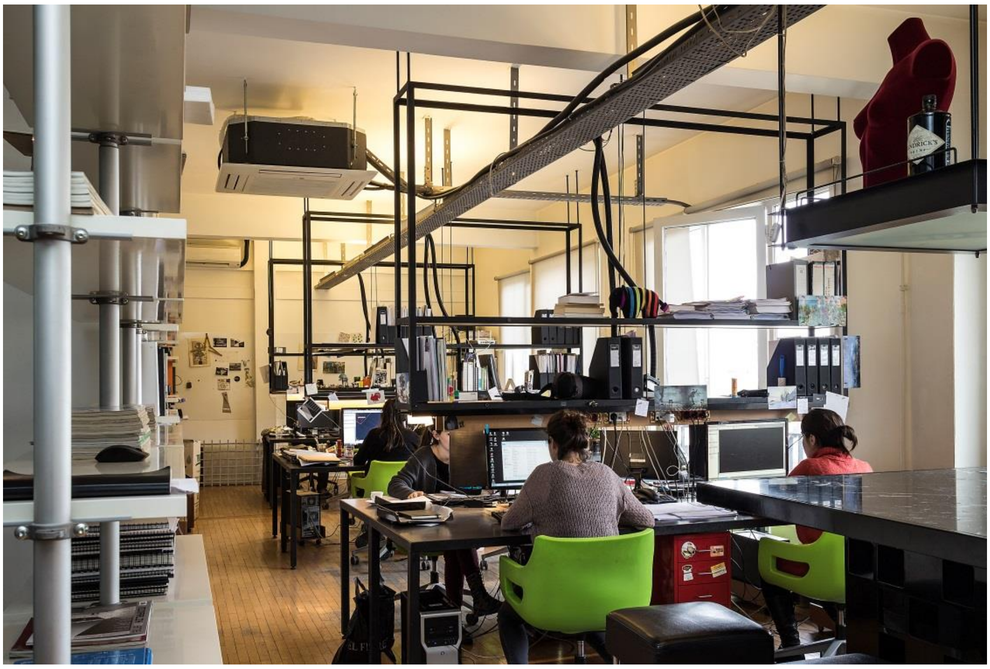

Figure 43. Interior from Teğet Architecture, showing the main workspace with the office bar to the far right of the picture, 2014.[365]

> "A bureau is, in many ways, and more and more every year, a small laboratory in which many elements can be connected together just because their scale and nature has been averaged out: legal texts, specifications, standards, payrolls, maps, surveys. […] the bureau is something that can be empirically studied, and which explains, because of its structure, why some power is given to an average mind just by looking at files: domains which are far apart become literally inches apart; domains which are convoluted and hidden, become flat; thousands of occurrences can be looked at synoptically."[366]

This short chapter investigates the architect's office as a site of knowledge production by comparing and contrasting the knowledge making practices used by different kinds of architects with those of traditional Anatolian stonemasons. As the locus of the architect's day-to-day existence, the orderly design office provides an interesting counterpoint to the messy realities of the construction site. As Latour points out in the quote above, the main distinguishing characteristic of the office space is its reliance on the "file:" Nowadays both digital and physical, these modules of abstracted information enable designers to synthesise complex variables related to the site, materials and building codes within a common representational medium.

An architect's office displays elements of design in a somewhat flattened state – even when there are three dimensional representations of the sites and the

365. Source: Photo by Teğet Architects, 2014.
366. Latour, "Visualization and Cognition," 25.

buildings that are being designed by the office, the process of selective abstraction is a necessity for design data to be manageable. As discussed in Section I, architectural practice is essentially based on a process of translation, and anything that does not lend itself to visualization gets lost along the way. In a way, the design process starts at the same time the designer decides what to include in the set of abstractions he/she will use in designing the building. In routine architectural practice, site-specific conditions such as local skill sets, existing patterns of use, and local climate are often undermined, with the building site reduced to its shape, size, and topographical properties. The loss of some information notwithstanding, defining the ground of intervention and enabling information to be mediated in order to work at a distance is a necessity for contemporary architecture, especially now, when offices work around the clock across separate continents.

The interiors of architects' offices feature a vast array of artefacts - models at different scales, maps, rolls of sketch paper, material samples, catalogues, architectural publications, reference books, various stationary, the office's previous projects exhibited through presentation drawings and models, as well as the ubiquitous computers which have become the norm for design drafting as well as design development since the late 1980s. During a normal day, architectural offices display an organized chaos formed by the people working and the artefacts they use to produce their work. When designing, architects are enveloped by this environment that affords constant stimuli coming from the artefacts and tools of representation. Site visits also enable a similar activation of situated cognition which influences design thinking by means of visual clues - like colour, texture, or form; as well as non-visual ones - like scale, acoustics, or climatic performance - surrounding the designer's immediate vicinity.

In this chapter, the techniques and skill sets of architects are discussed in relation to the different feedback loops various architects utilise in conceptualising the building production. A juxtaposition of the methods employed by architects with those of the stonemasons suggests that self consciousness about design techniques and methodologies is one of the starting points for design invention.[367]

367. "Self consciousness" as a distinguishing trait of modern designers from vernacular builders is already suggested by Christopher Alexander in his books. In particular see:
Christopher Alexander, *Notes on the Synthesis of Form* (Cambridge, MA: Harvard University Press, 1964).

The process of designing is an intriguing area for researchers, with its vaguely defined problems and poorly understood procedures that lead to the final design outcome. More often than not, we come across the "black box" analogy, especially in reference to design ideation. In the previous chapter using an ANT approach, I referred to buildings as objects in black box status, and discussed how stonemasons reiterate the strategies used within traditional buildings by a process of reverse engineering. Compared to traditional stonemasonry, the ideation phase in architectural design has arguably become more transparent and explicit due to the impact of information technologies and the increased interest in design tools and techniques. We are at a period where our self-conscious attitude towards design tools and techniques has resulted in an expanded formal vocabulary as well as a more informed assessment of our design intentions.

This chapter also explores the adoption of particular roles and the inherent division of labour in architectural practice in relation to the material settings of these interactions. Throughout this section, I refer back to the evolution of the role of the architect from a situated building practitioner to an office worker that manipulates information within an abstract design space, and how this particular change in the definition of the architect's role influences the formation of architectural knowledge. I especially refer to the role of the architect during the stage of implementation and how it feeds back into the design knowledge.

In the previous chapter, I referred to the setting of the stonemason interviews as active participants in my conversations with the traditional Anatolian stonemasons. In this second set of interviews, the impact of the interview setting was mostly negligible. I conducted most of the architect interviews within the respondents' offices, apart from two interviews out of twelve.[368] In only three of the ten architect interviews that I conducted within an office was I invited to take a tour of the office, or to view the artefacts that were referred to during the course of our conversation, and featured as part of the office environment.[369] One strong exception to this situation was the Sagrada Família Basilica design office, which acted as a cognitive infrastructure during most of the design conversations

368. The interviews I conducted outside of an office setting was with Tom Daniell, whom I interviewed at our university during one of his visits to Australia, and with Mehmet Kütükçüoğlu, whom I had to interview in a café due to scheduling conflicts.
369. The architects who utilized their office environment as an active part of our interview were Burçin Altınsay Özgüner, Bruce Allen, and Alexis Şanal.

conducted on office grounds.[370] This is not to say that architects do not use their immediate physical environment as an extension of their thinking processes – it is just that in daily practice they seem to do it without deliberate intention, unlike the stonemasons who underline the potential of the physical settings as a valuable teaching and learning tool at every opportunity.

Before moving on the individual subsections, it is important to note the heterogeneity of the architect respondents involved in this research: spread across four countries, individual practice contexts and various practice backgrounds make deriving general conclusions from this small but varied sample very difficult, if not impossible. Each architectural practice has a distinctively different working method, and the extrapolation of the data gathered from such a variety would only become meaningful if the substance of comparison between the respondents is discussed before the presentation of results. Distinct routes of expertise like restoration or construction management notwithstanding, generalist architects tackle with a variety of design problems. Nevertheless, as a "control group" to be juxtaposed with the first set of respondents, this heterogeneous group gives a qualitative idea of different kinds of knowledge making processes in architectural design, and how they are affected by different degrees of involvement with the process of construction.

In the following pages, individual subsections of this chapter present different aspects of architectural practice within an office environment. In subsection 5.1, Office Hours, the different areas of expertise are presented in relation to individual design processes. The next subsection, 5.2 "Translations from Drawing to Building," investigates the ways in which architect respondents process information during their daily practice. In subsection 5.3, On-Site / Off-Site, the impact of sites in the generation of design knowledge is discussed at two different scales. In subsection 5.4, "Models, Mock-ups, Rehearsals," the means by which architects engage the site of construction into their design process is presented and the relevance of such strategies as the basis of collaboration between different building practitioners is discussed. The final subsection, 5.5 The Mediated Site, sums up the general findings from the architect interviews and presents what the architect respondents consider to be the biggest challenge in their current practice.

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370. The specific case of the Sagrada Família design office will be described in the next chapter as a deviant case scenario.

5.1 Office Hours

Figure 44. Snapshot from Sanal Architects showing samples for a façade propped up against the wall on the office entrance, 2011.[371]

Figure 45. Snapshot from Burçin Altınsay Özgüner's office showing hard hats along with site surveying equipment, 2008.[372]

> "- And how would you describe your area of expertise?"
>
> "- I'm an architect, architects don't have areas of expertise, they have to do everything…You know, I'm the director of the company so I have to direct the company. And I do… [long pause] >I design and document buildings<"[373]

In Section I of this study I referred to the environmental philosopher Christopher J. Preston, and his approach to knowledge making practices which underlines the impact of physical sites on cognitive conditioning. In elaborating on the nature of the attitudes that negate the impact of physical sites on thinking, Preston proposes the closed office space as one of the settings that enable philosophers to engage with abstract knowledge work, "work of the mind," free from sensory distractions:

> "The library and the closed office space have usually been considered the most reliable sites for the production of philosophical knowledge. The freedom from sensory distraction that these places offer allows philosophers to forget for a while that they are embodied creatures and enables them to engage in what appears to be the purest of all kinds of work, the work of the mind. In these settings, the enveloping earth is nowhere in sight."[374]

There is a difference in kind between how architects work in their offices and the knowledge work carried out in the workspaces of philosophers. Architects

371. Source: Photo by the author.
372. Source: Photo by the author.
373. Excerpt from the interview with architect Paul Minifie, Melbourne, 2009.
374. Preston, *Grounding Knowledge*, 74.

constantly interact with physical objects and manipulate symbolic representations such as drawings and models that refer to sensory realities outside the office. However, the relative distance from sensory realities of the construction site may still undermine the actual physicality of the buildings, making it a secondary concern within the abstract design space.

In the group of architect respondents, most were directors of their own firms except for those involved in the Sagrada Família Basilica design office.[375] The group of architect respondents featured a variety of practice backgrounds which involved different degrees of engagement with the construction site: Two of the respondents, Mark Burry and Bruce Allen, were closely familiar with design-build practice, and had decided to change their respective career paths to devote more time to designing without the financial and managerial responsibilities that are a part of the design-build environment. Allen also had a craft background in metal fitting, but had later decided to study architecture and urban design to expand his practice opportunities. At the other end of the spectrum, there were young practitioners like Mehmet Kütükçüoğlu and Tom Daniell, who have a strong competition background, and who had recently started to get involved in the realization stage in architecture. There were practitioners like Paul Minifie, who adamantly opposed the idea of a craft based approach in their practice,[376] and prioritised the abstract opportunities afforded by the form and concept generation aspect of architectural design, while keeping his involvement with the construction stage to a minimum, preferring an "industry standard" involvement with the construction site. In contrast to this approach, architects like Alexis Şanal and Burçin Altınsay Özgüner were actively involved in the stage of realization, and regarded the site of construction as a place of learning.

Some of these differences in attitude are related to the definitions of expertise defined by the architect respondents, with some specializations requiring a closer interaction with the construction site by definition. Burçin Altınsay Özgüner, architect and conservation specialist and Antoni Caminal, technical architect and expert in stonemasonry, are such examples. However, in the case of generalist architects, the degree of involvement with the construction site is largely a

375. Mark Burry and Antoni Caminal.
376. "...what I would refer to as a kind of discourse of authenticity around material and craftsmanship and so on... [...] that kind of discourse [...] is not the kind of discourse and a set of evaluation that I'm interested in applying in architecture..." Excerpt from Paul Minifie interview, Melbourne, February 04, 2009.

matter of self-imposed role definitions, and the adoption of an agenda that prioritizes an economy of means, as in the case of Alexis and Murat Şanal.

Differences among the individual practices aside, the process of design in the daily life of architectural offices appear to be relatively similar; especially when compared with the knowledge making practices utilized by traditional stonemasons. As indicated at the start of the chapter, the main activity within the design office is the production of information which is mediated. Apart from ubiquitous computers used as drafting stations, work within a design office involves sketching, the building of physical models, preparation of reports, and the display of the results of these activities throughout the office for feedback from the employees, as well as for the purposes of informing actual and prospective clients. In describing a usual day at work, architects listed additional activities such as extended meetings with employees and consultants, site visits, report writing, and researching for case studies.

Compared to the group of stonemason respondents, the architect respondents have less in common with the exception of the size of their practices. However, office size is considered to be a decisive factor in defining the specific character of the architectural office, and one of the first distinguishing features expressed by architects when defining their practice.[377] According to Dana Cuff, small offices - with less than 10 employees - are characterized by "informal management, less specialization, lower pay, smaller-scale projects, direct contact with clients and consultants, a higher concern for design quality, and few bureaucratic traits."[378] These characteristics are corroborated by the findings from the interviews conducted with architects in directorial positions in small scale practices. I was able to gain insights on the complex interactions between practical considerations and design knowledge thanks to the non-corporate character of small offices, where there is less alienation in terms of work involvement, and a more hands on approach with regards to decision making throughout the realization phase of building.

The decision to remain small was expressed by many architects I interviewed. In expressing this decision, the architects suggested that the hands-on aspect of their practice also enabled them to be quite agile without the need to

377. See "The Place of Practice" in Dana Cuff, *Architecture: The Story of Practice* (Cambridge, Mass.: MIT Press, 1991), p.45.
378. Ibid., 46.

redesign the whole office structure. The size of the office also meant that specialization and strict division of labour within the office was kept to a minimum.

> "...within the office everyone is essentially (0.8) essentially our office is fairly small, so it tends to be fairly horizontal, and it means that there isn't a large degree of specialization, that occurs between different people and we expect any person to be able to work across the full range of architectural stuff that you have to do. [...] I think there are some key issues: one is that the specialization within an architect's office doesn't really make sense until the office gets quite large and even then it often doesn't make sense either."[379]

In many of the architect interviews, there were various (positive and negative) references to "crafts based architects," even though none of the architects defined themselves in that way. This definition is also found in architectural discourse, usually denoting a hands-on interest in construction, close collaboration with builder teams and a somewhat impractical attitude concerning financial matters - a constellation of attitudes generally adopted by small architectural firms. In elucidating what this might mean for the nature of the architectural knowledge as affected by practice, I must first discuss the notion of "normal" practice based on my field observations and by referring to the interviews. The difference in design attitudes associated with "normal" practices and innovative practices were voiced as distinguishing characteristics in most of the architect interviews.[380]

Even though I did not have enough acquaintance with the social atmosphere of each office, the ones I was more familiar with strived to ensure a spirit of collaboration and get their ideas across within an informal environment of interaction. Without the close ties of the brotherhood of the masons, architects in the modern world create this atmosphere of collaboration and shared ideals via different means. Some of the more self-conscious ones among the interviewed referred to their "happy hours" in the office, where all team members could relax, and feel initiated into the social life of architects. In fact, a couple of the architect interviews were carried out just before those happy hours, and I was invited to stay on after the interview was over, to mingle with other team members.

> "Well, this is it, this is the office. It's just a small, friendly, opposite of... I see it as more of a lifestyle, than a workplace. I spend a lot of time here. We treat it both as a place of work and a place of social... a social place as well. But everyone is very serious... You know, we've all got... one of the criteria in selecting staff is that they have a good sense of humour. We do have, I mean the office does have a sense of humour but on the other hand we all take work very seriously... And the ideal size I'm finding is around five to eight people... that are the way I like to work..."[381]

379. Excerpt from Paul Minifie interview, Melbourne, 2009.
380. This issue was raised specifically by Mark Burry and Bruce Allen, and implicated by Alexis and Murat Sanal.
381. Excerpt from Bruce Allen interview, Melbourne, 2008.

I went to Allen's office on a Friday afternoon, as he wanted me to stay and observe the atmosphere around the office at the end of the week, where the small group of people gather around drinks and snacks in the meeting room and informally talk about the past week. Allen explained how the convivial atmosphere of the office was maintained by underlining the importance of a sense of humour in determining the atmosphere of the work environment.

5.2 *"Translations from Drawing to Building"*[382]

Chapter 1 provided a discussion on the characteristics of representations, how they relate to perception and cognition, and the creative opportunities afforded by the translation from the project to the built artefact. This chapter points to the different affordances of the different representational media such as different kinds of drawings, the use of modelling, both digital and physical, and discusses the use of abstract geometry for form generation as opposed to the use of practical geometry by the traditional stonemasons.

When asked about their set of tools, architect respondents listed a variety of representational media ranging from different types of digital modelling software, to site visits and texts. In this list it was the hand drawing that predominated: as a medium for thinking, sketches and the like still providing the easiest way to make design thinking explicit whilst using a minimum of resources. Another important medium of design communication mentioned by the architect respondents was dialogue: similar to the stonemasons' building practice, talking and listening was defined as essential precursors to formulating a relevant design proposal. One of the unexpected items on the list was research defined as a design tool. In a mediated version of traditional stonemasons' working method, Paul Minifie mentioned the research of precedents as an important design tool.

While the working drawing is slowly being subsumed under the bureaucracy of contractual obligations,[383] its epistemic potential for furthering design work nonetheless remains secondary; the knowledge embedded in and achieved through the mediation of drawing, diagramming or modelling, is as such, worthy of further inquiry.

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382. Title borrowed from Evans, *Translations from Drawing to Building*.
383. JosephRykwert, "Translation and/or Representation," *RES: Anthropology and Aesthetics* (1998): 64-70.

In Chapter 2, I discussed the mediating aspect of representations and their relation to making. In the architects' offices, types of representational devices used to represent the realization stage ranged from shop and detail drawings; detail models, and integrated 3D models, to material samples, prototypes, and rehearsals on site. The representative aspect of these various media leans more towards the concrete as the degree of involvement with the actual construction stage advances.

It is common knowledge that the architects are not supposed to work on site themselves, much less develop an affinity with a single material. In order to keep up with the times, architects have to have the agility to develop their ideas through a multitude of different materials. In the myth of the architect as the master builder, the romantic notion of the architect who claims knowledge of materials, of the building process and innovative design; using all his/her expertise to produce excellently crafted buildings persists. In reality, such a claim would bring contemporary design process to a near absolute halt,[384] such knowledge encyclopaedic in scope and subject to continual updating.

In comparison to the visceral interaction of the stonemasons and their materials, architects material selection process involved various different considerations. Owing to the necessity of working across several materials, theirs was not a bodily involvement, although at times the selection process could sound extremely sensuous.[385] David Leatherbarrow points to the ambiguity of the material selection process saying that it is a "rarely discussed procedure and one that exposes strikingly obscure and indefinite thinking when questioned."[386]

During the architect interviews, there were a couple of interesting comments about the process of material selection. Some responded that it was a matter of course, and that their selection mainly depended on fiscal criteria.[387]

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384. As Richard Neutra in his 1954 book *Survival through Design* notes, the times where the paucity of material choices made such an expertise possible are long gone, and the properties of materials used to build a "little road-side service station" would make a considerable tome if listed in writing:

> "Once upon a time, the material specifications had been short and simple. For the Parthenon they were marble, quarried in the neighborhood. This was the only material employed from flooring to roofing. Now, the material specifications, not only of a huge monument but even of a little road-side service station could easily fill a heavy tome if they were to be pounded out on a typewriter."

Richard J. Neutra, *Survival through Design* (Oxford: Oxford University Press, 1954), 117.

385. One architect that immediately comes to mind is Peter Zumthor, who often refers to his material selection process in sensuous terms. See: Peter Zumthor, "A Way of Looking at Things," in *Thinking Architecture*, 2nd ed., (Basel: Birkhäuser, 2006), 7-28.

386. DavidLeatherbarrow,"Material Possibilities," in *The Roots of Architectural Invention: Site, Enclosure, Materials* (Cambridge: Cambridge University Press, 1993), 143.

387. Paul Minifie was the only one of my architect respondents who listed cost as one of the first factors in the material selection process. However, although it was not the first criteria listed in the rest of the

Others were quite poetic on the issue. Mark Goulthorpe, when referring to an apartment renovation project in Paris, narrated his interaction with his client, and how the client's materials preferences shaped the final design. In this account of his project, he noted that the builders were also on board with the harmony of the materials, and one of the carpenters actually made a very insightful remark concerning the material affect and its relation to the client's childhood memories in Africa.[388]

It should be noted that collaboration is of great importance here: No longer master of a single material, architects should still be open to endless possibilities arising from different materials, and be prepared to enter into a creative partnership with the craftspeople on realizing these possibilities within their designs.

In the current discussions on the intermediary step between design conception and construction, models, both digital and physical, are suggested as the medium for design iterations, taking on the former work done by design drawings. The closest architects come to a bodily encounter with materials is through building models. Although model materials in no way reproduce the material and structural qualities of building materials and their actual structural behaviours, they still provide tactile feedback to the designer triggering a series of thought processes not available through computer models or line drawings.

In my interview with architect Mehmet Kütükçüoğlu, he described how he encouraged people in his office to "play with tools" and use them in tasks for which they were not intended in order to break free of technical determinism. Any discussion on technique involves an investigation on the notion of the medium of representation, translation, the notion of scale, and, if the researcher is familiar with knowledge management or innovation studies, a comment on the epistemic work carried out by artefacts. In design professions, all techniques of representation

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interviews, apart from the case of the Sagrada Família, cost was always a point of consideration when architects talked about the selection of materials.

388. "I know what I don't want - I don't want design. Give me austerity, materiality and that .[53:01] He's an extremely lucid contemporary film producer. And he seemed to be articulating... He couldn't clarify what he meant by that, but he knew that he was after something that was different from the current imposition of a stylism or something – Philippe Starckism of life. And in the end two and a half years later when we finally built that house, one of the carpenters said to me, "you realise what we've done in this apartment, you created a digital desert, which is his childhood memory in North Africa – and it floored me that the carpenter had spotted that – but, the choice of every kind of element and every material was his personal and material yearning that we then had to go and identify: so he didn't like red woods or beige woods; he liked silver wood, but he didn't articulate it as that was some bleached wood from North Africa. [...] He was yearning for architecture as a material memory, not as a representational, or abstract kind of imposition."
Excerpt from Mark Goulthorpe's comments during my 5th GRC review, Melbourne, October 2008.

are tools of the trade. A compositional and poetic engagement with tools enables the reconsideration of design practice as a process based on iterative evolution and performance.

5.3 On-Site / Off-Site

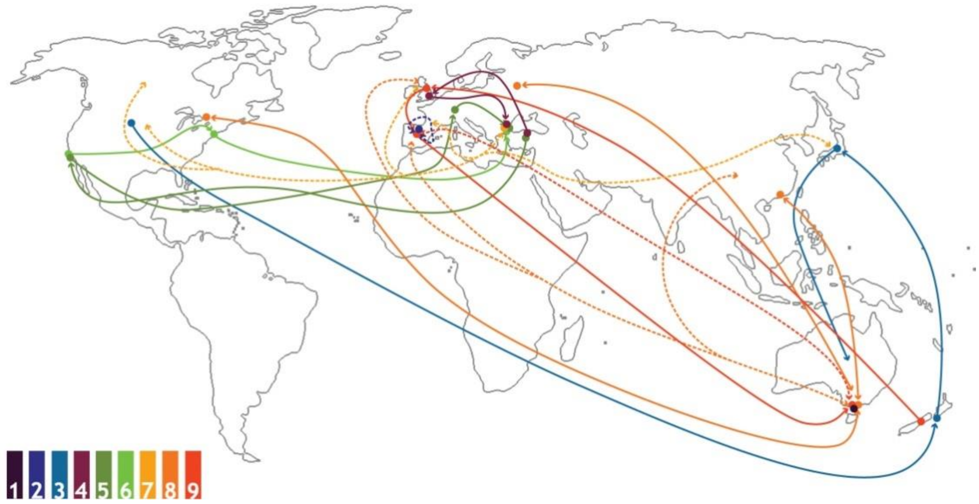

Figure 46. Superposed practice maps of architect respondents: **1.** Paul Minifie; **2.** AntoniCaminal; **3.** Tom Daniell; **4.** Burçin Altınsay Özgüner; **5.** Mehmet Kütükçüoğlu; **6.** Alexis Şanal; **7.** Han Tümertekin; **8.** Bruce Allen; and **9.** Mark Burry.[389]

> "I like the challenges of working in strange places, you know, where there's more than just the design of the building involved."[390]

Owing to the nature of my respondent group, it became evident that the specificities of the building cultures in "strange places"[391] and their potential to encourage new ways of thinking was an attractive challenge for architects: A period where a young architect travels abroad to gain experience in a different cultural setting emerged as a "global apprenticeship" phenomenon throughout the interviews. The itinerant background of this specific group of respondents was driven by a motivation to visit centres of excellence, or to practice in different building cultures.

An overview of the practical and educational background narratives of my architect respondents characterizes this specific sample as a globalised tribe. Among the ten interviewees that I decided to include in this research, only two have stayed in their country of origin, while the rest were either educated abroad, worked

389. Source: Infographic design by the author, execution by the author and Ceren Balkır Övünç. The practice maps are based on respondent statements concerning their education and practice backgrounds. For individual practice maps of each respondent, see **A.8** in the *Appendices*.
390. Excerpt from Bruce Allen interview, Melbourne, 2008.
391. His terminology: During the interview, Bruce Allen indicated that one of the defining characteristics of his office was the international project portfolio, and said that he liked practicing abroad, as the experience made him aware of the cultural specificity of each building industry.

as an expatriate architect for a while, or both. In fact, three of my respondents were practising as expatriate architects at the time of the interviews. Although not a generalizable characteristic, the exposure to different sites and practice environments on a global scale affects the attitudes of the architects, as their responses to the impact of local building culture on their design approach clearly demonstrate. The responses to interview questions illustrate that interacting with more than one building tradition and experiencing different working cultures foster a nuanced sensitivity towards the peculiarities and potentials of a given building context.

Although impossible to state definitively based on the small number of interviews conducted, it seems that the respondents who valued exposure to new sites through their practice or education abroad were also more open to the influence of site-specific characteristics when formulating their design approach. During the interviews, many architects expressed an interest in using local resources, although few had formulated explicit strategies that would make this possible. Şanal Architects was one of the few offices that could elucidate their work process in relation to making use of the affordances of local situations:

> "For all the obvious reasons and ethics of environmental design, we always always prioritize local materials and local labour to avoid any type of absurd transportation >like shipping stone around the world<..."[392]

In most of the architect interviews, similar intentions were voiced by young practices that were coming to terms with the risks and opportunities offered by the various indigenous situations encountered during the realization phase of architectural design. By "reflecting in action" as suggested by Schön,[393] they become aware of the impact of construction on the site and the landscape, realising the design affordances within each stage of construction, as well as their ecological impact.

One of the minor revelations of this part of research was that even outwardly leisure activities such as travel and sightseeing could be used as deliberate knowledge making strategies. First hand experiences related to the ephemeral and time based aspects of architecture unfold during these ambulatory "studies," and

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392. Excerpt from Alexis Şanal interview, Istanbul, 2011.
393. "In a good process of design, this conversation with the situation is reflective. In answer to the situation's back-talk, the designer reflects-in-action on the construction of the problem, the strategies of action, or the model of the phenomena, which have been implicit in his moves."
Schön, *The Reflective Practitioner*, 79.

one comes closer to the ancient knowledge traditions in architecture dependent mainly on active observation.

In Chapter 1, I referred to the cognitive impact of "dislocating experiences" as proposed by Preston. In the stonemason interviews, sightseeing was proposed as a cognitive strategy used by builders to maximise their architectural vocabulary by way of exposure to new sites with diverse patterns of habitation and architectonic solutions. This theme also emerged in the architect interviews, especially with the three expatriate architects, who arguably have the strongest "dislocating experiences" during their initial induction to practice within a different cultural and physical environment.[394] One of the architect respondents, an American expatriate architect practicing in Istanbul, Alexis Şanal, regarded working in a different cultural environment as a creative challenge:

> "The problem is just that certain tools are designed under certain assumptions – and I think that until you have those assumptions in your market, they often don't make sense... For example *Revit* assumes that people make decisions with foresight, well people don't make decisions with foresight in Turkey, so it doesn't... I mean no matter how great of a tool it is, it doesn't make sense here because nobody's deciding those things in the <schematic design>... They decide them on site, and they decide them based on the economy of the moment... Although there are certain things that I'd really like to move into like those systems >and we've been investigating it a lot and trying to start finding projects that make sense for it< the tools you choose, the process you choose, and the culture of building that you work with (0.5) has a lot to do with it..." [395]

Here the designer is negotiating a fine line between the tools at hand, tools that she has been accustomed to using in the initial stages in design and the architectural market within a different culture. It is possible to observe from this contested interaction that operating within a new social environment brings out the necessity of adopting new habit and employing new tools, which challenge the accustomed ways of making employed by the designer. Even though tools seem to be beyond the bounds of cultural specifics, they are in fact designed with certain assumptions in relation to a specific way of designing, and a change in environment conceivably results in a change of how these tools are utilised, accompanied by necessary adjustments in the design approach, as clearly elucidated by Alexis Şanal.

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394. Although not relevant from a design theory point of view, exposure to new sites and novel cultural environments experienced by expatriate professionals has also been related to "cultural intelligence (CQ)" in a 2014 study on British expatriate architects.
Aswini Konanahalli, Lukumon O. Oyedele, John Spillane, Ron Coates, Jason von Meding, John Ebohon, "Cross-cultural intelligence (CQ): Its impact on British expatriate adjustment on international construction projects", *International Journal of Managing Projects in Business* 7, no. 3 (2014): 423-448.
395. Excerpt from the interview with Alexis Şanal, Istanbul, 2011.

Another instance of a dislocating experience was the "ephemeral"[396] site visits. Throughout the interviews, most architects indicated that they valued the time spent on site discussing details with builders as an important learning experience. Both the architects and stonemasons interviewed alluded to the qualitative differences between stonemasons or architects trained on site, and their workshop and studio based counterparts. According to the respondents who expressed this observation, there is a qualitative difference in thinking as well as difference in the type of works produced. A practitioner who becomes aware of the epistemic affordances of site can benefit from informed observation.[397] Even though the current norm of training in architectural practice is via formalized education, tacit knowledge based on exposure to various types of practical challenges still is an invaluable source of information. In order to get the best from both worlds, formally educated practitioners ideally need to hone their skills of observation and develop an analytical eye through direct engagement, if not immersion in the site.

In Chapter 1, I referred to Renzo Piano's use of precedents as a cognitive strategy to complement a design understanding that is typically dependent upon abstractions and mediated information. A number of architect respondents referred to existing buildings when describing their design processes like Piano does, and made comments concerning the effects of weathering, or the patina on the surfaces; structural performance; patterns of building use by the inhabitants; or acoustics,[398]

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396. Yvonne Rydin, "Using Actor-Network Theory to understand planning practice: Exploring relationships between actants in regulating low-carbon commercial development," *Planning Theory* 12, no.1 (2012): 38.

397. "Few design engineers are expert machinists or welders or millwrights or riggers, but young engineers can learn important lessons about the latent possibilities and limits of craft knowledge and skills if they will but watch experienced workers in their expert, unselfconscious performances. And ask them questions. A designer who spends time intelligently observing field and shop work can expect to learn how to improve the construction of a project and to avoid the surprises that too often result from an engineer's ignorance of the nature of manual skills."
Eugene S. Ferguson, "The Mind's Eye," in *Engineering and the Mind's Eye* (Cambridge, Massachusetts: The MIT Press, 1992), 59.

398. In an interview I conducted before the start of this research with architect Steven Holl - my former design studio tutor - he talked enthusiastically about Çiçek Pasajı, a 19th century covered arcade in Istanbul that he had just seen, critically reflecting on the constituents of its patina in order to understand how to achieve a similar effect in new designs:
"In experientially intense architecture, every material, every light, every reflection counts. They are all working to make the total experience. [...] For example we just came down the street and walked into this wonderful gallery which has restaurants and it is L-shaped. It is like the street's coming up into the building and so what's inside and what's outside is reversed.... This is incredible: just walking in that space like that already exciting all your senses... [...] There is glass but the glass has been painted with some kind of paint, so now the light also has a patina, as if there is some strange waxed paper or something that you're looking through this light. So all these are mixing - the smell, the sound... all mixing together to make an experience."
Elif Kendir, "Idea and Phenomena: Interview with Steven Holl," *XXI* (2003).

however the use of precedents was not as deliberate as in Piano's case, who uses them as strategic tools in order to assist design thinking. Of particular note is how Piano uses case based knowledge in order to understand all those aspects that can be observed *after* the finalisation of the building, the aspects of building that cannot be represented via conventional means of representation, and need to unfold in *time*.

Three of my respondents were expatriate architects, meaning their main practice was established outside of their native countries. While this might seem inconsequential for the purposes of this research, I have come to realise that being an expatriate in a country with different practice cultures and regulations make practitioners more aware of their own practice strategies.

New Zealander architect Tom Daniell, who teaches and practices in Japan[399], points to the effect of a dominant craft culture on builders "coming from centuries of tradition" that provides an intangible quality in construction, "an invisible accent to everything":

> "-So I would like to ask this question about your past projects: what >if any< is the impact of local building culture on your projects?
>
> - It is huge, but a lot of it is invisible. Basically it's because if you have Japanese contractors, whatever you drew will be built in exactly the same way. The drawings an architect produces are kind of... (2.0) >no matter how detailed and precise you try to make them< they are still abstractions (.) and the builder will try to find his own way. And you find that you draw something and the builders will do it in their own way, it will still look good (.) it will look almost the same, but basically every kind of nuance, every corner and detail have a slightly unexpected quality to it, a very good quality. [...] So I know it is there: it is like an accent to everything, kind of touch to everything based on Japanese tradition."[400]

The importance of local building culture on the quality of work was one of the leading questions in the interview guidelines. I deliberately put this question to the respondents in order to tease out their attitudes towards the cultural specificity of their working environment. It turned out that recognizing the capabilities of the social environment and putting them to good use was a popular subject among the practitioners - even though some of the respondents evidently thought on the fly when answering this question, following this line of inquiry led to an interesting discussion on the impact of the local building culture on the generation of architectural knowledge, and its transfer via embedded knowledge within the artefact. Daniell also talked about how he learned a great deal about the particular

399. Since the time of the interview, Tom Daniell has relocated: as of 2014, he works as the coordinator for the Department of Architecture and Design at the University of Saint Joseph in Macau.
400. Excerpt from Thomas Daniell interview, Melbourne, 2008.

details while dismantling the building when working within a heritage environment, a point also expressed by a number of stonemason respondents.

One of the most important ways architects referred to precedents was through publications. Paul Minifie pointed to the importance of "local conversation" where architects deliberately used the medium of writing and photography besides actual conversations and built works to contribute to the ongoing conversation within their local practice networks:

> "- What's the impact of local building culture on your projects?
>
> - Uhm...(4.5) <a fair bit>... well (1.0) >I mean that the inflection here is that those projects<... I mean all Australian projects that I've mentioned so far came out of >was very much a form of< local conversation which has second place between a number of different architects over a number of years and part of that conversation has been verbal, part of it has been through published (1.5) theoretical works, and part of it has been through the actual constructed buildings >and so in fairly particular ways< the three projects that I mentioned, the ARM project, the Minifie-Nixon projects, are results of that conversation."[401]

Throughout my architect interviews, respondents referred to precedents in an abstracted manner, that is, they were mediated rather than the subject of their actual experiences. However, when asked about the impact of local building culture on their design approach, most were ready to admit that the tacit component in their knowledge base is still largely dependent on their interactions with the environment and previous experience of buildings. This also became evident when they were not answering to a specific question, but when they are talking about a different topic, as a subsidiary insight. Here again the problem of explicit knowledge shows itself: processes of rationalization can easily fall into learned categories rather than depending on the source of actual knowledge making process, which remains tacit.

On a different scale, the dichotomy between the on-site and off-site aspect of architectural practice comes up in the architect respondents' answers to the question on their work environment. Among the architects in this research, more than half defined their practice as office based, with frequent site visits as necessary when their projects were under construction. The architects who defined their practice as mainly on-site were specialist architects, whose expertise required constant supervision and/or engagement with the site. For those who were predominantly office based, the site of construction was mediated through site plans, diagrams, analyses, occasionally phasing plans, performance analyses, and

401. Excerpt from Paul Minifie interview, Melbourne, 2009.

site models. The use of relevant representational media, coupled with visits to the site emerged as a sustainable strategy of design within a collaborative context.

5.4 *Models, Mock-ups, Rehearsals*

This section is named after a classification made by architect Alexis Şanal when she was presenting her use of models in relation to her office's design processes. As a young practice with a hands-on approach to construction, whose projects have recently begun to get built, this classification by Şanal struck a chord with my insights developed during the earlier stages of the research, before this last detailed interview.[402] In explaining her tripartite classification Şanalrefers to the idea of "transferable knowledge":

> "...it's also part of this idea of *transferable knowledge* that you're creating, a **model** is trying to… It's an abstraction; it's a great abstraction in different scales… You use the different scales to communicate some type of a production… to help the client understand what is happening, for them to communicate to other groups, […] for solving the geometry so that everybody can understand… <to study lighting>… >but it's always a great abstraction< and has much more to do with (1.0) geometry and massing and (.) contextual relations I think… or material connections… bigger ones do that as well…
>
> A **mock-up** is a full scale illustration of what is going to happen so to say, and therefore everybody agrees on the final performance of it (.) that it has this finish, and you know, the colour is right, and so on… It's like a proof of… (1.0) A model I'd say, is like a proof of a concept, whereas a mock-up is (.)<the proof of a system>…
>
> And then the **rehearsal**, which is the most important, >which is confused with the mock-up, but it isn't the same< is where everybody rehearses what is going to happen (1.2) s::o all the different people that are going to influence it, even the user, can come and rehearse > tell us it is going to work<… I mean you can build a platform and see how big a window is, or you can look out the window and say "OK, it's too high" or "too low"… Or you can get the aluminium guy to get coordinated with the electrical guy to coordinate the window opening, etc... You can get everybody involved in realizing it (.) and you play it through once… And therefore everyone who comes to do it, like a rehearsal, everybody has, at one point, had a chance to interact with each other, and ask each other what's going to happen… >so I think they're all very very important parts of it<… ((talking about Turkey)) In such a tactile culture, it is very important to feel and touch and hear things… In visualization, putting things into 3D, >that and simulations as opposed to visualizations (.) I'd add to that too<…they're just all part of creating the **collective mind**...of what's going to happen...and everybody to have a shared understanding of what is going to be achieved and an opportunity to input into it…"[403]

In her classification, she used the term "models" to indicate abstract and incomplete design representations, acting alternatively as epistemic objects or boundary objects depending on the context where they are used. The main purpose of models is to enable design iteration by providing instances of the design project under construction in reduced scale and in abstracted materials for the architect,

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402. That's the reason why I decided to invite Alexis and her partner Murat Şanal to become my last architect respondents after hearing a presentation by Alexis on the different uses of models in their office, more than two years since my last architect interview.
403. Excerpt from Alexis Şanal interview, Istanbul 2011.

which act as intermediary artefacts providing visual and relational information for the builder. Scale models instigate conversations on general form, massing, or detailing that is important for both the architect and the builder. They are the first instances around which design conversations revolve, and initial ideas about interrelations of forms, lights and shadows and materials can be formed.

Different architects use scale models for different purposes - some offices may only use presentation models, which are complete in themselves and do not afford much design conversation – and are therefore technical objects in the epistemological sense. While some others use study models for tackling issues as diverse as structure, materials and lighting as well as form generation.[404]

According to Alexis Şanal, "mock-ups" were full-scale models, constructed within the office in a different material than the material which will be used in the actual building. In mock-ups, the form is almost finalized, but there is still uncertainty about its "fit" into the larger framework of the building. In her account, their use across different actors in the building process indicates it is a boundary object for developing the system proposed by the architects. The use of these models indicate that they are primarily agents for dynamic knowledge making, rather than static representations – different types are used by different stakeholders to achieve unity of design.

"Rehearsals", according to Şanal are the most important type of models among the three. Built in full scale using actual materials, they provide a final opportunity for testing out design ideas and for negotiating final changes with different stakeholders, including the end user.

After discussing the different ways in which models are currently being used, the commonly accepted notion of modelling as representation does not seem to do justice to the complexity of the act itself. Modelling is inextricably linked to cognition – encompassing a whole array of mental and bodily processes, and a necessary medium for design iteration, as an environment which provides tactile and material feedback to the designer, while providing explicit design information for the builder. The architect interviews show that through the introduction of ideas such as performance, material parameters and embodied interaction, models are

404. In 1998, the central room in Steven Holl's office in New York - which was a small practice with no more than 8 people working at that time - was the model room. In that room it was possible to see every kind of material subjected to various treatments, like painting, etching, acid throwing and inducing rust, in order to be utilized in study models of various scales.

reclaiming their position as one of the most immediate design tools that reciprocate bodily sensations by means of their material or simulated resistance.

Models in different scales found in architects and builders' practice have unique epistemic characteristics – different scale models inform different aspects of building design. The ways in which different scale artifacts are used in relation to design development, and how they are exhibited or stored in work environments impact their cognitive influence on designers. One important aspect of using models involves putting the models out there into the world: the impact of putting an artifact in an environment to observe how it interacts with its surrounding context suggests a dual interaction between the artifact and its environment. Indeed, this is how articulated spaces of production act as *epistemic environment*s - they are actively involved in knowledge making processes; through their affordance of deliberate and incidental observation they become integral to the generation of design knowledge.

5.5 The Mediated Site

The distancing of the architect from the site of construction has been the starting point of the contemporary architectural profession as we know it. This chapter argued for the re-establishment of the link between the office and the construction site, through an analysis of the issues put forth by the architect respondents in relation to the design affordances of the building under construction.

Apart from the ephemeral site visit, the building site is almost always mediated in contemporary architectural practice. This fact puts architects in the position of organisers and reconciliators, as overseers who manage the "exigencies of the construction site" from a safe distance, working within the confines of their office. During the interviews, it became evident that this was not uniformly true for all of the respondents. According to their role definitions, architects had varying degrees of involvement with the site, ranging from a totally theoretical practice with no built projects, to a sustained on-site presence in conversation with the rest of the professionals in the building production. The architects who refrained from extensive involvement with the construction site referred to strict contractual obligations and the element of risk involved in continued design during the construction phase.

In contrast to this risk-avoidant approach, some of the architects proposed replacing risk with trust by nurturing relationships between different building professionals to form and sustain collaborative design teams. These practitioners spent more time on site, and regarded the specificities of different building contexts as design challenges, if not opportunities, rather than constraints or risk factors. For most of the architect respondents in this research, the main challenge of their practice was forming collaborative project teams, and transferring knowledge and expertise gained from an active involvement with the construction site.

CHAPTER 6. *The Construction Site*

Figure 47. Former Architect Director and Coordinator for the Sagrada Família Basilica Jordi Bonet i Armengol explaining construction details at the SFB building site, Barcelona, 2006.[405]

Figure 48. Melbourne architects Sir Osborn McCutcheon and Mr. A. F. Salman with an unknown man in front of Collins Place building site, Melbourne, 1973.[406]

The pictures above are indicative of two fundamentally different attitudes towards the construction site in architectural practice. [407] Until quite recently, and although acknowledged as a part of the architectural design process, the stage of construction has rarely been discussed in terms of its affordances for design and innovation. Addressing this gap, this chapter presents the construction site and the building under construction as *epistemic environments*, and illustrates how built artefacts enable the generation, sharing and handing down of knowledge by acting as constant points of reference.

Along with the thematic analysis of the interview data of both stonemasons and architects concerning collaboration, this chapter involves a case study of the knowledge making practices at work in the design office of the Sagrada Família,

405. Source: Photo by the author.
406. Source: Photo by Wolfgang Sievers, courtesy of State Library of Victoria, Melbourne.
407. Both photographs show architects in relation to a construction in progress. In the photograph on the left, Jordi Bonet i Armengol, chief architect and director of works at the Expiatory Church of the Sagrada Família, is describing the latest stage of construction in progress to a selected group of architects (out of frame) on the church grounds. At the time of the interview Mr. Bonet was 81 years old, and the meeting where I took that photo was taking place on a platform in one of the towers, more than a hundred metres above street level. His passion for the work under construction is obvious to the point of being contagious. In contrast, the other photograph depicts the architects in a more traditional pose, maintaining a cautious distance to the construction site in the background.

which brings the account of practice presented here closer to an example of "cognitive ethnography" as defined by Edwin Hutchins.[408]

This chapter discusses the affordances and dynamics of the construction site from a design point of view. After presenting a contemporary building site that has been under construction for over a century, the discussion posits the construction site as the infrastructure for collaboration among different building professionals. Similar to the previous chapters in this section, the chapter is formed by five subsections presenting different aspects of the field research: In subsection 6.1, "Festina Lente: Slow construction," the unique case of the Expiatory Church of the Sagrada Família under construction is investigated through the presentation of a short cross-section from the specific knowledge making processes at work, through observations made during a design meeting conducted during a routine day of work in the present day design office. In subsection 6.2, "The loci of innovation," design affordances and the innovative potential of the construction site are discussed through the findings from the architect interviews. The next subsection, 6.3 "Enabling collaboration," questions the notion of collaboration and its impact of design thinking in reference to the findings from both stonemason and architect interviews. Subsection 6.4 "Creating the collective mind," presents collaborative strategies used by architects with respect to the notions of distributed cognition and situated learning. Finally, the last subsection of this chapter, 6.5 "The site under construction," pulls together the different strands of discussion related to the construction site, and underlines the impact of situated interaction within a site under construction on the generation, maturation and transmission of design knowledge. This last section re-examines the notion of intangible heritage, and how craft traditions engender a building culture based on mutual respect between the builders and the architects, bringing the discussion to an expanded definition of the notion of site and the intangible knowledge networks it hosts.

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408. Hutchins proposes cognitive ethnography as a research method in contrast to cognitive studies conducted in a laboratory setting:
"Most of what we know about cognition was learned in laboratory experiments. Certainly, there are many things that can be learned only in closed controlled experiments. But little is known about the relationships of cognition in the captivity of the laboratory to cognition in other kinds of culturally constituted settings. The first part of the job is, therefore, a descriptive enterprise. I call this description of the cognitive task world a 'cognitive ethnography'."
Hutchins, *Cognition in the Wild*, 371-372.

6.1 Festina Lente:[409] *Slow Construction*

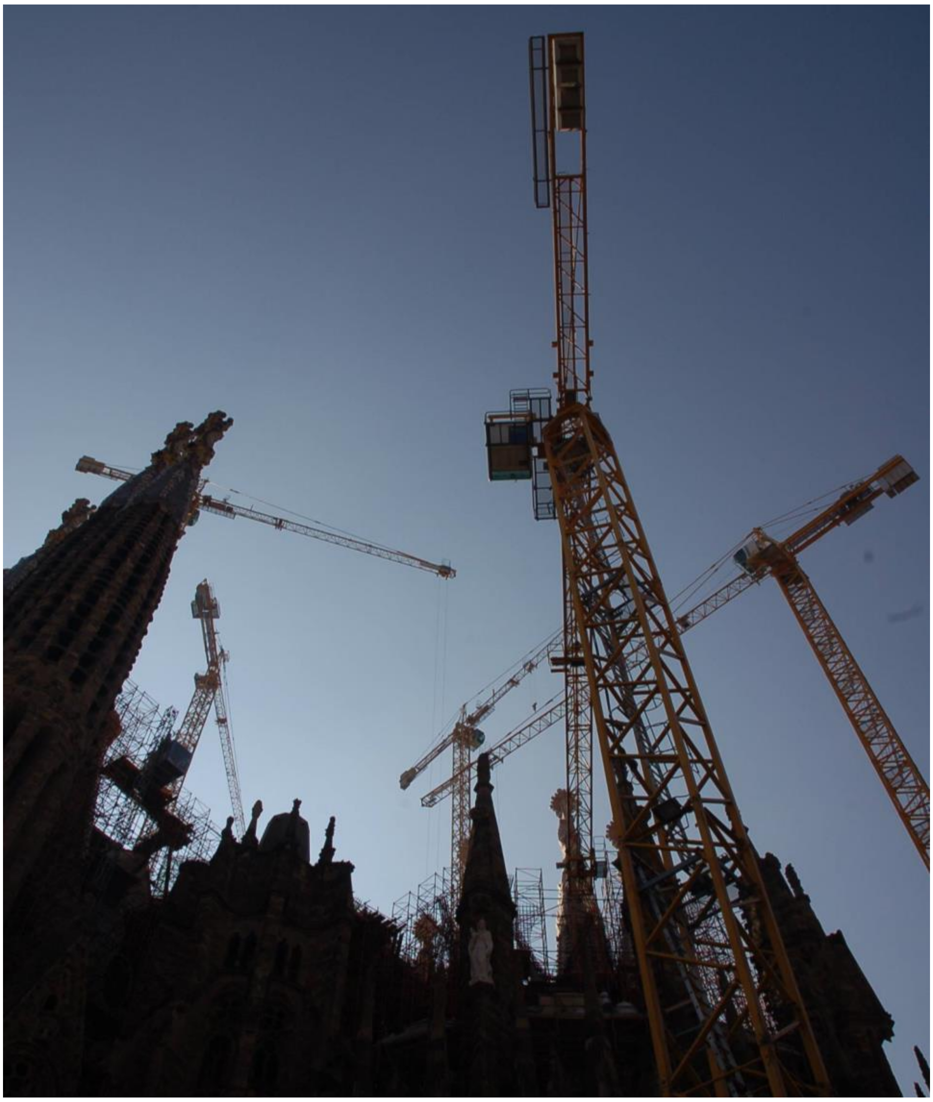

Figure 49. Building site of the *Expiatory Church of the Sagrada Família*, Barcelona, 2008.[410]

"MB- The big problem about la Sagrada Família is that it's a building that has taken so long that there is a comfort zone in its production that is simply not available on any other project. So it's kind of a social question rather than a professional question. Can we see a point where we would encourage buildings to be built like this so that there's an ongoing innovation? (2 .0) Effectively, SagradaFamília is a living lab. [...] This occurs in all projects using stone, stone building takes a long time. So maybe all major restoration projects or all very rare new projects using stone would have this opportunity. It would be very unusual and obviously we lose something by not having that.

EK- What do you think that is?

MB- Well, new knowledge..."[411]

409 ."Crossing over to the north-facing Nativity facade we come face to face with a bizarre mountainous growth. The central doorway, divided by a central column, is capped by a life size sculptural group of the Holy family. At our feet the two palm tree columns that divide the whole space sit upon the backs of two tortoises, a symbol also chosen by Cosimo de Medici - its motto *Festina lente* ('Make haste slowly') a perfectly appropriate symbol for Gaudí's temple."
Gijs Van Hensbergen, "The Cathedral of the Poor" in *Gaudí* (London: Harper Collins, 2001), 251.
410. Source: Photo by the author.
411. Excerpt from the interview with Mark Burry, Melbourne, 2007.

During the course of this research, I visited the building site of the Sagrada Família three times: first in July 2006, next in February 2008, and the last time in 2010, just after the consecration of the church grounds. Its construction having commenced in 1882,[412] with its planned completion scheduled for 2026,[413] the building site has been under construction for almost one and a half century. In accordance with many other practitioners who have been involved in this unique project, two of my respondents from the architect interviews, technical architect[414] Antoni Caminal and Professor Mark Burry both pointed to the crucial impact working at the Sagrada Família has made in their respective practice backgrounds.

The present day cathedral construction involves a plethora of technical, social and epistemic networks working together towards the completion of this iconic building. Owing to its significance for many different kinds of communities - including the architectural community – Gaudí's Sagrada Família is a research area in itself that has spawned entire academic trajectories. Research on the project is distributed by the aforementioned knowledge networks and the communities of practice by means of exhibitions, publications and the web.[415] This impressive body of work makes the completion of the Sagrada Família Basilica one of the best documented construction processes in architectural history. Starting from the time of Gaudí himself, the ongoing construction, almost medieval in terms of the project flow, has acted as an invaluable source of information for observing the socio-technical relationships on the building site.

As most of the technical and social aspects of the design and construction work conducted at the Sagrada Família are already widely disseminated through exhibitions and publications,[416] my intention here is to propose a tentative framework for the *epistemic* aspect of the design practice related to this unique heritage project that engenders a whole new way of design thinking based on Gaudí's legacy.

I use the motto "Festina Lente" in the title of this section so as to point to an attitude that is quickly disappearing from the contemporary practice landscape. In

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412. The construction process was initially conducted by architect Francisco Paula del Villar, however, due to a difference of opinion between the church board and the architect, the construction was commissioned to young Gaudí in 1883, just one year after the start of the construction.
413. The centennial of Gaudí's death.
414. See the *Appareilleur* discussion in Chapter 2.
415. See SFB website: http://www.sagradafamilia.cat/;
SIAL website on La SagradaFamilia:http://sagradafamilia.sial.rmit.edu.au/
416. For a recent book related to an international series of exhibitions on Gaudí's legacy, see:
Mark Burry, ed., *Gaudí Unseen: Completing the Sagrada Família* (Berlin: JovisVerlag, 2007).

the slow progression of the project, an entire codex of design had to be formulated by Gaudí as quickly and diligently as possible, in order to enable the construction to go on as envisioned, while providing enough leeway to let the designers coming after him to contribute to the project during its continuation. This in itself required an incredible insight, anachronistic both in its almost medieval acceptance of the individual limits of one designer, and progressive in terms of its current design approach, which has come to rely on parametric methods, necessary in order to reverse-engineer the embedded design intentions.[417]

> "During his final 12 years, Gaudí proposed that the surfaces of the Sagrada Família Church all be defined geometrically - he rejected freeform in his experiment in updating the Gothic for the post-industrial age. His plastic experimentation is revealed in his final models for the project, but it is a notoriously slow process. Using cartographic principles, his geometry requires mapping by his successors for the project."[418]

When talking about the recent changes in the technologies utilised in the construction of this impressive project, Mark Burry refers to Gaudí's insistence that innovation must be in the design, not in the making, arguing that traditional methods should be used in order to keep risk to a minimum. However, he also points out the fact that in his final years, Gaudí began to realise through experimentation that new materials and methods would need to be introduced to the project. [419]

> "The hardships and delays of the works gave Gaudí plenty of time to meditate and draft a new project which was to revolutionise the whole Gothic structural system."[420]

There are several research papers and book chapters on the workshop and studio used by Gaudi,[421] where he literally spent his whole time surrounded by models, prototypes and other paraphernalia, going so far as to sleep there towards the end of his life. Even his desk, designed by himself at the start of his career, was a

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417. Gaudí himself has advocated the necessity of taking time to finish the church:
"I do not want to complete this church, because this would not be appropriate. A work of this nature must take a long time, the longer the better. The spirit of the monument must be preserved, but its life must depend on the generations with which it lives and grows."
Bonaventura Conill, *El Propagador*, 1906, excerpt cited by Mark Burry in "Masters of building: Gaudí, the making of La Sagrada Familia", *Architects' Journal 195*, no: 13 (April, 1992), p.40.
418. MarkBurry, "Design through making: 'Homo Faber'," in *Architectural Design* 75, no. 4 (July/August 2005): 30-37.
419. Ibid.
420. "The Tree Structure" in the Sagrada Família website.
421. In particular see: Josep Gómez-Serrano, "Gaudí's Studio-Workshop" in *Gaudí Unseen: Completing the Sagrada Família*, ed. Mark Burry (Berlin: JovisVerlag, 2007), 90-97; and Jordi Bonet i Armengol, "El taller de Gaudí i la seva continuacio" in *L'Ultim Gaudí: El Modulat Geomètric del Temple de la Sagrada Familia* (Barcelona: ECSA, 2000), 40-53.

micro-environment where he contemplated the epic construction task at hand.[422] It is this iterative cycle of creative observation and analytical form making based on the principles acquired by abstracting his immediate environment that made Gaudí's design process such an important precedent for design innovation.

Figure 50. Gaudí's studio in the *Expiatory Church of the Sagrada Família,* Barcelona, circa 1920.[423]

In his final years, Gaudí literally at home on the construction site, further developed the geometrical vocabulary, details and the means of representation for making the design intentions explicit for the future generations of architects who would continue the construction of the temple. Relegated to the margins of architectural discourse as an eccentric for a long time, it is only during the past couple of decades that his true value as a thoughtful and masterful designer has been

422. "The desk was ideal to test out his evolving theories on. Its heavy coffin form resting on four tapered legs, joined by a kicking plate, presented a clearly wrought balance between the desk's function and form. ... Set against the wood, the young architect applied decoration which gathered together a 'topographic kingdom'. Snakes, birds of prey, a squirrel and a lizard, a praying mantis, a cockerel, butterflies and bees swarmed through the trailing ivy and sprigs of bay. This was Gaudi's 'Great Book of Nature' - but domesticated and brought safely indoors."
Gijs Van Hensbergen, "The Architectural Apprentice" in *Gaudí* (London: Harper Collins Publishers, 2001), 55.
423. Source: Image taken from the article by Josep Gómez-Serrano, "Gaudí's Studio-Workshop" in *Gaudí Unseen: Completing the Sagrada Família*, ed. Mark Burry, (Berlin: Jovis Verlag, 2007), 90.
Photo ©*Arxiu Històric del Col·legi d'Arquitectes de Catalunya*.

revealed by the dissemination of research on his magnum opus. Although the public reception of the Sagrada Família Basilica and the ongoing attempt for its completion has changed for the better over the years, there is still some confusion in terms of the true point of this project, which stylistic critiques invariably tend to miss.[424]

One of the main interests of the Sagrada Família Basilica as a case study is Gaudí's dedicated research into historical systems of analysis for streamlining construction, including stereotomy.[425] Gaudí's aim in conducting such research may have stemmed from an interest in regulating the work process of the stonemasons, or his research may have been the theoretical basis of an effort to leave a codex that explicitly states the way to complete the building. In any case, the research activity initiated by Gaudí still continues to this day through the ongoing efforts of his successors, resulting in an exciting project environment that feeds from the design affordances of a challenging project.

The practice vignette in the following pages is based on the field notes taken during a routine design discussion at la Sagrada Família [LSF] design office[426] about the latest situation of the design and construction in February 2008. Thanks to the interval of time between now and then, it is possible to observe the development of design and how the issues raised during the meeting were resolved. I will first present the scope and flow of the discussion via isolated scenes, and then comment on the implications of the type of design work conducted in during the meeting.

The LSF design office is situated in the basement of the cathedral next to the model workshop. The office interior features the common chaotic variety of artefacts at an architectural office: there are computer stations; labelled material samples; publications - including PhD theses on the Sagrada Família Basilica; printouts; models of various scales and sketches. At first glance, the main distinguishing characteristic of the design office seems to be the abundance of models at various scales. However, the real difference stems from the location of the office: Contrary to the majority of design offices, the LSF design office is literally on

424. For a recent example see: David Cohn, "Gaudí's Sacred Monster: SagradaFamília, Barcelona, Catalonia," *The Architectural Review* (2012).
425. Santiago Huerta, "Structural Design in the Work of Gaudí,"*Architectural Science Review* 49, no.4 (2006): 324-339.
426. As noted previously, the name has been changed to Sagrada Família Basilica since the consecration in 2010, however, I have kept the former name in references from specific dates, keeping the name in accordance with the date referred. For general references, the acronym SFB is used along with the new name.

the building site, blurring the conventional on-site/off-site distinction generally found in knowledge making practices in contemporary architectural design offices.

> "EK- And has there been a two-way dialogue between builders and designers in anyway? [Have you been informed by the specific aspects of construction site?]
>
> MB- [That's generally the way it works.]
>
> EK- Could you elaborate that a little?
>
> MB- Oh, I mean the building team and the architectural team are in the same office (1.0) we are literally in the same physical space. <Well, until recently we were in the same room>, now we're in adjacent rooms, so (.) [...]. So it works from the very first…so any decision will be superseded by a meeting between architects, engineers, the builders and the technical architects."[427]

In order to observe the specific opportunities afforded by this proximity between the workspace and the building site, I diagrammed the main room of the design office where I classified different types of (human and non-human) actors within the immediate environment. Each location within the office is structured according to the type of knowledge work being conducted in that area: for example, the environment that surrounds the adjunct director of works architect Jordi Faulí, responsible for the overall coordination of the construction process and the management of information exchange, features a plan of the church, a typical calendar, along with a longitudinal section of showing projected phases for completion.

While the environment of the LSF design office is not very different from a "normal" design office, its direct connection to the building site with uninterrupted access to in-house model-making studios and to the completed parts of the church gives it a distinct advantage. The social and historical context of the project imparts added motivation, distinctly characterizing it as an obvious deviation from standard practice. Add millions of tourists visiting the site every year; various academic and practice connections; the unique funding structure managed by the construction board of the church, and we have the prime example of a "deviant case"[428] for analysis.

The following diagram is an analysis of the visible environment of the design office located on the basement floor of the Sagrada Família that labels its contents according to the three factors influencing the generation of design knowledge I have discussed so far in the body of this thesis - namely, networks, artefacts and environments.

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427. Excerpt from the interview with Mark Burry, Melbourne, 2007.
428. As discussed in Chapter 3, the methodological explanation of this study.

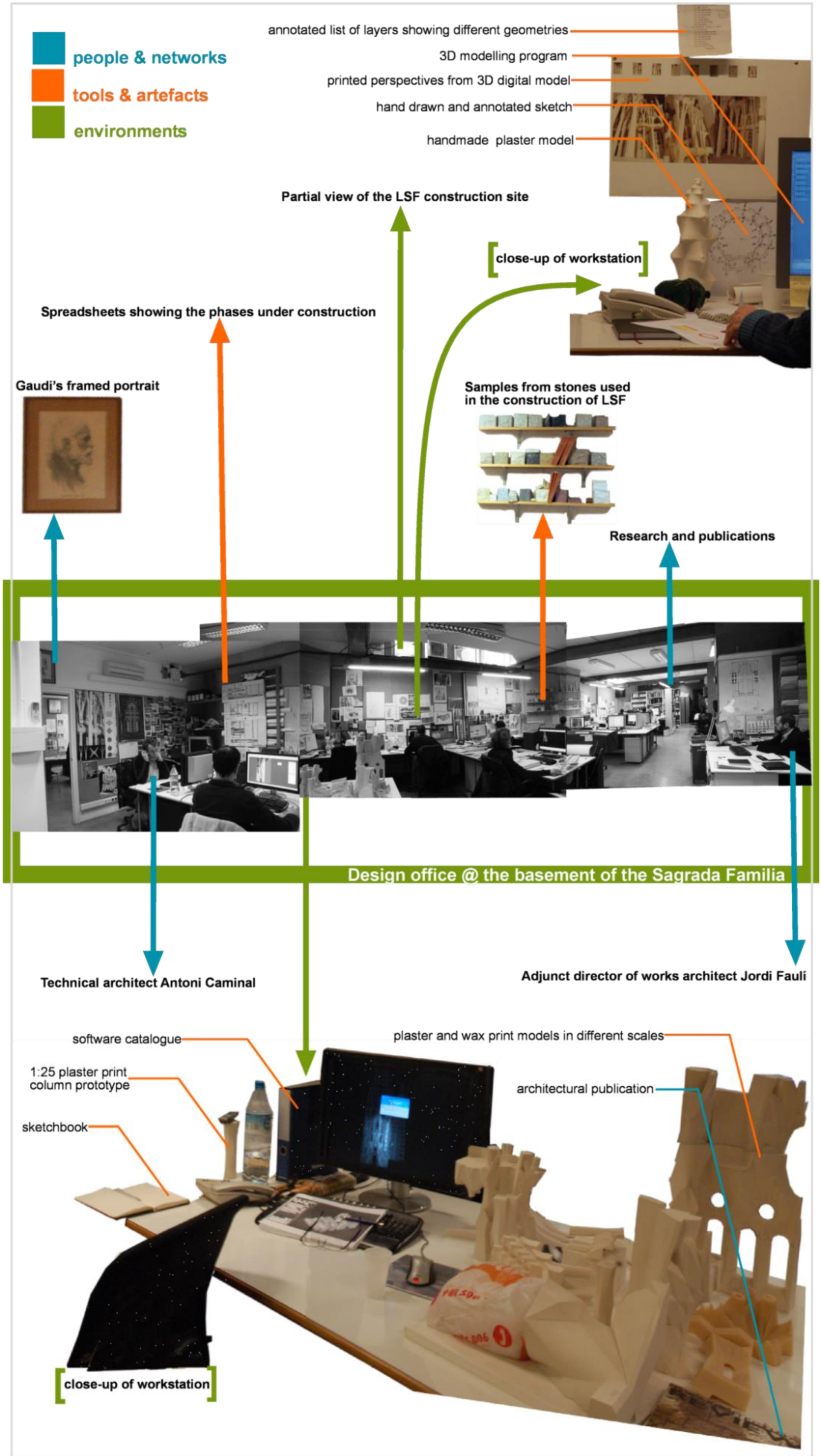


Figure 51. Diagram based on a panoramic interior view of LSF design office, February 2008.[429]

429. Source: Diagram design and execution by the author. Diagram shows the office structure valid at the time of the observation, in 2008. In 2012, the SFB design office was substantially modernised.

Coded in blue, networks and people involve human actors and the social networks affecting the nature of design work conducted at the LSF design office. Human actors are people working in the office in specific roles, as well as important figures like Gaudí, whose legacy and personal history is probably one of the main motivations for the people working in the office. Therefore, the diagram shows people currently working there as well as representations of significant role models as part of the same category. This category also includes publications used in the dissemination of research as signifiers of practice networks.

Coded in orange, artefacts include the usual non-human actors, namely, technical tools like material samples, models, drawings, spreadsheets, software catalogues and ubiquitous tools like computers.

Coded in green, environments include all the specifics of the physical setting from the micro to the macro scale. This category features environments with varying boundaries: from the physical office space to the immediate vicinity of a single desk with design paraphernalia organised in a specific fashion; from an obstructed view to the construction site to the computer screen.

I will now move on from a discussion of the physical setting of the office to the observations of a design meeting that I had the chance to view during a routine day at the Sagrada Família thanks to my thesis supervisor Professor Mark Burry. Owing to the specific nature of design work conducted at the LSF, there is a constellation of knowledge making practices in action enabling active participation with all parties involved - from architects, to model makers, to sculptors and stonemasons to designers of construction machinery; indeed there is an abundance of information and a myriad of lessons to be derived from this rich process. Keeping this complex background in mind, in the following pages I describe the micro environments from a routine design meeting, and investigate the ways in which they impact the unfolding of the meeting by grounding several artefacts, enabling the human actors to utilise them as epistemic objects.

The discussion group features people from the main design and technical team, the main stonemason, technical architects and director of works Jordi Bonet i Armengol. Discussions during the design meeting were mainly conducted in Catalan except when Mark was making comments to Jane who attended the meeting from Melbourne, Australia via video conferencing.

Table 4. Notes from a design meeting at the Sagrada Família Design Office, Barcelona, 2008.

NOTES FROM A DESIGN MEETING AT THE SAGRADA FAMÍLIA[430]	
DATE	21 February 2008
PEOPLE	Jordi Bonet i Armengol, chief architect, director of works at the Temple la SagradaFamília [LSF from here onwards] at the time of the interview Jordi Faulí i Oller, adjunct chief architect at LSF Jordi Coll i Grifoll, project architect, head of project department at LSF Antoni Caminal i Homar, technical architect at LSF Jordi Barbany, sculptor and owner of stonemasonry workshop Granits Barbany Mark Burry, executive architect, researcher for design development at LSF Jane Burry [via Skype], architect, researcher for design development at LSF
LOCATIONS	Design office and then model gallery at the *Expiatory Church of la Sagrada Família*, Barcelona, Spain
TOPICS	Design development of the columns on the Narthex, Passion Facade, LSF
ARTEFACTS	Framed photograph from Gaudí's sketch for the Passion facade, several 1/10 and 1/25 scale plaster and wax print partial detail models, exhibition catalogue *Gaudí Unseen*, digital 3D models, 1/25 scale models showing the whole church at the adjacent gallery, project calendar, plans, sections, sketches, elevations in print and digital form
DURATION	2 hours 30 minutes

> "The construction of rich and complex forms, however, cannot be the product of a routine. They require a love for quality in work and an attention to detail that is not common among businessmen. And anyone with enough experience in the field knows that generally the designer and the technician have little direct intervention in the work once construction begins. They limit themselves to administrative control, demanding financial performance and scheduled completion. It can be said without exaggeration that in many cases the work is built by the foreman. But the complex structures of which I speak require not only conception and calculation; they also require our input at the site during execution, and a greater personal commitment on the part of the contractor. They force him to be a builder, not merely a businessman."[431]

This section revolves around field notes taken during a two and a half hour design meeting I observed during my second visit to the building site of the Sagrada Família in February 2008. These notes, coupled with the snapshots from the meeting will form the basis of my argument, where I propose that the site acts as an *epistemic environment* and is actively involved in the generation of design knowledge.

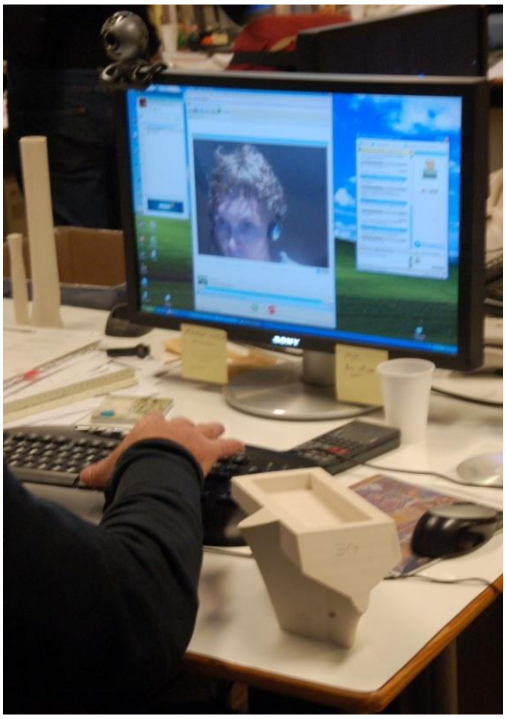
430. All photographs used in the collage in the preceding figure, and in the following scenes belong to the author unless otherwise noted.
431. Eladio Dieste, "Some Reflections on Architecture and Construction," *Perspecta* 27 (1992): 186-203.

SCENE 1	FIELD NOTE
	**12:15pm** *- Discussion in reference to partial models and the remaining photo of the project.* *- New 3D plaster prints are introduced and participants of the meeting are talking on the basis of Jane's model sent over from Australia.*

This first scene is from a couple of minutes after the start of the design meeting. Participants are gathered around the computer screen in order to be able to keep visual contact with Jane Burry who is attending the meeting via Skype. The seating arrangement is informal, and the desk is covered with 1:25 and 1:10 3D plaster print models showing the columns for the narthex on the Passion facade of the Sagrada Família. Note the framed photograph of Gaudí above the doorway and the diversity of artifacts populating the scene. At the start of the meeting the framed photo of Gaudí's surviving sketch for the Passion Facade is hanging in the adjacent office space visible at the left hand corner of the photograph. Later on during the meeting, it is taken from its place and for a good hour acts as the main reference for the design discussion. From left to right, people in this scene are: Jordi Faulí, Jordi Coll, Mark Burry, Antoni Caminal, Jordi Bonet and Jordi Barbany.

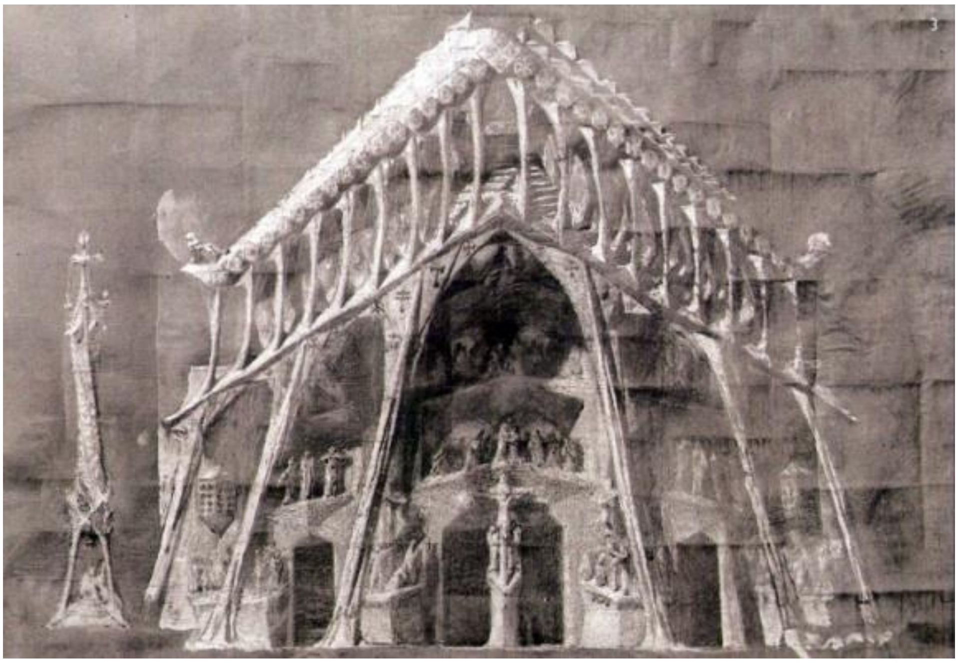
SCENE 2	FIELD NOTE
	*- Sr. Bonet takes the lead.*

In Scene 2, chief architect and the director of works at the Sagrada Família temple, Jordi Bonet takes the lead in the discussion and starts talking about the formal characteristics of the 1:25 scale column prototype with the sculptor and stonemason Jordi Barbany seated to his right, while project architect Jordi Coll listens to the conversation on the far left hand side, as Mark Burry is taking minutes from the meeting and sending them over to Jane Burry who attends the meeting from Melbourne via Skype. The nature of the conversations implies that the division of labour is quite horizontal in the design team, and everybody gets an equal chance to contribute their thoughts concerning the shape of the columns. Even within this horizontal collaborative structure, Jordi Bonet has a special place, as he has been involved in the construction of LSF for generations, his father having worked with Gaudí himself before his death, and Bonet himself having worked there as the chief architect since 1987. He is essentially a living link to Gaudí's legacy.

SCENE 3	FIELD NOTE
	**12:30pm** *-Jane sends model labelled Dec '07 via Skype.*

In this scene, Jane Burry, whose interest in flexible modelling and architectural geometry makes her a vital actor in the design research team at the LSF, sends the latest digital prototype for the narthex columns. The setup for this kind of distance collaboration is provided by the establishment of rapid prototyping facilities at each end, with 3D models being printed at the same time in Barcelona and in Melbourne, allowing researchers in each location to be able to work through direct interaction with physical models. Note the 1:10 scale prototype showing a section of the column. These types of prototypes act as *epistemic artefacts*, non-human actors in the design process, mediating the knowledge work carried out by the stonemasons and the architects, while being utilized within the different branches of the design team as tangible models in development.

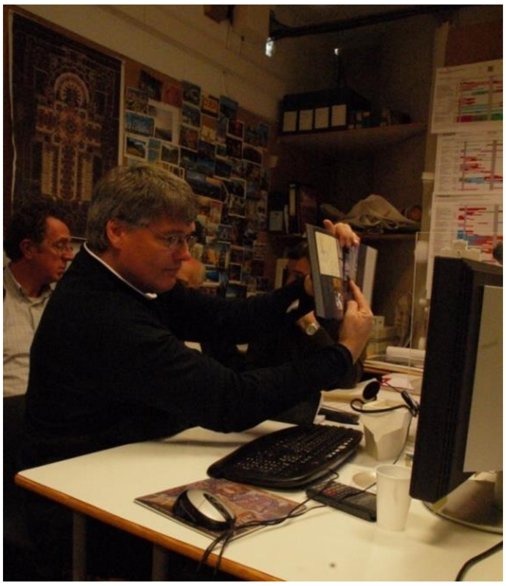
SCENE 4	FIELD NOTE
	- *Sr. Bonet compares the model to the existing photo and (discusses different types of shadows)* ((*Participants constantly refer to the scheme and the qualities depicted in the photo/ Their attitude can be compared to restoration or reconstruction work, where referring to a precedent - an original is the norm.*))

DETAIL from SCENE 4
 **Figure 52.** Framed photograph showing Gaudí's only surviving sketch of the Passion facade that Jordi Faulí is showing in Scene 4.[432]

Scene 4 shows how the meeting revolves around the framed photograph of Gaudí's final design for the Passion Façade, illustrating how he envisioned the narthex area, where the columns under discussion will be placed. The framed photograph was originally in the adjoining room, but as the conversation progressed, Jordi Faulí has brought it to the place of the meeting for closer inspection, after which the conversation solely focused on the qualities depicted in this photograph.

---

432. Source: Image taken from the article by Jordi Bonet i Armengol, "The Relationship between the Sagrada Família and Other Works by Gaudí" in *Gaudí Unseen: Completing the Sagrada Família*, ed. Mark Burry, (Berlin: Jovis Verlag, 2007), 66.
Photo ©Arxiu Temple Sagrada Família.

SCENE 5	**FIELD NOTE**
	**12:47pm** *- Mark shows the book "Gaudí Unseen" ((shows a specific photo))* *- discussion of qualities like texture, robustness, potency* *- Mark sends commentaries over to Jane via Skype and Jane sends questions back.*

DETAIL from SCENE 5

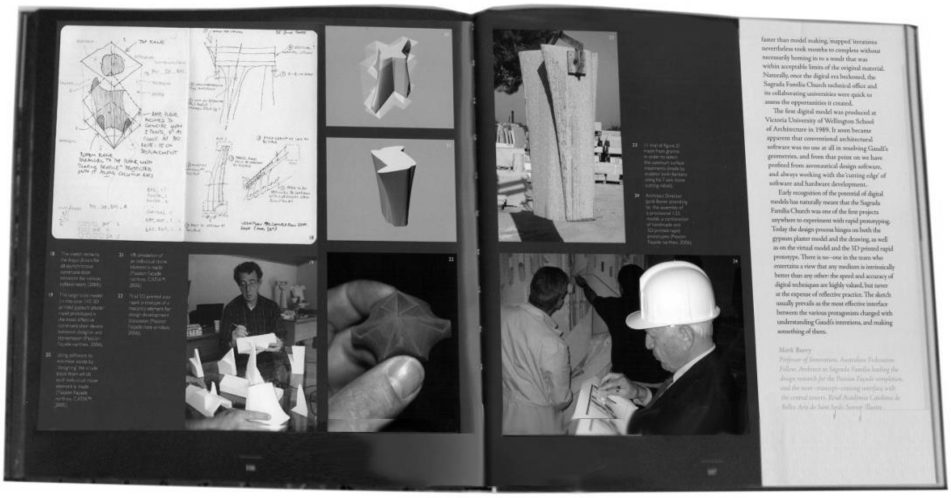


Figure 53. Double page spread from the exhibition catalogue *Gaudí Unseen* which Mark is showing to Jane in Scene 5.

In scene 5, Mark Burry refers to the 1:1 column prototype produced at the stonemason's yard. The rest of the page features photographs of other media used in the development of the column prototype. Note the iterative process of designing, making, producing representations and reintroducing them to the design process as new epistemic objects. This catalogue is used by a number of stakeholders for a number of different purposes like funding, marketing, creating public opinion about the project as well as the technical development of the project itself.

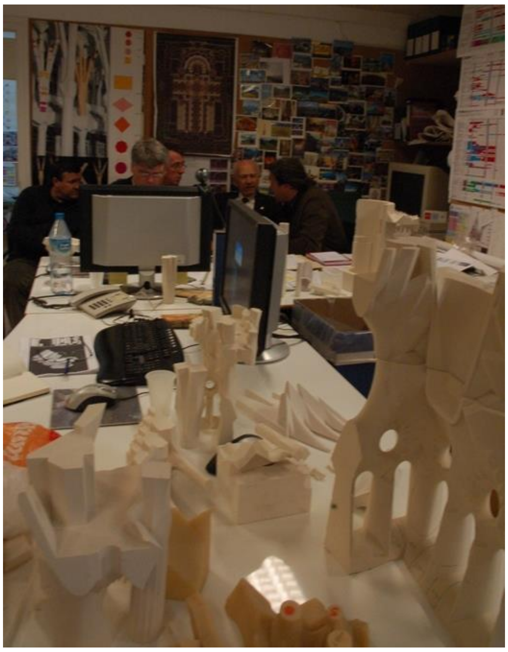
<table>
<tr><th>SCENE 6</th><th>FIELD NOTE</th></tr>
<tr><td></td><td>- Jordi Barbany, the sculptor sitting next to Sr. Bonet has news that he can produce bigger pieces: The participants discuss the measurements of the model based on this new possibility of production.

- First Jordi Bonet and Jordi Barbany are talking among themselves then the others join in.</td></tr>
<tr><th colspan="2">DETAIL about SCENE 6</th></tr>
<tr><td colspan="2">
Figure 54. Block of granite at the Granits Barbany stoneyard, Barcelona, 2010.[433]</td></tr>
</table>

Artefacts in Scene 6 include texts as non-human actors in generating knowledge. Easy to miss at first sight, a spiral bound text is located in front of Jordi Barbany which is seen to be a research report prepared by Antoni Caminal on closer inspection of the photograph, as well as 1:10 partial 3D plaster print prototypes for

433. Source: Photo from Granits Barbany, "La Sagrada Família: Nàrtex," accessed July 2012, http://granitsbarbany.com/projectesIframe.php?id_cat=1&id_pro=13.

individual stone elements and a 1:25 scale model for a column. Meanwhile, Mark is constantly updating Jane about the meeting via Skype. The detail photo is from the website of Jordi Barbany, and shows what seems to be the block of stone that he was referring to during the meeting.

SCENE 7	**FIELD NOTE**
	*- Antoni is talking about the scale of production machines with Jordi Barbany.* *- At least two conversations are going on at the same time while Mark sends minutes over to Jane in Australia and she joins in to the discussion through the questions she sends.-*

In the diagram showing the interior of the design office, plaster and wax print prototypes are scattered around the office, while some smaller scale versions are on several racks on the walls, next to the stone samples showing every type of stone used in the construction of the church. The LSF website lists 22 kinds of stones[434] used in the construction of the temple. One kind, originally used by Gaudí himself, is Montjuïc stone; another kind is porphyry, mainly used in the twelve-sided columns of the transept. Gaudí's sensual and material knowledge is visible in the final artefact with materials employed to their utmost potential for an architectonic effect proper to the standing and function of this religious building.[435]

434. According to the interview with AntoniCaminal, there are actually 25 different kinds of stones currently being used in the construction. A fantastic article co-authored by Caminal describes the geological characteristics and performance criteria of these different stones with close-up photographs of their surfaces showing visible mineral structures. See:
Alícia Masriera, Antoni Caminal, Rafael Navarro, Vicenç Planella, and Josep Adolf Samper, "Les roques del Temple de la Sagrada Família: Un itinerari petrogràfic a través dels seus elements arquitectònics i ornamentals," *Treballs del Museu de Geologia de Barcelona* (2005): 83-113.
435. Interestingly, Byzantine emperors were known as "Porphyrogennetos:" literally born into porphyry, to denote high standing and wealth. For further information on stones originally used by Gaudí and their iconic properties see: http://www.sagradafamilia.cat/sf-eng/docs_instit/pedres1.php

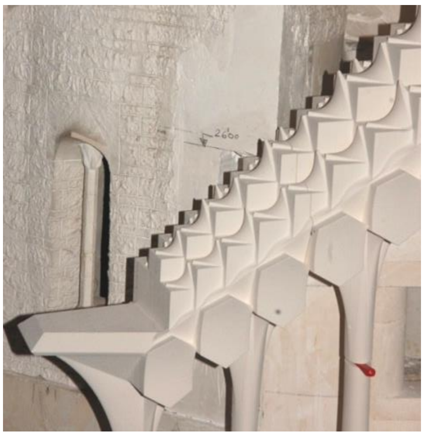
SCENE 8	**FIELD NOTE**
	*- Sr. Bonet measures the model in discussion with a ruler. (the model is a computer generated plaster model)*
SCENE 9	**FIELD NOTE**
	*- Antoni gestures to describe a spatial effect.* ACTORS in this SCENE [from left to right] Gaudí's sketch; Jordi Faulí; Jordi Coll; Antoni Caminal; Mark Burry; exhibition catalogue *Gaudí Unseen* in the foreground.

In Scene 9, the framed photo of Gaudí's surviving sketch of the Passion Façade is propped against the wall on a chair to the left of Jordi Faulí. In this instance, the human actors' co-presence in the room affords the possibility of conveying complex spatial information through ephemeral means like gesture.[436] Face-to-face meetings enabled by the co-presence of actors within a single location facilitate emergent interaction patterns, both among human actors, and among human actors and artifacts. In this sense, design meetings involve complex cognitive processes not easily translatable into explicit knowledge, with the site of the meeting grounding face-to-face interaction between different actors.

436. For a detailed discussion on the use of gesture as a means of social interaction practices see: Jürgen Streeck, Charles Goodwin, and Curtis Le Baron, eds., *Embodied Interaction: Language and Body in the Material World* (Cambridge: Cambridge University Press, 2011).

SCENE 10	FIELD NOTE
	**01:15pm** *- Mark talks to Jane.* *- At the start of the meeting there are about 15 people in the office – with the number reducing to about 5, not including the participants of the design meeting.* *-The discussion still revolves around measurements.*
SCENE 11	**FIELD NOTE**
	*- The participants of the design meeting are talking about the difference between the geometries found in the model and of in the photo. [=the archetype]* EPISTEMIC OBJECTS *Sketch, model, photograph, digital drawing.*
SCENE 12	**FIELD NOTE**
	*- Sr. Bonet compares a spatial effect depicted in the photograph with that of a partial model, arguing that the effect is not the same.* *- Sr. Bonet points to the differences in proportion between the two representations (the photograph and model)*

As the meeting progresses in the design office, the participants form different subgroups, with more than one conversation going on at the same time. Jane Burry, who attends the meeting via Skype, is occasionally left out of the conversation as the participants of the meeting change their places, and start moving to the different parts of the office in order to refer to different models and drawings distributed across the office space. Eventually, they move the meeting outside, to the model gallery, in order to resume their discussion in reference to the 1:25 scale model.

SCENE 13	**FIELD NOTE**
	*- The meeting moves to a larger scale model, and Sr. Bonet leads the procession out of the design office into the LSF exhibition area for larger models.*
SCENE 14	**FIELD NOTE**
	*- The meeting continues around the 1:25 scale model, in front of the Passion facade.*
SCENE 15	**FIELD NOTE**
	*- Sr. Bonet re-examines the 1:25 scale model, in front of the Passion façade.*
	DETAIL from SCENE 15
	 *- Pencil marks on the 1:25 plaster model*

SCENE 16	FIELD NOTE
	**02:45pm** *-Meeting ends after about 2.5 hours, and the participants return to the main design office.*

In the model gallery, moments of reflection and deciding on the best possible alternatives through a process of re-evaluation characterize the design meeting. At the Sagrada Família Basilica all models are treated with care and respect, while at the same time they are used to their utmost potential in providing design feedback for the designers and builders. These models are certainly not treated like presentation models, they are prodded, photographed, annotated, with pieces cut and replaced, in order to arrive at a moment of resolution. The very incompleteness of objects such as these models qualifies them as epistemic artifacts, vehicles for knowledge generation.[437]

After observing the meeting, it is easy to imagine that different stakeholders respond to the different kinds of representations in their own way. In this sense, models seem to provide an alternative that is intelligible across many decision-making platforms. Towards the end of the meeting in the model gallery, a number of tourists were taking pictures of the design team and their discussions taking place around the plaster model. It is possible that they too were amazed at the intimate interaction between the design team and the models on display.

437. Boris Ewenstein and Jennifer Whyte, "Knowledge Practices in Design: The Role of Visual Representations as 'Epistemic Objects'," *Organization Studies* 30, no.1 (2009): 7-30.

Figure 55. 2 years later, Jordi Bonet, Jordi Faulí and Antoni Caminal examining the stone columns fabricated at Jordi Barbany's workshop, *Granits Barbany*, Barcelona, 2010.[438]

The knowledge making practices at the Sagrada Família Basilica indicate that motivation and pride in the quality of work are important factors in instigating design innovation.[439] A conversation between Mark Burry and Antoni Caminal pointed to the dynamic aspect of the construction work carried out at the Sagrada Família as a factor of design motivation, and how the complexity and high quality of the design work afforded a constant learning opportunity:

438. Source: Photo from Granits Barbany, "La Sagrada Família: Nàrtex,"accessed July 2012, http://granitsbarbany.com/projectesIframe.php?id_cat=1&id_pro=13.
439. "It would seem that not only was the Sagrada Família Church one of the first projects anywhere to have adopted the most sophisticated digital tools, it is also one of the first to enter a post-digital era as a leader, in circumstances where the continued contribution of the craftsperson is judged as a crucial partner to the digital dialogue".
Mark Burry, "Design through Making: Homo Faber", *Architectural Design* 75, no. 4 (2005): 30-37.

"- And then other elements... The sculptural elements... ((to Mark Burry)) How long did it take to make them?

- Nineteen years. (.) [Nineteen long years...]

- [But different...] Sempre he cambiat de feina, mai he fet la mateixafeina.

- He's never done the same work, it has always changed..."[440]

During each of my visits I had the opportunity to meet with Sr. Jordi Bonet i Armengol, and his energy and dedication have been a source of fascination for me. He comes from a long tradition of working at the SFB, his father, who knew Gaudí personally, also worked on this project before him; and it is obvious that working on the Sagrada Família Basilica is a labour of love for Sr. Bonet. It would seem that faith and determination are vital aspects of sustaining interest within a protracted construction project. Similar to the stonemasons I have studied, this project is in many ways an example of cognitive archaeology, one of a kind in terms of its scope and clarity of the design work. The very duration of the project makes its codification a necessity, due to the impossibility of a single human actor's supervision from its start to its completion.

The Sagrada Família Basilica has been described as the biggest challenge for anybody involved,[441] and stands as a testament to the influence of challenging major projects as epistemic objects as well as sources of innovation, while assisting at the same time in the handing down of craft knowledge by means of apprenticeships:

> "The project got some support from the government as a place for apprenticeship. So, basically, it is recognised as a place where certain skills are being engendered. In the time that I've known it, it's gone from all of the stone production being on site, to some of the stone production being on site, to none of the stone production being on site. It's very weird, 'cause I've got two memories from la Sagrada Família, one is of the south end being completely on this huge shed full of very noisy and dusty machines for stonecutting and stonemasons. So it's just an area with a constant sharp sound of chisels, maybe ten chisels working at one time. And in the time that I've known it's gone from having no air extraction to having extraction. So it was quite a dangerous place to work up until late 70s..."[442]

The design meeting provided invaluable insights on the nature of knowledge making practices within the ordinary practice setting of an extraordinary project. Although the practice at SFB is anything but ordinary, the insights gained from observing the day-to-day working routine and the agency of the physical setting enabling design collaboration at the SFB design office can be

440. Excerpt from the interview with Antoni Caminal (TC) and Mark Burry (MB), Barcelona, 2008.
441. "MB- The Sagrada Família is the biggest challenge, and of course, it influences the way he ((stonemason Barbany)) works with his other projects....
TC- Però no solament el Barbany, també Castell. (But not only Barbany, Castell too.)
MB- For anybody who works there... Sagrada Família gives them their biggest challenge, and it always feeds back... back to the other projects." Ibid.
442. Excerpt from Mark Burry interview, Melbourne, 2007.

extrapolated to provide clues concerning the attitudes and techniques that foster innovation within architectural practice.

6.2 The Loci of Innovation

> "...so in every project we'll try something new, and we'll try one step further (0.8) whether it's playing with light, or whether it's (1.2) >working with a new material< like coloured concrete... whether it is learning lighting design, or whether it's trying to play with a new idea of (.) compressing and expanding space - we always learn from our projects... ((referring to the interview guide, and responding to the question about the characteristics of the construction site)) And yes, they're always sites of invention; I mean every one ((of the projects)) is very much cumulative that way..."[443]

As repeatedly pointed out in this research, the case of the Sagrada Família Design Office and its specific circumstances are unique within contemporary building practice. However, the issues raised by this unique case are vitally important for the so-called "normal" architectural practice, especially so as they indicate alternative means of engaging with the realities of construction, by pointing out the design affordances of a concerted collaboration effort during the resolution stage of the architectural design process.

Complementing the investigation of the unique practice of the Sagrada Família, the architect interviews featured a question that specifically requested the respondents to indicate their views on the nature and significance of construction sites, and to what extent they were open to being involved in the later stages of a project. In the excerpt above, Alexis Şanal, an American expatriate architect practising in Istanbul[444] is referring to her practice experience to describe the ways in which her firm learns from each individual project during its realization phase. This office is one of the most enthusiastic practices in terms of recognizing the innovation potential of the construction sites.

> "... particularly in a renovation project, (0.8) uh, the site is not just where they make the drawings physical (.) You have to make decisions on site; because you never know what you're going to find... And the other thing is, even if it is new construction, occasionally you find things aren't working out..."[445]

A different practice account from a completely different background points to renovation projects as fruitful grounds for a process of discovery on the site. Expatriate architect Thomas Daniell talks about the necessity of on-site presence and site supervision within the context of Japanese building culture. He underlines that site is not only where the drawings are realized, but a place to make decisions

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443. Excerpt from the interview with Alexis and Murat Şanal, Istanbul, 2011.
444. See A.5 and A.8 in the *Appendices* of this study for further details on the practice background of Alexis Şanal and her office Şanal Architecture | Urbanism.
445. Excerpt from Tom Daniell interview, Melbourne, 2008.

and tackle with ambiguity. Daniell notes that the builders in Japan redraw the architectural project in order to extract their own shop drawings, like an orchestral score that is divided according to the different instruments involved. He notes that the role of the architect is to orchestrate this process:

> [...] improvisation on site is really important for architectural innovation and it's really important on site to check what the builders are doing, to... But also other opportunities come up where you...(0.8) you could explain the (design) here and it would take the same amount of effort to look really <u>really</u> good >and it did not occur to you in the drawing state< it didn't occur to you that they could build it that way, or that's how... So, u::m (1.0) I think there's lots of opportunities on site to use the knowledge of (.) builders, and what they're capable of (1.2)<to find new ways> of construction."[446]

In response to the questions concerning the construction site as a source of innovation, some architects rightfully brought up the limits to the notion of innovating on the site, especially by indicating that contractual obligations and time limitations severely constrain that kind of fluid work process, as the focus throughout the building industry is on reducing risk, rather than enabling an innovative building practice. In response to my question about whether he would observe his design getting built and whether he proposes changes according to his observations on site, architect Paul Minifie pointed out a vital point:

> "But you all know that all the other processes in the contemporary world are about absolutely eliminating that kind of activity (.) and removing that kind of uncertainty over what a designer might want to introduce into <the design process> and so (1.2) nearly all the contemporary procurement and contractual design issues are about (.) reducing risk to a minimum."[447]

The reduction of risk as a main objective during the construction stage of a project is especially understandable from a managerial point of view and perhaps inevitable in large scale projects where the scale of the project makes it impossible to maneouver according to the specificities of the local situation. However, it is also important to keep alternative models in mind, where smaller offices use smaller scale projects as vehicles of innovation, later using their expertise in the context of larger scale projects. Gaudí's architectural practice is essentially an example of this kind of approach, where he employs "workmanship of risk" [448] in individual smaller scale projects like the crypt at Colònia Güell. Similar to the practice of Gothic cathedral builders,[449] Gaudí used such projects as laboratories for testing out ideas,

446. Ibid.
447. Excerpt from the interview with Paul Minifie, Melbourne, 2009.
448. David Pye, "The workmanship of risk, and the workmanship of certainty," in *The Nature and Art of Workmanship* (Cambridge: Cambridge University Press, 1978).
449. The use of small scale buildings as experimental prototypes was previously discussed in Chapter 1, subsection 1.4, "Dynamics of Epistemic Environments."

and applied the results of his research in larger scale projects like the Sagrada Família.

So far, I have mentioned the impact of contexts on the generation of design knowledge by focusing on physical sites. However, throughout the interviews, a more abstract kind of context emerged as a determinant of innovation – the context of a challenging project. Both stonemasons and architects pointed to specific projects, generally involving a series of challenging constraints, as serious learning opportunities. In this sense, unconventional or experimental projects such as the continuing construction of the Temple Sagrada Família can also act as loci of innovation. In such project contexts, standardised work relationships are challenged and institutional support make seemingly unviable types of collaboration possible. Throughout history, the realization of monuments, religious architecture or prestige buildings have acted as vehicles of innovation. The contemporary building scene is no different: companies like *ARUP*, *SOM*, or *Gehry Technologies* have all emerged as the result of idiosyncratic construction challenges posed by innovative projects.

In ten of the twelve architect interviews, the respondents indicated interest in engaging with the construction site beyond the "industry standard"[450] as dictated by the contractual agreements. Those that expressed such interest were more open to extending their role definitions to find alternative material and structural solutions. These designers pointed to the importance of establishing the cognitive infrastructure for enabling such research that would lead to architectural innovation.[451]

As discussed in Chapter 1, some environments are more conducive to innovation than others. Architect and stonemason interviews show that different types of artefacts in different scales reveal different aspects of the design under development. The search for design resolution can sometimes be based on the intentional use of scale change in design representations, as evidenced in the progress from less resolved, smaller scale models to larger detail models in design development. This process reaches completion with the finalization of the building itself and the resolution of its relation to the site. It is therefore important to

450. One of the architects Paul Minifie defined the amount of his engagement with the construction site as "industry standard."
451. One of the most enthusiastic architects on this issue, Alexis Şanal pointed to the importance of establishing a common ground for innovation, and described their strategies for establishing a common ground between collaborators in detail.

reconsider the notion of the building site as the final stage for testing design resolution, and the design implications of this idea.

6.3 *Enabling Collaboration*

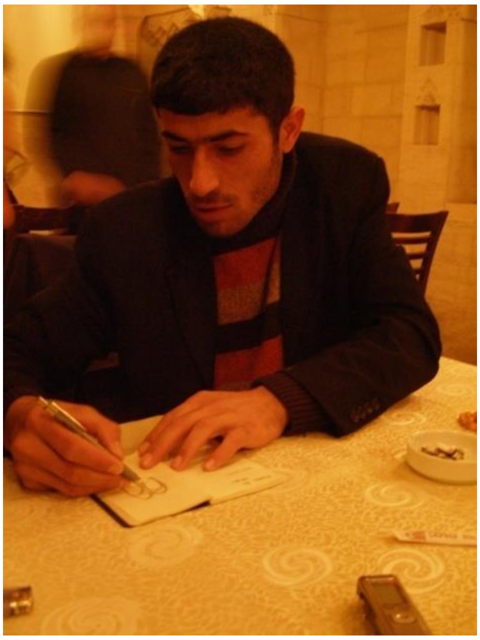

Figure 56. Young stonemason Halis Göksu explaining groin vault construction on an axonometric sketch, Mardin, 2007.[452]

Figure 57. Technical architect Antoni Caminal explaining the construction of columns in the principal nave of the Sagrada Família, Barcelona, 2008.[453]

> "And it's relatively rare for a project to have a moment where, in the middle of the construction the architect and the builder scratch their heads and say how are we going to do this? If you just speak to some other crafts based architects, you'll find that they have lots of opportunities to... with builders they work routinely, to do this... But in the major projects I cannot imagine any contract construct that would allow that type of conversation." [454]

Recognizing the collective aspect of architectural practice not only defines a clearer view of the possible areas of intervention, but also provides relevant knowledge making strategies that can be applied during the initial stages of the design process itself. My main purpose in this research has been to understand and elucidate how these complex networks of relationships feed into the initial stages of design and as a consequence, influence the practice of architecture.

Although the majority of the directors of small architectural practices do not believe in the role of the expert, there are clearly some exceptions to this generalist approach in some contexts where the nature of the work necessitates

452. Source: Photo by the author.
453. Source: Photo by the author.
454. Excerpt from the interview with Mark Burry, Melbourne, 2007.

specialization. Apart from obvious examples like heritage specialists, construction managers, or hospital designers, there is another type of specialization which I found quite interesting throughout this research, the intermediary architect, the *appareilleur*,[455] a technical architect, introduced in Chapter 2, who streamlines the making of buildings by researching ways to find and detail building materials in accordance with the project. Mediating between the architect and the builders, the *appareilleur* ensures that the specifications provided by the architect are realized in accordance with the properties of the materials - in this sense, they are skilful problem solvers.[456] An example of this vital intermediary role is portrayed by Antoni Caminal i Homar from the design office at the Sagrada Famìlia.

For most of the stonemasons I interviewed, their collaborative experiences with architects varied. In most instances, they collaborated with heritage architects on the restoration of old buildings, and sometimes with architects from archaeological teams on the restoration of antique ruins, which necessitated a different kind of expertise from conventional building construction. In the construction of new buildings where they worked with an architect, some of their experiences were decidedly negative, due to a lack of communication and wilful insistence on inadequate or inappropriate detailing by the architect. Whenever stonemasons expressed a positive interaction with an architect, it invariably involved respectful listening on the architect's part, and providing autonomy for the mason to improvise within a set of predetermined constraints.

As for sensibilities that are important for stonemasons, perceived differences in professional status were a common theme for complaint. The stonemason interviews suggest that respect and trust are important constituents of the social factors influencing craft based practices. Since quality is an elusive concept, fostering respectful relationships and establishing trust among the interested parties is of vital importance for motivation and collaborative effort. Pride in the quality of the work brings forth the ethical dimension of practice.

> "Some people come and say "I am an architect, or I am an engineer, you will do as I tell you". You have to do what they say even if it is wrong. In order for us to produce something valuable, we need to establish dialogue and understanding. Let's say you are an architect, you bring us a job, if you say "you will do it as I say", I cannot do anything but conform to your commands. But if I say "It would be better if we did it in this way"

455. Briefly discussed in Chapter 2, Section 2.2 "From Master Builder to Architect: A Genealogy of Roles" of this thesis.
456. I am indebted to Chris Williams for attracting my attention to this specific figure in the writings of Viollet-le-Duc when I met him after his presentation at the international *Tectonics - Making Meaning* conference in Eindhoven at the end of 2007.

and you take the time to listen so that we arrive at a mutual understanding, that is when we will be able to produce a beautiful piece of architecture."[457]

In some cases, the stonemasons stated that they have never worked with an architect:

> "Architects are the apple of my eye, literate people, intellectual people, I wish they would employ me. But I have never worked with them... never found the opportunity until now. Their knowledge, their technique is fine; my practical [wisdom] is fine. Their techniques are fine, but not related to this stone."[458]

The sentiments expressed by the architects related to their collaborations with stonemasons, or other builders where they had the chance to closely supervise the construction process were similar. Negative experiences stemmed from the rapid deskilling of the labour force, where architects complained of a lack of know-how in the market. However, in the positive instances, they narrated examples of close collaborations with builders, after which both parties were able to expand their knowledge base.

In an interview with Melbourne based architect Bruce Allen I asked whether his firm involved builders in the early stages of projects:

> "BA - Sometimes we call them in, to show them what we're doing to see if they'd have any suggestions on the buildability aspect of it.
>
> EK - So it's a two-way dialogue?
>
> BA - Oh yes, definitely. Once the job is under way, we're always interested in them putting out suggestions and we find it works for us relatively well... If they think that their suggestions are going to be well received and considered and occasionally implemented, they will have a much more positive approach to the work they're doing so that with every job that they're doing they'll think – "well, could this be done better", so they'll tell us, and if we think it is then we would say, "alright let's go with it""[459]

The ratio of negative to positive experiences expressed by the group of architects differed according to the cultural context where they were operating. In the architect interviews that I conducted in Turkey, lamentations concerning the effects of deskilling were more evident, although there were also success stories made possible by the deliberate decision to collaborate with builders rather than working within a conventional hierarchy.

One of the most important kinds of knowledge work I could discern from the interviews conducted in order to oppose the proliferation of deskilling in the

457. Excerpt from Ahmet Özkavak interview, Kayseri, 2007.
458. Excerpt from Yusuf Kıdır interview, translated by the author. The original in Turkish is much more expressive:
"Mimarlar benim gözümdür, canım ciğerlerimdirler, okumuşşkişiler, aydın kişidirler, keşke beni çalıştırsalar. Amma calışmamışım. Firsat olmamıştır şimdiye kadar. Onların bilgileri, onların teknikleri güzeldir; benim de pratiğim güzeldir. Onların teknikleri güzeldir, ama bu taş üzerine değil."
459. Excerpt from Bruce Allen interview, Melbourne, 2008.

building factor was the initiation of the programs of apprenticeship in the building sector. Burçin Altınsay Özgüner, one of my primary respondents and a heritage specialist, referred to the fostering of knowledge communities related to traditional building skills:

> "We try to announce these as much as is possible. We definitely collaborate with students coming from universities - there are very diverse teams coming from different universities for their own courses, coming from abroad, we tell them what we are doing here, and try to bring an awareness to the type of work we do here, and disperse our ideas."[460]

Özgüner then pointed to an attitude change concerning conservation as a result of their work in the area. Since theirs is more openly a technical field, that also incorporates sensitive community issues where people have strong opinions about a right way and a wrong way of doing things, it is relatively easier to observe the changing attitudes towards design decisions, compared to the much more ambiguous ethical field of 'designer architects'.

> "In terms of an attitude change over the past five years, it seems that there is greater awareness concerning the issues of preservation. Of course this goes both ways, institutions are also demanding systemic change now. Beforehand, we were pushed really hard to make people accept the results of our material research based on the composition of traditional types of mortar, whereas now, everybody accepts the necessity of using the correct type of mortar... Preservation councils and other related institutions are actually demanding the use of the correct type of material now."[461]

Both designer architects and heritage architects occasionally move between domains of specialization and at least one of the architects that I interviewed has used the skills and understanding that she acquired from studying historical buildings in her private practice as a project architect when she is designing new buildings.

Han Tümertekin refers to a different strategy of collaboration with builders utilising a common process to make different products:

> "We didn't even change the way they make things; but enabled the end product to be very different. It is the same as inciting a company that is specialised in industrialised building production to do what they always do, but making sure that the end result is completely different. Even though we are now working in an industrial scale, our aim is to achieve this…"[462]

In his account of practice, Tümertekin referred to "establishing precedents" by means of successful collaboration with builders, which resulted in new buildings that not only the architect, but also the builder could use as a reference for their future work. In talking about his project, for which he won the *Aga Khan Award for*

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460. Excerpt from Burçin Altınsay Özgüner interview, Istanbul, 2008.
461. Ibid.
462. Excerpt from Han Tümertekin interview, Istanbul, 2008.

Architecture in 2004, he pointed to the importance of innovating *from within* the expertise of builders in order to be able to establish such precedents. He referred to an anecdote by the stonemason with whom he collaborated, where he told Tümertekin that although he worked in a similar way for 30 years, it was the first time that he was able to achieve a new result; and he that he referred to this project as an example of his capability for future work when talking with prospective clients.

In an interview where I had the opportunity to talk to a practitioner working in Japan, American architect Thomas Daniell, the building experience and collaborating with Japanese builders was much more positive, and he had been able to establish a fruitful dialogue with the builders:

> "EK- How would you describe the impact of this dialogue between you and the builders on your design approach? In what way does it inform your design approach?
>
> TD- ...yeah, you have to become aware of what's available and what's possible. [...] You know if you don't draw the blinds, the joists, they'll be there. [...] The builders assume that even if you didn't draw a proper waterproofing detail (1.6) the builders make an assumption, >well we'll have to make waterproof building< so they'll (1.0) they'll fix it. But they will price accordingly from the beginning (4.2) I guess there is kind of a faith (2.0) >What it means is that you can be more< (1.4) When I say it's precise, I mean, you might not imagine this detail, 'cause you leave to the builder to decide which materials are gonna be used and how they're actually gonna put it, and you give just kind of the image that you want to achieve - but then the other thing is that you can draw things that are innovative and then you don't actually know how it's gonna happen, but you're confident that between you and the builder you'll find a way.[...] together we make it happen, and I rely on all of those incredibly skilful people around me. And that's why it's so hard to build in the West, because it doesn't happen, so no one is interested in working with you, they just want the precise drawing, so when they're not correct there'll be a problem."[463]

A number of architect respondents referred to the impact of building cultures on the type of work - the determining factors varied from economy and skill base to range of materials: In Melbourne there's a specific shortage of skills due to the history of the country, in Japan cultural policies concerning the built environment favour a trusting relationship between the architect and the builder teams, in Turkey the ambiguities within quick changing regulations necessitates that architects develop a more agile attitude that makes acting within an ambiguous environment possible.

Alongside the technical scope of work, project team hierarchies tend to be defined by actors' coordinative capacity for global networking. I have already pointed out in Chapter 1 that innovation is a result of distributed creativity. In this respect, authorship in collaborative projects and globally distributed networks of

463. Excerpt from Thomas Daniell interview, Melbourne, 2008.

collaboration come up as important factors influencing the attitudes adopted by practices. In many of the examples from the interviews, what distinguishes these types of collaboration from forms of conventional practice collaboration is that their design sequence is less deterministic, and the collaborators are involved in the projects right from the start.

In terms of their project types and involvement within different collaborative networks, architects had varying degrees of extended influence zones. Almost all but two architects had their own websites and were using these to promote and further their work, as is the convention in contemporary practice. All of the architects also were involved in academia in varying degrees, either teaching part-time in an institution, or attending design studio panels on a regular basis.

Some architects were actively nurturing institutional affiliations in order to be able to operate within an expanded field with more established connections. This approach was especially crucial to heritage architects, whose work depends on the active cooperation of institutional bodies and on the mechanisms of policy making. One example was the Fener-Balat conservation project where Burçin Altınsay Özgüner worked as the head architect. The project necessitated the deployment of local traditional stonemasons, local carpenters, and metalsmiths as well as working with local authorities to change legislations concerning heritage preservation. This project also featured collaboration with the municipality of Barcelona, in order to learn from their experiences in the preservation of the historical districts within the city.

Another type of institutional involvement is through academia. As the locus of research and innovation, universities played a vital part in the practice of many of my architect respondents. Their involvement with academia provided the research facilities and support not usually affordable by architects in small practice. Even when they were in full-time positions like my supervisor Professor Burry, their involvement with practice through ongoing projects focused and directed their research. In this way, it is possible to evade the fiscal constraints of "normal practice" and be able to work on innovation by straddling the boundaries of research and practice within an environment that rewards innovation:

> "Over the years, I have not felt constrained by normal practice– it's probably why I'm not involved in normal practice directly. I was sort of involved in the conventional practice through association, through industry partners that we had

through Australian Research Council grants, but not personal. 1996 was the last year that I had formal practice involvement where… of a conventional nature."[464]

There are specific instances in architectural practice where the challenges involving the relationship among the actors in the building process[465] are surpassed if the main motivation is carefully steered towards a shared ideal of quality, rather than economic feasibility. In my last architect interview conducted with *Şanal Architects* in 2011, I asked about their experience of these dynamics in practice, especially in relation to the interaction between architects and builder teams in a specific project which they thought was successful in terms of joining the forces of everybody involved:

> "EK- Is this normally an antagonistic relationship? I mean with the builder teams, the designers and the people who give you the commission... How did you build up that passion? Because it seems very difficult – what were your specific ways to incite passion in all the parties involved?
>
> AS- No I think it is more important... It's not our... *We are not driven by our will.* We are driven by doing good architecture. And good architecture is not done by an individual's will; it's done by everybody that makes it. I think that's also why we don't go into things like product design, or into housing where that's very much important... We very much feel that we represent the people that are going to use it, meaning like the city people, or the daily people that are going to use it, we see as our clients. We have our core client, whom we empathize with... I mean these people are investing a lot in us, they're investing a lot of their resources into this, and the builder is going to make everybody successful."[466]

The disadvantage of strong wills within a collaborative framework was brought up by stonemasons and architects alike. One architect, Mehmet Kütükçüoğlu, commented on the image of the architect as the *Fountainhead*, and indicated that such a closed-off demeanour did not breed good communication essential for a creative working environment. While working closely with builders was part of the agenda for some architects, it was not a concern for many others. The interviews showed that it was a conscious decision to collaborate with a local workforce even at the expense of a large amount of risk taking and an increased time commitment for an optimal division of labour and autonomy within the collaborative network.

464. Excerpt from Mark Burry interview, Melbourne, 2007.
465. "There is thus a likely conflict between the will of the architect and the capacities of local builders. When naming construction materials one can consider either local skills or professional interests, whether the latter are matters of routine or invention. The difficulty of this choice is exacerbated by the fact that, nowadays, nearly all materials are used for nearly all purposes. Local material, local builders, successful habits, or current experiments - is one of these topics primary? Is there a principal basis for the selection of materials, or instead must all these topics be considered? Must choice in anticipation of construction always reconcile opposite and rival interests? Is there no firm basis for this necessary part of practice?"
Peggy Deamer, "Introduction" from *Building (in) the Future: Recasting Labor in Architecture*, ed. Peggy Deamer and Philip Bernstein (New York: Princeton Architectural Press, 2010), 19.
466. Excerpt from Alexis and Murat Şanal interview, Istanbul, 2011.

6.4 *"Creating the Collective Mind"*

In the lack of a shared consensus over the quality final building, one aspect of design knowledge has to incorporate the creation of a common level of understanding among all related parties. In the final architect interview, this issue was clarified with a beautiful description by the architect Alexis Şanal:

> "You can get everybody involved in realizing it, and you play it through once… >getting everybody involved in the realization< and therefore everyone who comes to do it, like a rehearsal, everybody has (.)at one point, had a chance to interact with each other, and ask each other what's going to happen… so I think they're all very very important parts of it. (0.8) In such a tactile culture, it is very important to kind of feel and touch and hear things… And it takes away this idea…> I mean in visualization, putting things into 3D <that and> simulations as opposed to visualisations< (.)I'd add to that too… they're just all part of (0.5) <creating the collective mind> (1.0) of what's going to happen..."[467]

In "normal" architectural practice, buildings, once they are realised, become an integral part of a specific location and add to the collective experience of that place. During the making of a building, the concerted effort necessary to bring the abstract project to its conclusion needs a "collective mind," to use the compelling definition of Alexis Şanal. Creating the consensus necessary for a fruitful collaboration requires certain strategies: Different from the strategies employed during abstract design stage, these strategies need to bring together a heterogeneous crowd of human and non-human actors within a situated context, that is, the site of construction. One such strategy is to use the site as an observation platform at a 1:1 scale. This is a strategy that often appears during the stonemason interviews which is afforded by the slow construction process; however, it is rare in contemporary building practice.

In the case of the Sagrada Família, the building itself becomes a testing ground within the context of the whole city, while "the collective mind" belongs to a number of different interested parties both on-site and off-site: Apart from the designers, the teams of builders, church funding bodies, and the residents of the city of Barcelona, the whole architectural community is enrolled in the collective mind via publications and information disseminated through the web.

In the architect interviews, apart from the on-site test which brings together human and non-human actors involved in the realization of a building, publications; talking and listening; and teaching or academic involvement came up as relevant strategies for creating the cognitive infrastructure for collaboration, all of which are utilized consciously or as a matter of fact by the respondents.

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467. Excerpt from Murat Şanal interview, Istanbul, 2011.

6.5 The Site under Construction

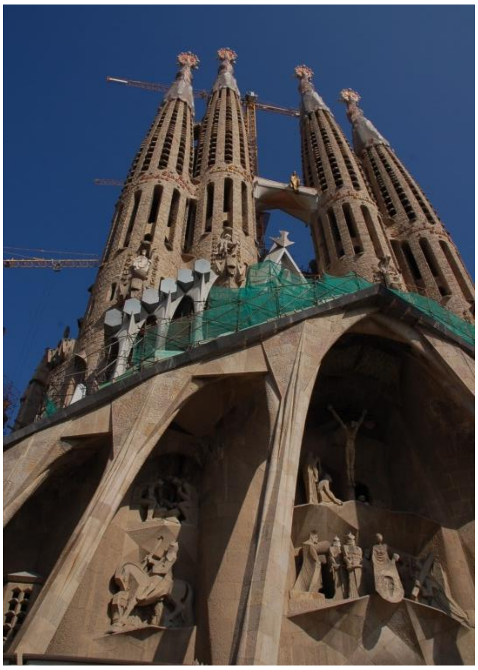

Figure 58. Full scale mock-up of finials tested on the Passion Façade at the construction site of the *Sagrada Familia,* Barcelona, 2008.[468]

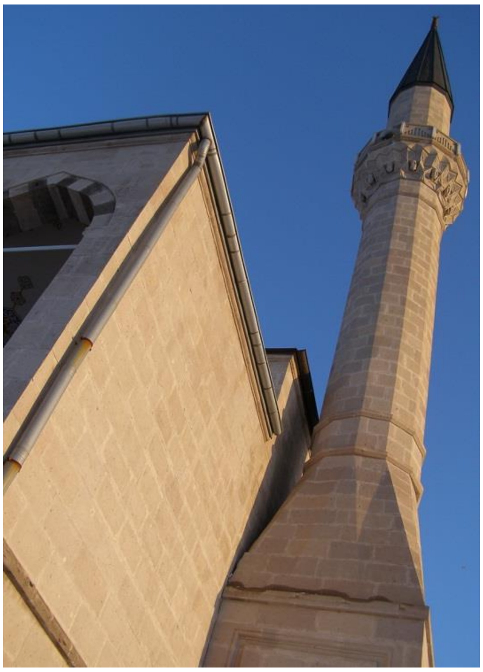

Figure 59. Recently completed minaret in the construction site of *Evliyalar Mosque*, Kayseri, 2007.[469]

> "Usually, the great advantage of visiting construction sites is that they offer an ideal vantage point to witness the connections between humans and non-humans. Once visitors have their feet deep in the mud, they are easily struck by the spectacle of all the participants working hard at the time of their most radical metamorphosis. This is not only true of science, but of all the other construction sites, the most obvious being those that are at the source of the metaphor, namely houses and buildings fabricated by architects, masons, city planners, real estate agents, and homeowners. The same is true of artistic practice. The 'making of' any enterprise - films, skyscrapers, facts, political meetings, initiation rituals, haute couture, cooking - offers a view that is sufficiently different from the official one."[470]

Bruno Latour argues that the "work in progress" nature of any construction leaves one with a feeling that things could be different, a feeling that does not exist in the presence of the finalised artifact. It is precisely this aspect of incompleteness and lack of resolution that gives the construction site its potential to act as an epistemic environment. In architecture, the site under construction offers a unique insight into the resolution stage of building design, available only to those who have learned the necessary skills of observation.

Compared to empirical building practitioners such as traditional stonemasons, architects' experience of the construction site is limited by their degree of engagement with the realisation stage. As explained in the previous

468. Source: Photo by the author.
469. Source: Photo by the author.
470. Bruno Latour, *Reassembling the social*, 88-89.

chapter, for most generalist architects, this experience does not exceed the boundaries of the ephemeral site visit. Based on my observations in this research, I argue that the construction site affords new starting points for a context sensitive and sustainable design practice. Even when architects do not intend to get involved with the construction stage in their practice, it is important to acknowledge the design relevance of tacit knowledge that can be derived from site visits.[471]

This research features sites of work as the focal points of analysis. In this context, the spatial description of a design meeting at the Sagrada Família, and the depiction of the ways in which different artefacts and sites impact upon the nature of design conversations illustrate points discussed in the previous chapters within a shared site of collaboration, which is essentially a domain of intersection for the two groups of respondents. Being a deviant case, the uniqueness of the design practice at SFB does not make it irrelevant in achieving an understanding of contemporary dynamics of design and construction processes, but rather serves as a counterpoint to "normal practice."

Similar to the heritage environments providing a learning opportunity for empirical building practitioners through a process of reverse engineering discussed in Chapter 4, the site of the Sagrada Família, under constant construction for over a century, acts as an epistemic environment that transmits and builds upon the design expertise of Gaudì. Like Gothic cathedrals, it acts as an area of knowledge production and transmission, its epistemological significance arising from the state of being under construction. However, as the differences between the practice of traditional Anatolian stonemasons and the stonemasons working at SFB indicated at the start of Section II show, the specific circumstances enabling the existence of such environments rarely come together in contemporary building practice.

One of the most important conclusions to derive from this section of the field research is the effect of local building cultures on the generation of design knowledge. The accumulation of building expertise at the site of the Sagrada Família is not coincidental. Factors such as Gaudí's educational background that

471. Compared to architectural design, engineering design is arguably much less site specific; still, Eugene S. Ferguson underlines the importance of observing construction sites for practising engineers: "A designer who spends time intelligently observing field and shop work can expect to learn how to improve the construction of a project and to avoid the surprises that too often result from an engineer's ignorance of the nature of manual skills."
Eugene S. Ferguson, *Engineering and the Mind's Eye* (Cambridge, Massachusetts: The MIT Press, 1994).

brought him into contact with the practice of stereotomy[472] and graphical structural analysis,[473] and the existence of a learned patron like Eusebi Güell who appreciated and enabled Gaudí's experiments in smaller scale structures such as the crypt at Colònia Güell come together in the Sagrada Família Basilica, an environment exemplary of sustained knowledge generation and transmission. Indeed, it is only through the coming together of such diverse factors that the context of a challenging project is able to provide the grounds for innovation within a larger context of building and thinking traditions. Prioritising constructability through abstract structural research or through the reutilisation of indigenous structural types seemed to be a continuing strand of thought in the building culture of Barcelona at the turn of the twentieth century. Gaudí's use of the catenary arch[474] and Guastavino's use of the traditional Catalan vault, both examples of an active engagement with a living tradition, illustrate a complex genealogy of interests that distinguishes the context of the SFB within the contemporary architectural practice landscape.

In comparison to the deviant case of the Sagrada Família, the research into "normal architectural practice" reveals some niche practices that seek to formulate sustainable practice patterns based on collaboration utilising an economy of means versus economies of scale, in response to local specificities.[475] In some areas like Japan, where the cultural policy does not relegate craftsmen to a lower hierarchy, but fosters an environment with a strong cultural acceptance of the values and ethics related to making and practical knowledge, maintaining such niche practices is easier to accomplish. However, in other areas like Turkey, where the building practice is becoming increasingly homogenized and the workforce progressively deskilled, this proves rather difficult, and suggests that fostering centres of excellence at the lower end of the technological spectrum is vital for preserving such niches in architectural practice. Most of the differences between different contexts like Australia, Spain, Japan and Turkey are rooted in these cultural biases.

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472. There seems to be a growing interest in stereotomy in recent literature. See: Richard A. Etlin, "Stereotomy: The Paradox of an Acrobatic Architecture," in Giuseppe Fallacara, ed., *Stereotomy: Stone Architecture and New Research* (Paris: Presses des Ponts, 2012), 14-35.
473. Josep Maria Tarragona, "Curs 1872-1873: Anton intenta ingressar a Arquitectura," Gaudí: L'home i la seva obra, last modified April 8, 2007, http://www.antonigaudi.org/curs-1872-1873-anton-intenta-ingressar-a-arquitectura-468.html.
474. Huerta, "Structural Design in the Work of Gaudí."
475. Examples of such practices were the offices of Alexis and Murat Şanal; Bruce Allen, and Burçin Altınsay Özgüner.

Contrary to any possible prejudice, interviews with the groups of stonemasons and architects show builders from each group are both willing and ready to expand their knowledge bases through active collaboration. In the face of a real challenge explained properly and with respect, collaboration between the architects and builders need not be a contested territory. It may be impossible to replicate a similar understanding between builders and architects under contemporary conditions, but recognizing the affordances of collaboration and how it might impact upon the final quality of finished building is crucial for an innovative practice.

The issues around collaboration reveal important zones of conflict within different instances of building practice: These included the negative effects of contractual obligations on the path to an innovative practice, and replacing risk management with the fostering of trust networks in order to counteract this negative impact. Replacing risk with trust[476] was a common wish coming from the two sets of practitioners aiming for a fruitful collaboration. When asked about their opinion on the affordances of the construction site, nine out of twelve architect respondents indicated that they see the construction site as a place of innovation that affords the opportunity of learning from the skills of other collaborators in the process, underlining the importance of forming collaborative networks with trusted building professionals.

This chapter focused on the construction site as an alternative domain where the opposing forces of globalisation and localisation can be observed in their full force until they are resolved in the final tectonics of the built form. The conclusion of this research, coming up in Section III, will involve a reconsideration of the building site as the facilitating framework for the development of an indigenous tectonics informed by the larger context of locality, materiality and social networks - a site of deviation from the globalising thrust of the latest technologies.

476. Based on a suggestion by Prof. Mark Burry, my primary supervisor.

SECTION III:

TOWARDS AN ECOLOGY OF ARCHITECTURAL KNOWLEDGE

CHAPTER 7. Conclusion

> "Every site has a long history that bears on its present. Every site will have a long future, over which the designer exerts only partial control. "[477]

With more than half of the world living in cities,[478] the construction industry employs millions of people with many urban areas constantly under construction at any given time. The majority of this building production belongs to what would once have been called vernacular production – without any design intervention from a registered architect or expert building team. Apart from a small ratio of 'prestige' buildings, completed urban infrastructure is mainly the result of an ad hoc process governed by forces of the contemporary building industry.

In addition to the chaotic aspects of building production, industrialized construction processes and the thrust of the contemporary market economy towards shorter construction time with lower risk margins makes the building industry a hostile environment for an innovative architectural practice. In order to promote innovation and resist the encroachment of the design-build sector in the industry, architects look for ways of validating their professional contribution by associating the knowledge base of architecture with science and technology. However, an epistemology of architecture cannot rely solely on technical rationality, as it is a knowledge domain with strong ties to ongoing traditions, locality and the vernacular.

A need to dissociate the act of construction from its association with technical rationality in order to recognize its design affordances motivated me to conduct this research. I used craft as a heuristic concept to trace epistemic networks that determine the nature of architectural knowledge. The diagram on the previous page shows how I mapped my research interests in the beginning of this study after I decided to utilize the notion of craft as a heuristic device. In that diagram, theory and practice, technique and materials, technological notions and site are shown all muddled together in an attempt to find a way to navigate through this complex web of relationships.

I started by questioning the impact of information technologies on design knowledge and how these technologies promised a return to an idealized situation where architect had a greater amount of control over the building process.

477. Kevin Lynch and Gary Hack "The Art of Site Planning," in *Site Planning*, 12.
478. The World Bank, "Urban Development: Data," http://data.worldbank.org/topic/urban-development.

However, soon after beginning my inquiry into the nature of craft knowledge, I gravitated towards looking into the genealogy of some of the myths shrouding the inherent technological determinism pervasive in architectural discourse on making in relation to modern technology. In the initial stages of the literature review, the interrelations between the issues mapped in the diagram seemed to be as complex and chaotic as the building industry itself. My main motivation therefore was to bring at least some semblance of order to this chaos by delineating an area where making and thinking could be reconciled by the careful consideration of insights coming from an epistemological investigation of building practice.

At the start of my thesis, I claimed that the separation of making and thinking and the fragmentation of knowledge domains in architecture had a detrimental effect on architectural practice. The empirical study based on two different niches within the building industry indeed suggests that practice of designing and making in architecture is increasingly influenced by the utilisation of homogenising templates of design details, resulting in a proliferation of globally distributed building types without much response to local contingencies, even though practice constellations formed around some unconventional projects occasionally counteract this tendency by acting as nodes of innovation within the homogenised practice landscape.

In a landscape dominated by managerial culture, speed of construction rather than long term sustainability becomes the norm. This approach, favouring economies of scale over an economy of means, results in a decreasing interaction with the immediate environment and local materials. However, building approaches with a craft sensibility require active engagement with the site and sustainable use of materials, as well as the knowledge of maintenance with respect to the finished artefact. By pointing out an alternative notion of expertise that informs the translation from the design to the built material artefact, I discussed alternative models of building practice so as to define future strategies for making in architecture.

Findings from the fieldwork conducted within two separate niches of building practice were presented in Section II, with a discussion of various social, material and cognitive strategies used by architects and craftsmen presented in order to delineate the impact of building practice in the generation of design knowledge. These discussions involved a reconsideration of the notion of site as an epistemic environment that enables the generation and handing down of design knowledge in relation to the larger context of locality, materiality and relations - a site of deviation from the globalising thrust of the latest technologies.

The present study, by its exploratory and qualitative nature, asks as many questions as it answers. I conclude this investigation and analysis of affordances of the construction site in relation to design knowledge by proposing lines of inquiry for future research based on the results of my fieldwork, followed by an epilogue in the form of an auto-ethnographical account of my own design practice.

Recognizing building practice as an ecology implies diversity and complexity based on mutual interaction. Although the use of the ecology metaphor is not new within the architectural discourse, the mutual interaction patterns it suggests between the designer and her immediate environment has not previously been investigated through empirical research. By defining architects from small practices and stonemasons as distinct niches within the ecology of building practice, this thesis puts considerable flesh on the bones of Gibson's theory, and stakes out an alternative critical standpoint within the contemporary architectural discourse. This standpoint is crucial for countering the idea of a design practice based on unilateral control, and promoting the idea of responsive design that values diversity, and acknowledges the potentials of various niches of design knowledge within the practice ecology. This ecological standpoint also enables the thesis to reframe the notion of sustainability in architecture by proposing the concept of epistemic environments in the context of building practice, and by presenting physical sites as the cognitive infrastructure of design thinking.

The empirical research conducted for this thesis adds to existing theories of design by investigating the act of construction "in the wild" and assessing the tendencies and attitudes within actual building practice with respect to the construction site. By problematizing the boundaries of normal practice, the research delineates knowledge making strategies from the everyday practice of research respondents to define the factors enabling an innovative practice.

An area for future inquiry would involve the adoption and development of the genealogical method used in the literature review section of this thesis to conduct further design research informed by the history of architecture and heritage from the point of ideas rather than styles. By pointing out genealogies of some attitudes and ideas, I explored the resurgence of some notions associated with craft within the current architectural discourse and pointed to their close connections with former building traditions such as medieval stonemasonry, aiming to harness the potentials within the area of construction history. I especially looked into role models within recent architectural history who embodied the characteristics of designers like Frei Otto, Renzo Piano and Eladio Dieste to elucidate the background behind their individual successes.[479] However, further work in this vein is needed to establish the use of genealogical method in architectural theory that seeks to challenge the preconceived notions related to practice, and inform novel design strategies by utilising history and heritage to discover innovative strands of thinking and making as opposed to stylistic classifications.

In the first chapter focusing on the epistemic characteristics of the stonemasonry workshop, the knowledge making practices of the traditional Anatolian stonemasons were investigated by referring to vernacular craft recipes for the construction of traditional structural types as told by the stonemason respondents. The research was developed by referring to a larger framework of discussions that incorporate craft skills as an essential part of the site of construction; along with oral traditions, culinary cultures, cosmologies and rituals. The practice of the traditional Anatolian stonemasons presented in this chapter provided the clues for establishing a conceptual framework for the redefinition of the notion of site in its capacity as a *resource*; a *repository* of building knowledge, and an *observation platform* for assessing the performative qualities of buildings.

In the next chapter, the knowledge work mediated through strategies of representation in architectural offices was questioned with regards to its innovative potential. Through this line of questioning, I argued that a subtle shift from transcription to translation[480] in building practice would result in a more responsive practice that is informed by an economy of means. I then pointed out the inherent dangers in adopting an approach characterized by the quest of unilateral control of the designer and offered an alternative strategy that builds from the inherent gaps

479. Ochsendorf talks about the strategies utilized by one of these role models:
"...large companies look for general solutions to construction problems and do not encourage local solutions, which depend on local expertise... He directed and trained a generation of workers in the construction of brick structures. He worked outside of conventional regulations and developed his own design methods to demonstrate the safety of thin shells constructed in brick. He pursued practice locally and remained personally responsible for the work."
John A. Ochsendorf, "Eladio Dieste as "Structural Artist"," in Stanford Anderson, *Eladio Dieste: Innovation in Structural Art* (New York: Princeton Architectural Press, 2004), 94-105.
480. This dichotomy is investigated within an historical context by Alberto Péréz-Gómez and Louise Pelletier in *Architectural Representation and The Perspective Hinge*, 1997.

within the process of translation from the design idea to the built artefact for instigating innovation in design practice.

In order to be able to effectively use the affordances offered by social networks and epistemic communities mediated through representations to fit the office environment, determining a specific agenda for practice was singled out as having strategic importance for the furthering of design knowledge within architectural practice. Incidentally, roles and agendas adopted by the practitioners were also influential in establishing a sound ethical basis for their practices, by providing tacit guidelines influencing ethical expertise. Compared to the established codes of conduct and traditional work ethics of the stonemasons, architects needed to navigate a more complex cultural landscape, where professional codes of conduct do not provide much guidance for the ways of acting in particular situations.

In addition to these insights, small practices were found to be important agents of innovation. Here reciprocal interaction and partnerships, rather than a hierarchical structure, along with attentive listening and respect for collaborators ensured the "creation of the collective mind" as defined so aptly by architect Alexis Şanal. Findings in this chapter indicated that innovation is based on mutual respect, with empathy and openness to communication necessary precursors to the creation of the collective mind. Also worth adding is the idea of communities of practice - this community would entail a close collaborative relationship between architects and builders.

Further conclusions from the chapter pointed to the agency of the site visit in the formation of design knowledge. The on-site / off-site dichotomy inherent in architectural practice is discussed by pointing out the necessity of utilising the site visit as a cognitive tool that enables collaboration between different building practitioners. Along with the site visit, the redefinition of models as epistemic artefacts was seen to promote thinking at a 1:1 scale, enabling the designer to reclaim material knowledge via the production of iterative design models.

The final chapter presenting the field work discussed the nature of collaboration among building practitioners and pointed out obstacles against innovation that occur within a collaborative environment: These included the negative effects of contractual obligations on the path to an innovative practice, and replacing risk management with the fostering of trust networks in order to counteract this negative impact. Replacing risk with trust[481] was a common wish coming from the two sets of practitioners aiming for a fruitful collaboration. Apart from this important strategic pointer, the importance of setting up a common agenda for practice resurfaced as a concluding remark. The findings from the interviews showed that choosing to work with local materials, as well as choosing to educate a team of builders are deliberate decisions that involve the well being of communities, which is also a vital aspect of architectural knowledge. The interviews also revealed an interest in the design affordances of the construction site, with more than half of the architect respondents defining the construction site as a site of innovation and the place that enables the cross-pollination of skills among different building practitioners.

The chapter on the *epistemic* aspect of the construction site brought together the two groups of practitioners presented in previous chapters. In this chapter, I discussed the implications of reintegrating duration into the design process, and pointed out that the knowledge of how buildings persist in time was not only relevant for the stonemasons, who already have an intimate affinity with this type of thinking, but would act as a vital source of information for designers, provided that they make use of the affordances of site as a dynamic context that enables contemplation on the effects of time and weathering on built artefacts. Apart from stonemasons who referred to weathering as an integral component of their design knowledge, only a couple of the architect respondents expressed interest in this area of inquiry. Compared to craftspeople, designers in the building industry seem to have neglected the potentials of this area as a fertile ground for discovery. This last chapter of the presentation of findings also involved a discussion on the epistemological characters of the settings that enable innovation and proposed site as an epistemic environment.

In accordance with this proposal vital areas for future inquiry open up: How do different sites impact the generation of knowledge? How do designers and builders relate to precedents when conceiving a building? In accordance with these questions using history as a source of creative inspiration by referring to precedents and distilling their performative aspects came up as an important context-sensitive design strategy. Another possible area for future inquiry would be the investigation of the processes by which knowledge is transferred via artefacts. This line of

481. Based on a suggestion by Prof. Mark Burry, my primary supervisor.

thinking, which was initiated by the testimonies from the practitioners recognizing the cognitive affordances of the artefacts across different kinds of sites, suggested an alternative framework to posit site as an epistemic environment within architectural discourse.

One of the most important conclusions I derived from the epistemic aspect of building practice concerned the effect of local building culture on the generation of design knowledge. In arguing this point, I discussed the specific circumstances enabling the existence of the Sagrada Família as an epistemic environment, sustained by a complex genealogy of structural and cultural interests within the local building tradition. Within this framework, the contemporary relevance of the Sagrada Família project stems from its explicit design rationale that prioritizes constructability paired with a highly specific and complex formal expression: This complexity, sustained and transmitted through a site under construction, unifies traditional working methods with cutting edge design technologies that involve the use of digital templates in its production.

Another critical observation enabled by this study is that workforce within the building industry, while highly specialized at the upper end of the technological spectrum - portraying a wide range of white collar professionals like civil engineers, material engineers, quantity surveyors, heritage consultants, acoustic engineers, construction managers and expert building teams specializing in different state of the art technology - is largely stripped of whatever local expertise was available at the lower end of the spectrum due to over specialization and deskilling. In case of prestigious projects with high budgets, the process of construction can benefit from the availability of centres of excellence where the pressures of market economy is counterbalanced by an informed researched agenda, and a community of dedicated building professionals pushing for innovation. However, at the lower end of the spectrum, there is the pressing need to foster excellence in everyday building practice; otherwise the impoverishment of environmental quality will come to unprecedented levels, especially in countries on the margins of technological development. Market pressures coupled with deskilling makes this a hard task to undertake. It can be argued that this is a case for at least keeping a portion of the crafts based practices in the building industry intact.

Epilogue: "House with a Thousand Stones"[482]

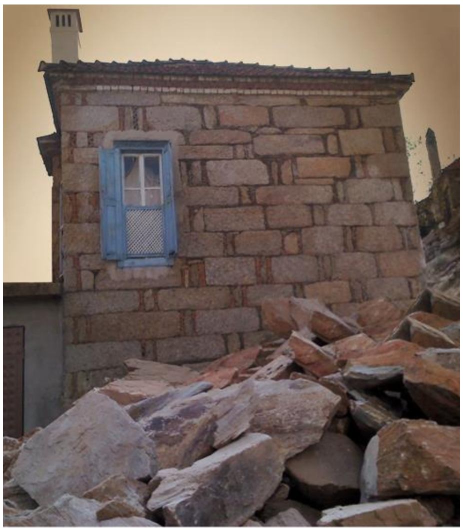

Figure 60. House from Çomakdağ, an inland Aegean mountain village, with stones piled up in front to build an extension, 2011.[483]

Figure 61. Landscape of Çomakdağ with surface rocks used in the construction of the traditional village houses, 2012.[484]

> "Since traditional discussions of knowledge have generally assumed that human situatedness in a physical environment is not relevant to matters of the mind, this continuing impoverishment of the natural environment has rarely been considered to have any detrimental effect on thought and belief. Epistemologists theorizing about knowledge might be vaguely concerned that a biologically impoverished planet could adversely affect their nutrition and their respiration, but they have never suggested that it might also adversely affect their decision and their contemplation. In the accounts of thought and mind that we have inherited in Western philosophy, the accepted story is that environmental destruction affects biology but not epistemology."[485]

During the course of this research, I received my first architectural commission for designing two stone houses in a historical tangerine garden in Gümüşlük, a Western Anatolian town on the Mediterranean coast of Turkey. Although the scale of the project is not comparable to the projects I have investigated during the fieldwork, it still features some key aspects that will further our understanding of generating design based on the perceived affordances of the building site, and of indigenous narratives of construction.

During the initial design stages of the project, I had the chance to visit Çomakdağ, an inland Aegean mountain village in western Anatolia, Turkey.[486] The village featured green hills with abundant surface rocks, which the village masons

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482. This section is based on an auto-ethnographical account of my design practice during 2010-2012.
483. Source: Photo by the author.
484. Source: Photo by Özgür Gök.
485. Christopher J. Preston, *Grounding Knowledge: Environmental Philosophy, Epistemology and Place*, (Athens, Georgia: University of Georgia Press, 2003), p.xiii.
486. I was there in the autumn of 2011, on a design studio trip with my students, who were asked to design new houses in the area within the context of existing vernacular fabric as a second year architectural design assignment.

used to build the houses in the village. Although more recent constructions involved concrete additions to existing stone houses due to the time and money constraints associated with traditional stonemasonry construction, there were still ongoing constructions using traditional stonemasonry.

In our excursion, I met one of the village stonemasons, Ahmet Dursun Sakallı, whose narrative on stone building provided the title of this section. He was kind enough to elucidate how he works with stone - starting from the extraction of pieces from around the village, to the building of the walls and the detailing of chimneys - an expressive characteristic feature of the buildings in the area. The most revealing aspect of his account, however, was the natural way he referred to the resources in his environment. When describing the stages of building a house, he explained that the person who wants to build a new house first decides on the size: "let's say he wants a house of a thousand stones;" and then extracts the rocks from around and piles them up on the site where he wanted to build the project. Indeed, we had seen a couple of empty lots on which there were carefully piled stones throughout the village. Some of the houses even used an existing rock as an integral part of the building, leaning on the face of the rock, and using it as one of their walls. He also referred to local flora in terms of their potential for use in different parts of the buildings,[487] as did my previous respondents from the stonemason interviews.

This way of relating to the environment, developed through intimate interaction with the site, ensures the mindful use of the *site as a resource*, in accordance with an economy of means characteristic of vernacular building production. This approach is naturally sustainable and in harmony with natural systems. It is also a type of building production that is irrevocably left in the past. There is no sense in longing for a past with a different social and economic context. What is of interest in the vernacular architecture is the intangible heritage of making according to the means at hand - the complex knowledge making practices that enable this sustainable approach.

In this sense, one of the main differentiating characteristics between the material knowledge of traditional stonemasons and that of architects is the degree of situatedness. Even if it is no longer possible to build a house "with a thousand stones," it is definitely worth trying to come to terms with issues concerning

487. For example, he referred to the use of the local shrubs like the tree heath, *erica arborea*, for strengthening foundations and for using as a cover material in the roofs under the layer of compacted earth.

materials, structures and their relation to natural systems in order to establish an ethical practice based on the traditions of making buildings without imitating past styles or shying away from new technologies. The challenge is to keep practising within an environment of technological determinism that is often hostile to any innovation alternatives posed against the economies of scale.

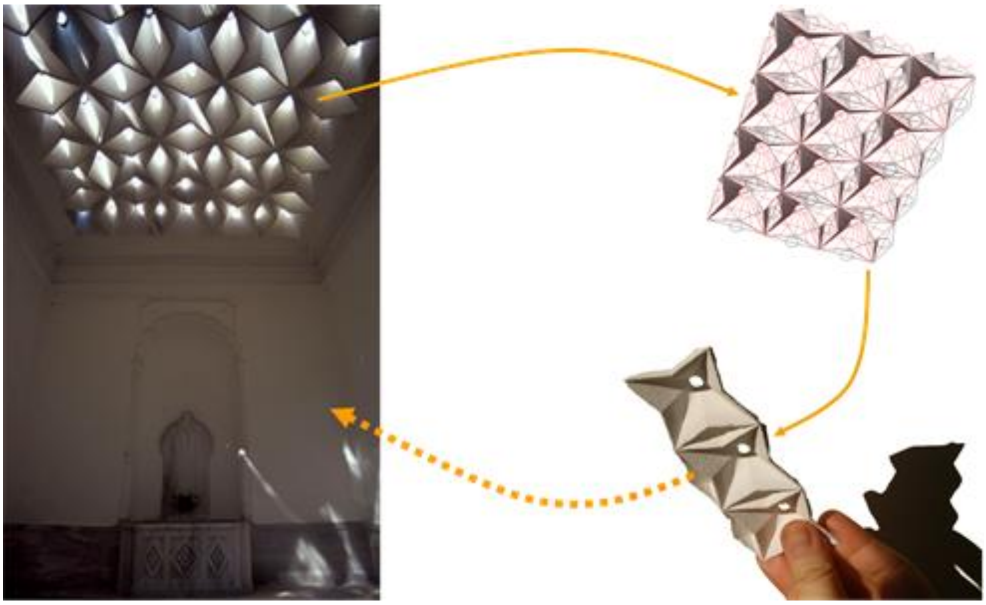


Figure 62. Diagram showing the initial artefact, its digital model, and plaster print, 2008.

In order to re-establish a creative relationship with the act of construction and the building site, the designer needs to make use of the circularity of perception, cognition, and abstraction during the process of designing. The reciprocal interaction between the builders and their environment is the most significant characteristic of the vernacular building process. What architects can contribute to this sustainable relation is their training in abstraction to reveal the innovative potential of traditional practices by means of creative translation. It is in this context that a return to the notion of the master builder would make sense: through a combination of reciprocal interaction with the site and active design research made possible by abstract means of translation to uncover the design affordances of the site. It would only then be possible to offer the master builder as a contemporary role model for a sustainable architectural practice – not as a lone genius with unilateral control over the design and production stages of a building process, but as a *situated practitioner* in tune with the actual requirements of her environment.

In an era of splintering specialisations, it becomes more important than ever to recognise the fragile ecology of design knowledge. In an increasingly homogenised environment, loss of one type of building practice might lead a whole culture of workmanship into extinction. By using craft as a conceptual model for tracing the lineage of different modes of knowledge that inform architectural design and its translation to the built material artefact, it becomes possible to critically assess the area of possibilities opened up by the renewed interest in techniques and technologies and to propose a framework for defining future strategies for making in architecture. Recognising the affordances of the construction site in architecture would lead to a better assessment operating according to an economy of means, and open up the way for a *reciprocal* interaction between designing and making.

APPENDICES

A.1: Consent Form

RMIT HUMAN RESEARCH ETHICS COMMITTEE

Prescribed Consent Form For Persons Participating In Research Projects Involving Interviews, Questionnaires, Focus Groups or Disclosure of Personal Information

PORTFOLIO OF	**Design and Social Context**		
SCHOOL/CENTRE OF	**Spatial Information Architecture Laboratory**		
Name of participant:			
Project Title:	**Genealogies of Craft in Architecture: Learning from the Construction Site**		
Name(s) of investigators: (1)	**Elif Kendir**	Phone:	**+61 3 9925 9985** office
(2)		Phone:	**+61 3 406 874 288** gsm

1. I have received a statement explaining the interview/questionnaire involved in this project.
2. I consent to participate in the above project, the particulars of which - including details of the interviews or questionnaires - have been explained to me.
3. I authorise the investigator or his or her assistant to interview me or administer a questionnaire.
4. I give my permission to be audio taped ☐ Yes ☐ No
5. I give my permission for my name or identity to be used ☐ Yes ☐ No
6. I acknowledge that:

   (a) Having read the Plain Language Statement, I agree to the general purpose, methods and demands of the study.

   (b) I have been informed that I am free to withdraw from the project at any time and to withdraw any unprocessed data previously supplied.

   (c) The project is for the purpose of research and/or teaching. It may not be of direct benefit to me.

   (d) The privacy of the information I provide will be safeguarded. However should information of a private nature need to be disclosed for moral, clinical or legal reasons, I will be given an opportunity to negotiate the terms of this disclosure.

   (e) The security of the research data is assured during and after completion of the study. The data collected during the study may be published, and a report of the project outcomes will be provided to_____________(researcher to specify). Any information which may be used to identify me will not be used unless I have given my permission (see point 5).

Participant's Consent

Name: ______________________________ Date: ______________
(Participant)

Name: ______________________________ Date: ______________
(Witness to signature)

Participants should be given a photocopy of this consent form after it has been signed.

RMIT University
Design and Social Context Portfolio
School of Architecture and Design

Plain Language Statement to be used in a research project involving human participation

Dear Mr./ Ms. ***…………***

My name is **Elif Kendir**. I am a PhD candidate studying at RMIT University, Melbourne.

This study is being undertaken as part of a PhD by Thesis degree through the Spatial Information Architecture Laboratory in the School of Architecture and Design. My research is being supervised by **Professor Mark Burry** who is the Professor of Innovation at the Spatial Information Architecture.

I am investigating the impact of craft in architecture, and how present practitioners use materials in their design process. The title of my research is "**Genealogies of Craft in Architecture: Learning from the Construction Site**".

The research addresses the nature of architectural knowledge, and investigates how knowledge is produced through practice. It regards material knowledge preserved within craft traditions as a potential source of architectural innovation that might be activated with the help of information technologies. It references such areas as sustainable technologies, history of architectural construction methods and computer aided design and fabrication.

I would like to invite you to become involved as a participant in this research project.

This information sheet describes the project in straightforward language, or 'plain English'. Please read this sheet carefully and be confident that you understand its contents before deciding whether to participate.

Aim/s and brief background
The research questions whether crafts practices can still act as repositories of architectural knowledge. The conducted study fits into the growing research field of computer aided architectural fabrication, and aims to complement existing studies by providing a historical and ethnographic outlook. It is being conducted to find better ways to reintegrate material knowledge into the architectural design practice.

Why you have been approached
In order to test the theoretical propositions of the research, I will be conducting interviews with a range of designers and craftspeople. In total, I am planning to interview 5-10 designers and 5-10 craftsmen. You have been approached to participate in this research because of your expertise in your field.

What is expected of you and how long it will take
If you agree to participate, you will be required to answer questions about your expertise during a 40-60 minute interview (please find the draft attached). The interview will be taped, and your work environment will be photographed.

I will collate the data collected from the questionnaires to use in my PhD. The collected information can also be used in articles and conference papers.

What happens if you withdraw
If you withdraw from the project at any time I will destroy any unprocessed data relating to your involvement.

Possible Risks and Benefits
There are no perceived risks outside your day-to-day activities. There is also no instant benefit for the participant, however, it is hoped that the research will help to improve the utilisation of appropriate materials and sustainable technologies in the practice of architecture.

Privacy and Disclosure of Information
Your participation in the study may be taped, photographed or videoed and this footage might be used in a presentation or exhibition environment. These records will be kept for 5 years in SIAL server, in a folder where only the researcher and her supervisor will have access to. As a participant, you will have access to the information collected from you at any time that you deem necessary.

Neither of these steps will be undertaken without your full, written consent. Please note, participation in this study is entirely voluntary.

For further information please don't hesitate to contact me through e-mail [elif.kendir@student.rmit.edu.au] or by phone on +61(0)406 874 288; or my supervisor Prof. Mark Burry on +61 (0) 3 9925 3520.

Kind regards
Elif Kendir

PhD Candidate
Spatial Information Architecture Laboratory
School of Architecture and Design
RMIT University
Ph: +61(0)406 874 288
[e]: elif.kendir@student.rmit.edu.au

Any complaints about your participation in this project may be directed to the Secretary, RMIT Human Research Ethics Committee, University Secretariat, RMIT, GPO Box 2476V, Melbourne, 3001. The telephone number is (03) 9925 1745.
Details of the complaints procedure are available from: www.rmit.edu.au/council/hrec

GUIDELINES for INTERVIEW type A: [STONEMASONS]

Information on the Participant:
How long have you been practising your trade?
How and where did you learn it?
Describe your working environment.

Project Specifics:
What kind of projects have you worked on in the last 5 years?
What kind of areas are they located in (ie. Urban, rural, metropolitan…)?
Has there been any institutional context for the projects that you have undertaken?

Collaborators:
Who are the collaborators in your projects?
Who is your primary contact during the construction process?

Materials:
What affects your choice of the materials?
How do you select the appropriate type of stone for a project?

Process:
Describe the process of a stone construction step by step.
How do you translate a design into the built form? Do you use drawings, mock-ups, models…?

Technology:
Describe your set of tools.
Do you follow the latest technology in your field?

Further Comments:
What would be a challenging project for you that you would want to get involved in? Why?
What do you think about the present state of stonemasonry?

GUIDELINES for INTERVIEW type B: [ARCHITECTS]

Information on the Participant:
Please describe your professional background and your current position. (ie. qualifications and job description)

How would you define your area of expertise?

Describe your working environment. (ie. on-site, office based… etc)

Project Specifics:
What kind of projects have you worked on in the last 10 years?

How long have you been involved in your current project?
What, if any, is the impact of the local building culture on this project?
What, if any, is the impact of this project on the local building culture?
How would you describe the impact of this project on your design approach?

Collaborators:
Who are your collaborators in the projects that you have been involved in?

Has the profile of collaborators changed over the past years? How?

Has there been a cross-pollination between the skills and/or approaches between different actors in the design/construction process?

Materials:
What kind of factors and considerations are involved in the selection of materials during the design process? (eg. Structural concerns, local availability, symbolic aspects, longevity… etc)

How do these material choices evolve during the construction process?

What are your observations on the use of stone in contemporary projects?

Process:
What were your observations on the construction sites of the projects you were involved in? (ie. are they sites of conservation? Are they sites of invention? …)

Are the skills developed during the construction of your projects transferable?

Have the construction sites of your projects evolved over the past years? How?

Technology:
Describe your set of tools. (ie. What type of instruments do you use in your design process? Which instruments are becoming more prevalent? Which instruments are becoming redundant?...)

Do you follow the latest technology in your field? Does state of art technology in your field influence your design approach? How?

Further Comments:
What is the biggest challenge in your current position?

A.4: Transcription Conventions[488]

.	*Period*: A stopping fall in tone.
,	*Comma*: Continuing intonation, as if reading items from a list.
?	*Question mark*: A rising intonation.
-	*Dash*: Cut-off.
...	*Ellipsis:* Inconclusive cut-off.
[]	Overlapping speech
(0.5)	Pauses in speech expressed in tenths of a second
(.)	A tiny gap between utterances
::	Stretching the sound preceding the mark
Word	Stress or emphasis on word
>word<	Compressed speech
<word>	Slow or drawn out speech
((transcriber's description of events))	
(word)	Best guess at a muffled word
( )	Inaudible - no best guess available for word

488. The sample transcript in the *Appendices* and the excerpts used throughout the thesis are based on the modification of a template in Paul Ten Have, *Doing Conversation Analysis: A Practical Guide*, 2nd ed. (London: SAGE Publications, 2007).

A.5: Individual Characteristics of Respondents

Below are the individual characteristics of the two main groups of interview respondents. The list doesn't contain participants from the preliminary interviews.

First Set of Interviews | Stonemasons

Ali Onur was a 75-year-old retired stonemason from Adatepe, a Western Anatolian village in Turkey at the time of the interview. This is the very first interview that I conducted. Ali Onur was a rural stonemason, who had extensively built houses in his own village, having travelled only once to build a stone house on a nearby island at the invitation of a local architect. *KOREFD (Conservation and Restoration Firms Association)* in Istanbul did not have a detailed database of traditional stonemasons according to their location, but they were able to provide me names of specific villages, like Onur's village Adatepe, where it would still be possible to find stonemasons working in the traditional sense. I went to the village without a specific name, found a stone house under construction, and one of the stonemasons working on the house gave me the name of his father, Ali Onur, who, being retired since two years would be happy to talk with me about stonemasonry. I conducted the interview while we were walking around the village, looking at buildings as points of reference for topics emerging during our conversation.

Mustafa Tümay was a 50-year-old practicing stonemason from Assos, a Western Anatolian town in Turkey. I had acquired his contact details via my contact at *KOREFD* in Istanbul. He was also a rural stonemason practicing within Western Anatolia. He told me that he had left his village a couple of times to go build in the neighbouring villages. I conducted the interview in the town square, where there was a house under construction, and Tümay was kind enough to show me his tools, and performed a demonstration of how to prepare a rough cut stone for construction by using hand tools.

Mehmet Özkavak was a 53-year-old stonemason practising in Kayseri, Turkey. I also reached him via the skills training institute in Istanbul. He was a diversified urban stonemason practicing around Central Anatolia. Contrary to the previous two respondents, Özkavak had travelled extensively in the region, building minarets - a construction type requiring extensive structural knowledge. Together with his older brother Ahmet Özkavak, they were able to build a number of complex stone structures ranging from houses to mosques and hammams. I had received his contact details from the archaeological excavation team at Sagalassos during my preliminary interviews.

Ahmet Özkavak was a 57-year-old stonemason practising in Kayseri, Turkey. I had initially made contact with his younger brother, Mehmet Özkavak, who subsequently introduced me to him.

Yusuf Kıdır was a 65-year-old stonemason practicing in Mardin, a Southeastern Anatolian historic city and a world heritage site known for its stone architecture, in Turkey. His interview was conducted on the construction site of a new mosque in which he was commissioned to do the stonework for the primary façade of the mosque, which was otherwise a featureless reinforced concrete construction. In accordance with the ethnic diversity of the region, he was fluent in a variety of languages, and exuded confidence and authority. [489] Other stonemasons in the area talked about him with respect, and referred to his extensive amount of work in the area as exemplary.

Halis Göksu was a 25-year-old stonemason practising in Mardin, Turkey. I reached him via an archaeologist, Kutalmış Görkay, who is conducting an archaeological excavation in the area and uses traditional techniques in reconsruction. Göksu is a diversified urban stonemason practicing within Southeastern Anatolia, and the youngest of the masons interviewed. In accordance with his age, he was sometimes prone to exaggerating his impact on the construction of some buildings to which he referred. However, he was also very helpful in providing contacts, and went into the trouble of guiding me through the important buildings in Mardin.

Elias Yaşlı was a 60-year-old retired stonemason from Mardin, Turkey. I reached him via the recommendation of Halis Göksu, who took me to the church he was currently working for as a guard. Together with Göksu, he explained stonemasonry details from the region while walking around the church grounds.

Davud Çetin was a 56-year-old stonemason practising in Midyat, Turkey. Midyat is a town close to Mardin and has many stone monasteries in its vicinity. Davud Çetin was the only stonemason I interviewed who owned a small workshop

489. Mardin is on the southeastern border of Turkey, neighboring Syria, and is a very cosmopolitan city with a long urban history. Therefore most people in the region are at least bilingual. Yusuf Kidir told me that his native language was Arabic, but apart from talking a beautifully poetic Turkish, he was conversing with the other stonemasons alternatively in Kurdish and Assyrian during the course of the interview.

producing decorative stone elements in batches. He was also the only stonemason who had people working for him, rather than with him. This was one of the shortest interviews, but I was able to observe the new tendencies in the region's stonemasonry culture when I had a chance to observe the working environment in his workshop.

Ramazan Güdüloğlu (44 years old), and **Mehmet Özcan** (57 years old), were stonemasons practicing in Dolmabahçe Palace in İstanbul, Turkey. They are urban stonemasons highly specialized in the maintenance of the palace. I interviewed both masons together in the stonemasonry workshop on the palace grounds. Due to their constant work on the palace grounds, they have extensive knowledge of the type of preservation materials used in stone structures to combat the effects of weathering.

Mehmet Talı was a 50-year-old stonemason practicing in the historical Balat district of Istanbul, Turkey. He was the only stonemason I interviewed that was a stone veneer specialist. His past experience involved making of structural stone walls, but had completely established his workshop for the production and installment of stone veneers at the time of the interview.

Selim Özdemir was a 67-year-old stonemason practicing in Istanbul, Turkey. I reached him via the skills training institute in Istanbul. He was an urban stonemason who was also working as an active teacher in the skills training institute and advocating for the preservation of stonemasonry at the time of the interview.

Second Set of Interviews | Architects

Mark Burry is an architect and academic teaching in Melbourne, Australia; and he has been involved in the research conducted for the construction of *The* the *Sagrada Família Basilica* [SFB] in Barcelona, Spain since 1979.[490] He was the primary informant who helped me get in contact with the construction team in the SFB project while sharing his insights on the overall process. He is the Professor of Innovation at the Design Research Institute at RMIT University, and an executive architect and design researcher at the SFB design office. Professor Burry is my primary supervisor and his was the first architect interview I conducted after the stonemason interviews. Although having a similar course of themes, his interview differed from the subsequent architect interviews in scope and questions as this constituted part of a pilot study on the case of the Sagrada Família Basilica.

Antonì Caminal i Homar is an architect working at the SFB design office in Barcelona, Spain. With degrees in architecture and urbanism, he has worked in various projects until his involvement with the construction of the *Expiatory Church of the Sagrada Família* in 1989, as a technical architect. He regularly contributes to the design research conducted at the technical office of SFB by coordinating the automated production of natural stone elements used in the church. His main area of interest is the production of stone elements used in the construction of the church by manual, mechanical and computer aided means. Along with Mark Burry, he is the primary informant for the case study of the design office at the Sagrada Família Basilica.

Mehmet Kütükçüoğlu is an architect and the founding director of *Teğet Mimarlık*,[491] a prestigious small practice from Istanbul, Turkey. Most of the office's major projects currently under construction, Kütükçüoğlu expressed his recent interest in the potentials of the construction site and talked about a couple of strategies they devised in order to increase site specificity. Apart from his practice, he is one of the founders of a graduate program in architecture at Bilgi University in Istanbul, and has been teaching graduate architecture studio there since 2002. Educated in the Middle East Technical University, he then left for the US to study at Sci-ARC, and consequently practised in Switzerland and the US before returning to Turkey to open his practice in 1996. He is one of the respondents with whom I had a prior collaboration history: we have co-tutored several graduate architectural design

490. For the SFB research website see: http://sagradafamilia.sial.rmit.edu.au/
491. For his practice website see: http://teget.com/

studios together between 2001-2004, and collaborated on an award winning architectural design competition in 2002.

Burçin Altınsay Özgüner is an architect and heritage specialist practicing in Istanbul, Turkey. She is the primary informant who helped me find the traditional stonemasons in the first set of interviews, and has extensive experience working with them in restoration and reconstitution projects. She is the local director of UNESCO heritage conservation committee for Istanbul's Fener-Balat district and the co-founding partner of *Parallel 41 Architects*. Her main area of interest is building materials - more specifically weathering and material conservation.

Han Tümertekin is an architect and the director of *Han Tümertekin Architects* in Istanbul, Turkey.[492] He runs a high profile small practice and teaches architectural studio part time in various universities in Turkey and abroad. He was the recipient of the *Aga Khan Award for Architecture* in 2004. He has also worked with local stonemasons on a variety of residential projects which he related during our interview.

Bruce Allen is an architect and co-director of *Allen Naughtin Architects* in Melbourne, Australia.[493] He runs a small practice and teaches part time in several universities. With a trade background in turning and fitting followed by a bachelor of architecture from Melbourne University and masters in urbanism from the University of Toronto in Canada, Allen has a diverse academic and practical background. He talked about his experience with a design build firm during the interview and discussed the insights he gained from working with a very different minded builder group.

Thomas Daniell is an architect and director of *Thomas Daniell Architects* in Kyoto, Japan.[494] Originally from the US, Daniell has a bachelor of building science and architecture from Victoria University in Wellington, New Zealand, and a master of engineering majoring in architecture from Kyoto University in Japan. During the time of the interview, he was a fellow PhD candidate at RMIT. His practice background involves working for different important offices in a various countries, and as of 2008, he had established his own practice under his name while

492. For his practice website see: http://www.mimarlar.com/
493. For his practice website see: http://www.allennaughtin.com.au/
494. For his practice website see: http://www.thomasdaniell.com/

teaching part time in Kyoto Seika University in Kyoto, Japan. He has also published a number of books and contributes regularly to architectural publications.

Tim Schork is an architect and co-founder of *Mesne*, a design office focusing on the innovative use of information technologies, operating from Melbourne, Australia and Copenhagen, Denmark.[495] During the time of the interview, Schork was a fellow PhD candidate from SIAL at RMIT, with whom I taught the *Tools for Conviviality* design studio in 2008. Mainly interested in the creative potentials of coding for architectural design, Schork had mainly built small scale installations with CNC produced components while with *Mesne* they acted as consultants to a variety of larger scale projects.

Paul Minifie is an architect and part time academic teaching at RMIT and co-director of *Minifie van Schaik Architects* in Melbourne, Australia.[496] During his lecture at the *Tools for Conviviality* studio, he expressed strong views on craft, which led me to invite him to participate in my research as a respondent. He has built several small and medium sized projects, and directs his own design firm since 2000.

Alexis Şanal and **Murat Şanal** are architects and founding directors of *Şanal Architecture | Urbanism* in Istanbul, Turkey.[497] They have established their own practice in 2002 and teach part time in several universities. This interview was the last interview, and was conducted considerably later than the previous interviews as a more detailed conversation discussing the issues that were starting to evolve in the thesis. Alexis Sanal was a guest lecturer at the basic design studio I was teaching at Bilgi University in Istanbul, and her presentation on their use of "models, mock-ups and rehearsals"[498] in their practice led me to invite her to participate in my research as a respondent. During the interview, Murat Sanal also joined the conversation, and they gave a detailed account of the day-to-day aspects of their practice. Alexis Sanal is originally from the US, and both Murat and Alexis were registered architects in the US as well as in Turkey.

Participants in Other Research Activities

Lisa Norton is a sculptor who conducted a project called *Systems for Slower Architectures* in China. During the preliminary interviews, I contacted her via email

495. For his practice website see: http://mesne.net/
496. For his practice website see: http://www.mvsarchitects.com.au/
497. For their practice website see: http://www.sanalarch.com/
498. This classification is used as the title of the subsection 5.4 in Chapter 5 of this thesis.

correspondence where she sent me the details of her project work conducted with stonemasons from China. Even though I do not refer to her project within the framework of this thesis, it was influential in sensitizing me to certain concepts related to the contemporary state of stonemasonry.

Sinan Ilhan is a sculptor with extensive experience in stone. Apart from his artistic practice, he has worked in classical archaeology excavations as a restoration expert for stone sculptures. Together with **Ceren Balkır Övünç** and **Hayim Beraha**, both architects, he has worked as a consultant and builder in the arts residency project[499] involving the construction of a low stone wall.

Mark Goulthorpe is a practicing architect and an academic from the US and France. With extensive experience in the utilization of digital technologies in architectural design and fabrication, he has collaborated with my primary supervisor Professor Mark Burry on a number of occasions. Goulthorpe was a panel member in one of my intermediate thesis reviews that was taped with the permission of all committee members, and was kind enough to let me use his comments in the body of the thesis.

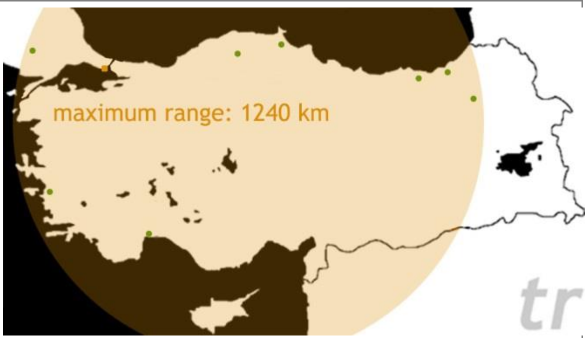
LSF Design Meeting: Jordi Bonet i Armengol, **Jordi Faulí i Oller**, **Jordi Coll i Grifoll**, **Antoni Caminal i Homar**, **Jordi Barbany**, **Mark Burry,** and **Jane Burry** (via Skype) in Barcelona were participants in a design meeting at the *Expiatory Church of la Sagrada Família*, the design office of which was used as a case study. This design meeting provided me with crucial insights concerning the nature of knowledge making practices within an ordinary practical setting, and its background is discussed in detail in Chapter 6.

Ahmet Dursun Sakalli was a village stonemason we came across during a design studio trip. The studio was a second year undergraduate architectural design studio about vernacular stone housing that I taught with a group of colleagues in the School of Architecture at Istanbul Bilgi University in 2011. Since it was a chance encounter I was not prepared to officially conduct an interview with this stonemason. After obtaining his verbal permission to take his photographs and use his name in my thesis, I reconstructed the story he narrated to our studio group from my field notes.

499. See A.9 "Arts Residency *fol@ypenburg* at Artoteek Den Haag, 2007" in the *Appendices*.

A.6: Sample interview summary | Stonemason Interviews

Interview Summaries | *Stonemasons* | ISTANBUL | Selim Özdemir, *1932

Participant Info:	Interview date: 26/02/2007 Interview mode: Sedentary Interview setting: A traditional café in the Balat district of Istanbul. Expertise: Structural and ornamental stonemasonry Experience: 54 years: Started apprenticeship at 12 years old, now teaching at the skills training institute in Istanbul. Workshop trained / performed chores in the shop during the first years of his apprenticeship / prepared toilet stones and hammam sinks First job as journeyman at the Mihrimah Sultan mosque / construction of the stone mihrab (ornamental tracery)	Working Mode + Work Environment: Urban- Itinerant Freelance with part-time institutional involvement Travels to different cities to perform as highly specialized master stonemason Notes + Quotes: "You have to introduce apprentices to this trade right after primary school, when they are no older than 12 years. That is when they are the most curious about their environment and are at their most receptive state. Older than that, they lose interest…"
Project Specifics:	Project Types: Restoration work for mosques, palaces, caravanserais, cisterns, clock towers Minaret restoration Minaret building Ornamental stone fountains Project Locations: Main location **Istanbul**, but has travelled to Erzurum, Edirne, Rize, Trabzon, Sinop, Kastamonu, Antalya, Kuşadası Institutional Context: Ministry of Culture Directorate General of Foundations High Council of Immovable Monuments and Antiquities Municipalities Universities KOREFD (Preservation and Restoration Firms Association) Skills Training Institute : *direct involvement	 **[On the specificity of stone minaret restoration]** "In our trade, not everyone is granted the chance to build a minaret. Do you know why? It is a rare skill, and the building of a minaret is highly problematic: you use the old technique, the old system, for example, lead is used, you have to use "*kelek*" (mud infill), you have to use "*zıvana*" (tenon) - you have to strictly follow the old rules, the same techniques. That is why a couple of groups left the project; they weren't able to do it. Then we went there, completed the minaret and submitted it in due time."
Collaborators:	Architects Restoration experts Primary contact: Architect	**[Anecdote about a stone minaret construction]** In one of the minaret constructions in which Özdemir was the master stonemason, the architect asks him to leave the stones on the interior of the minaret undressed, as they will not normally be seen. He says "I cannot steal from my art" ("*Ben sanatıma hırsızlık yapamam*")
Materials:	Criteria for material selection: **Quality**: He often visits quarries to select stones. Utilization according to the individual characteristics of blocks such as the **grain orientation**: He places stones according to their "reverse grain" ("*ters damar*") in order to avoid water absorption	**[Polysensorial assessment]** Özdemir says that he can understand the quality of the stone from its **visible characteristics**: surface stones tend to have greater pores and lesser strength, while stones deep from the quarry have a denser structure and have more resistance. He also **sounds the stone** with a mallet to see if its hollow

Process:	Quality control **Slow construction** Construction planning **Drawing on the ground** at the construction site Numbering stones Cardboard **templates** **Vault construction:** poplar formwork	[**Oral culture:** Anecdote about Sinan's Süleymaniye Mosque – where mythology is mixed with technical details. This anecdote is told to him by an old man. He talks about **the length of time spent on location**, allowing for a deeper connection to the place and its inhabitants] In the anecdote, Süleyman the Magnificent asks Mimar Sinan to build him a mosque to withstand the most powerful earthquakes and further his glory. Sinan waits for the **foundations** to settle for seven years: "…so that they are subjected to seven summers, winters, storms, rain and deluge…"
Technology:	Set square Ruler Compass String Chisels Pencils Mallets Cockscomb	He commissions an ironmonger to make his own tools.
Comments:	Özdemir complains about the lack of appreciation of art in Turkey, and says that the apathy concerning the need to train new apprentices poses the greatest challenge to their work.	(Referring to the photograph of the balcony of a minaret that he has built) "This lattice work, there is no master left to carry out this stone work anymore. I wrote this in my article where I say there will be no one left in Turkey to do this, and they will need to bring master masons from Italy and from Greece…"

A.7: Sample Transcript with Initial Coding[500] | Architect Interviews

The interview with Sanal Architects was the very last interview I conducted as part of my field research; therefore some questions were more specific in order to explore additional themes that emerged in the previous interviews.

Interview with Alexis Şanal **and** ***Murat Şanal*****, Istanbul** [Date: May 24, 2011; Duration: **01:37:09**]

[file names: **AlexisMuratSanal 1.wav + AlexisSanal 2.wav**]

[Quote; Keyword; **Question/ Proposed Concept; Theme**; Field Notes; MEMO; //..:overlapping conversation**]**

professional background & current position	Elif Kendir [EK]- I'll just go through these questions because I'm asking the same questions to every respondent, just in order to be able to compare things... So, in the first one I'm asking you to describe your professional background and your current position...
[0:01:09]	Alexis Sanal [AS]- My professional background is, architecture education at Sci-Arc, so my college degree is architecture, and then I worked for about six years in small practices, mid-sized practices and design firms in Los Angeles, and then I got a Master's degree in city planning, Masters of City Planning at MIT; afterwards I came into practice in Istanbul... [Asking her partner Murat Sanal] And now it's been what? Nine years?
	Murat Sanal [MS]- Yeah...
	AS- We've had this office for nine years...
	MS- Uhm, since 2002...
[**licensing**]	AS- So we've had our own firm since 2002, oh and then also licensing... We got professional licensing in America. And went through the internship training in corporate licensing... So that would give a kind of uhm...
	EK- Could you describe that process a little bit - because I haven't had the chance to talk to an architect practising in America...
	AS- The American process is a bit like other professions: like medical, or law or accounting as I saw it... I think these are the four or five... and they are considered to be professions that you need to actually... not only do you need to have your professional degree, which means a five year degree, or a master's degree, you then have to do a three-year internship which has very specific, uhm, kind of post-education training... Everything from concept design, to construction administration... anyway, they have some format of hours you need to complete... And then subsequently you have nine exams plus one oral exam. So the nine exams would be mechanical, electrical, plumbing, there are two structural exams, there's like a site planning exam...
[0:03:46]	MS- Pre-design...//
	AS- //...Pre-design, and then architectural design... And once you've completed these two years plus the nine exams, depending on the state, you'd have an oral exam, which usually has to do with contractual relationships and liability relationships... And then after that, you are qualified in local states to practice

500. In this raw transcript, conventional transcription symbols were not utilized. Only the excerpts in the thesis were restructured according to the conventions of Conversation Analysis.

architecture... And each local state also has unique conditions, for example in California, you need to be educated in seismic, if you're in Illinois, you need to be educated in wind... So those are the subtle differences each state has that they want people to be more knowledgeable of... And after you pass the ten exams, you become licensed... So it's very different from the system in Turkey or in Europe where, if you have a degree, you are qualified... And the thing that makes a big difference is that you have this license, called an architectural license, you cannot call yourself an architect in the US, even if you're running... giving architectural services and everything else... before that you are a designer. So it makes a big difference in terms of qualifications.

Alexis Şanal at the basement of their office where they store material samples, project files, and miscellaneous office supplies next to a small photography studio they have set up for photographing their models.[501]

501. Source: Photo by the author.

apprenticeship

EK- So where does this apprenticeship period take place? In the context of schools or...//

AS- //...You have to work in an office...

MS- And actually the total is about... education, higher education, and practicum – practice or apprenticeship, all together it's about a ten-year period in total.

EK- Like in medicine...

AS- Yes, just like in medicine...

MS- And before that you are not allowed to take any type of liability... That's the thing. You can design, but you cannot build.

EK- So what do you do? Do you go to a professional office and say that you are in your internship period?

AS- No, it's apprenticeship, it's not an internship. Unlike internship when you may be at school and you are doing it for the educational development, this is professional development, so you're actually an apprentice in a very traditional way – like you would be in a doctor as well... And through that period, you have to work under a licensed architect... You can't work...//

MS- //...Your hours are monitored, you have to complete them. You have to inform your supervisor about what you have worked on, etc...

EK- And what do you do in the end? Do you prepare a document like a logbook or a dossier?

AS- It's like a logbook, and your mentor, the person who is mentoring you during that period they sign up on these hours... So I worked in a total of four offices to collect my hours... when I got an undergraduate school with a five year degree, it was a very bad economy, so I did a lot of freelance work... And you can also do freelance work to collect your hours, you just have to be under a professional. You have to...//

MS- //...It's like a measured experience... It's not measuring the design capability. It's not how well you design, but you have to design correctly, so...

AS- And that system as well, it's also interesting, 'cause a lot of the people who maybe didn't get the education of, let's say, five years, also there are a lot of design-build contractors who are more and more giving architectural services, also in America, they're giving the opportunity to demonstrate, I think they have to complete a fifteen year period, they also can get an architectural license if they...//

EK- //...Really?

AS+MS- Yeah.

AS- //...If they can demonstrate that they have enough education by doing...//

[0:06:26]

MS- //...Education of building and also education about the built environment... And they can talk to the... they have to learn all the planning zoning and all those issues as well to be able to have a conversation about planning of the cities...

AS- But they also have the opportunity, after fifteen years, to apply for a license as well... Performance based and content based, you have to have a certain amount of content... Some schools qualify for it and some schools don't qualify for

	it. For example, a lot of schools, even though they give an architectural degree, they don't... the licensing boards don't recognise their degrees. EK- And is it to do with accreditation? MS- Yes. EK- OK, so that's the thing. MS- There's a national board for accreditation and their licensing is arranged by the AIA. AS- No. The licensing is not their... The licensing is arranged by NCARB, and for the educational things, AIA is a post-professional, or a professional organization that represents their interests. So even if they advocate for things, they do not monitor it...// MS- //...They don't monitor it but you get AIA title... AS- You can only apply for AIA if you are a licensed architect. EK- OK. MS- But AIA is an institution that is 170-200 years old... It is a very old institution that impacts the quality of the built environment. EK- It is like the Chamber of Architects here then. AS- Except that it represents the professionals' interest. I think the Chamber of Architects here... It is, in that sense, but I think the Chamber of Architects here also takes on a lot bureaucratic role. The AIA does not. MS- Every city does the bureaucracy, the building departments...// AS- //...No, the licensing... Every city, every state has a licensing board. And the licensing board is much more like the chamber of architects in that sense... MS- But you don't have to go through... I mean in Turkey you have to go through the architecture Chambers... AS- That's what I'm saying – the AIA is nothing like the Chamber of Architects here because they don't deal with bureaucracy... So in the states there are licensing boards, there are bureaucratic mechanisms to regulate it but they're
[0:09:10]	different... So the Chamber of Architects here is a little bit different that way.

expertise

EK - So how would you define your area of expertise?

[**expertise: adding value**]

AS- Mine is different from Murat's... [Talking very slowly and with frequent pauses] Mine is more on, looking at, how, let's say, the physical environment and the material environment... adds value to the cultures that use them so to say... So I'm more focused on urban design... more focused on, kind of, how buildings make meaning for people, and how people make meaning with the buildings... And therefore it goes from urban design to architecture – how that continues... down to the last detail. How does a detail still reflect the culture that built it and how that material thing captures the stories that they want to tell... So that's more my, kind of, expertise... So I work more on trying to keep those values, or principles, design principles continuous from the very early conception of a project to every last door handle that's used. So that it's just a very consistent message that's given at the macro scale and the micro scale. I have also expertise at the macro scale, urban design... And then how to deal with complexity when you have, you know different interest groups and stuff... That would be more my expertise I would say, as an architect.

[**0:12:04**]

EK- And when did you graduate from Sci-ARC?

AS- '95... And then I graduated from MIT in 2002. Masters of City Planning, with an expertise in city design, that's my focus. So the degree is masters of city planning.

EK- And Murat, is your background the same as Alexis'? Or do you want to...//

[**design-build versus "pure design"**]

MS- I have graduated in '93 from Yildiz Technical University in Istanbul, and then got a Master's degree in computation and design from UCLA, graduating in '95... Then I worked in Colorado for a long time, for about three years, in a design and build environment, to learn about the building industry, how buildings were put together in that environment... There I gained lots of experience about quick designs and quick building types, multiple purposes, from entertainment theatres to condominiums, little theatres, lots of resort activities... Then after that I decided to gain more experience in a more design-based firm. Then I went back to LA for another three years, and then during that period I also took the professional licensing exams, which I believe, has been one of the best things for professional development for candidates of architectural practice, practitioners, and it gives a level of confidence, a level of commitment... Then we returned here, in 2001 and 2002. And since 2002, we have been working on various projects and my expertise was mainly in making things as far as they come in the architectural scale, so I was very interested in making things... to raise the quality of the environment.

[**0:16:08**]

AS- You have a lot of expertise also in the actuation of that – you know, design management, let's say. It's a craft in itself to get all these various people come together to get things done... I think you have a lot of expertise in this area because of your knowledge in architecture and construction…//

[**observation**]

MS- //…I think it's also seeing a lot of different types of construction and observing, it's important to do that. That was one of my goals when I went abroad: to learn about different techniques and different practices and how the industry is

	organised, not the design... Design is only ten percent of the product. The rest is all this managing and realization., I think that once you notice this fact, you start to learn about it... Until it becomes an architectural problem, there is all this 90 percent planning, and that's where Alexis' expertise overlaps with mine... But I think planning, architecture and design, you can always... once you can distinguish the level of importance and the responsibilities you can play with these tasks. And that's how you can manage it I think. § **MEMO:** global apprenticeship: most of the interviewees have a period where they spent outside of their home country/ in some cases they decided to practice as an expatriate architect and have ventured to learn and conform to the local building culture of their new environment / how does this change the suppositions about making? / what does this say about the situatedness of contemporary design ?/ apparently one of the most important skills of the architect is to be able to analyse and conform to the specificities of a new environment / this might also be a positive aspect as the factor of alienation might make them more keenly aware of their untested assumptions §
working environment [**office size**] [**project team collaborators**] [**core team**]	EK- And how would you describe your working environment? First of all how big is your office? How many people are working? MS- We have tried a few models of working, and the one we're most satisfied with is having a small core team, and having also a peripheral network of very talented people with different expertise that add us value... it could be graphics... I don't know...// AS- //...Interior design, industrial design...// MS- //...Product design, this could be developers... Different things... AS- Mathematicians... MS- Software designers... So since we like to... we engage with every design, especially in this environment in this small to medium, smaller size practice, it adds value, with the designers being completely in charge rather than opting for any available product... we are always in charge, our hands are on every design... AS- Not just that, we are also very actively involved with the production of it, so it's not a top-down work model; we're really like very intimately involved with the production of it and how to, kind of, see it through... MS- And therefore our core team, right now we're about four to five people... It has flexed between four to maximum ten... But I think around four to six, we are comfortable... EK- And who are they? I mean are they all architects? AS- Our core team is all architects... And that's we've actually found out: if we make this core team four, maybe six most, with capable architects, who are not only good designers, but also managers, and good production people, then we can work very very seamlessly, project based, with all this other expertise we have... You know, everything from like a mathematician to industrial designer, to even bureaucratic issues.

[0:20:56]	MS- Hmm, yeah. AS- So this works really well for us... [MS suggests landscape architects] Landscape architects and all that stuff... In that way we can also.. I mean looking at this we are very much hands-on, we are very much office based in that we can really oversee, we can really make sure that everything is very good ... Minimizing every type of information mismanagement. So there is a very streamlined process between the core fundamental idea of the architectural or design intent and the information that goes out, and who that is communicated to. And we go like fourfold – the information goes from us to a production team, to the construction manager, to whomever... It's a very... a much more immediate relationship and we can control any type of interpretation... misinterpretation usually, or mistakes... or the conflicts in the information systems from the office. Having said that, we go on site quite a bit; though we do not work on site, we go back and forth quite a lot to make sure that you know, that information is being communicated and that there is a high level of understanding of...//
[**On-site presence**] Compare to the comment by Bruce Allen about the importance of being proactive, and how to convince the clients that architects' on-site skills are necessary in order not to cause too many compromises to the design.	MS- //...I think we work a lot in the office but typically, we have a great command on the site. We don't lose that command. And once the client and the builders see our value, they would like to see us there... and we have a great command actually. It is not like a scary authority but they know what we have done to solve their issues... and in every project that we undertake they need some type of special care to add value, to the client, and once that is integrated to everybody's mind, also to the builders' mind, they become very proud of what they are able to achieve... And they start to do that with a special care, they give us that extra ten percent. Or extra another hundred percent sometimes... and therefore our command on the site is great...
[**listening on the site**]	AS- That's also because we are good listeners on the site. I try to listen to what the challenges are, why something is not either being understood, or why it needs to be redeveloped based on what's known at the time... or maybe there's a better solution, somebody has... so we're really good listeners... and I mean it's a very trivial thing, but we try never to give decisions on site, so that we're not... again this information management is very important, we say "OK we understand all the problems" and then we'll come back to the office, look at the whole; again make sure the we have the whole picture to give a decision. MS- And these ideas are transmitted to everybody. That's the other thing I think – we transmit the ideas to everybody, so that people can add to it... I think that's very important... For example in the few projects that we have done, each trade can add to it according to the best of their capabilities, and they keep adding... EK- And what's your medium of communication in that? I mean how do you transmit your ideas to your collaborators? MS- Everything – there are the very classic things, drawings, papers, models, verbal, mock-ups... Going to them and making them together sometimes...// AS- Mock-ups are really very important part of it in that everybody sees the whole thing: because the mock-up also adds another thing, it's not just a one person thing... The mock-up has to incorporate the electrical, it has to incorporate the

aluminium people, it has to incorporate the dry wall people, so everybody sees how they have to work together, as one unit. If not, it's a bit of a problem if you've only solved one person's problem... If you only solved the aluminium people's problem and left the dry wall people out, it doesn't work. It is also the aluminium people's problem, even if they are not interested in the whole. And also giving them a lot of freedom to, you know, to just provide solutions – it could be more cost effective or more aesthetically... less material... so we do spend a lot of time listening …

EK- So there are lots of design meetings during your process...

AS- Yeah.

MS- Yeah. And I think...//

AS- //...But we do write a lot of instructions to say that we really are careful to come back to the office either to reread notes or to do a hand sketch over a detail or revising a set to make sure that people have access to it. I think that's also a little different in our practice than other people's practice... Although the system is fairly informal, as much as possible, we try to keep a level of formality so we feel comfortable, and feel that they're part of the system. You know, everybody gets an email of what's been decided. It's not just between Murat and the "usta", and then, you know... It's much more of a collective process that way.

MS- I think collective process is a very key part of our practice... The collective process goes from the beginning to the end and it's very influential. And that requires a lot of effort on our side... A lot... And it requires participation from the client's side...

AS- That's why our core team is very important... not just as a group of designers but... it's been an important part.

impact of the local building culture [**taking on the specificities of the local building culture as a challenge**] [**advocating for shared values**] [0:35:37]	EK- And is there an impact of the local building culture on your projects? Have you been working exclusively in Istanbul would be my first question, and then whether the vicissitudes of Istanbul have had an impact on your projects... If so, in what way? AS- Yes, absolutely... The first five years that we were here we really had to face this question like the system, or the building culture here is very different... and it is very specific and it has a very specific behaviour and it's a very dynamic system, and there's a lot of very fantastic things about it, but there's also a lot of very unsuccessful things about it... We decided that if we have this really good education, this really good passion for what we do and it's really good kind of professional practice – if we can't do it here, then how creative really are we? And if we can't do it here, under the way our value systems work, then, again, how much do we believe in what we are doing? And the part of it is just, you know, being the example... and to be sincere, for the first five years everybody told us that we would fail... that unless you do construction, you have no future in Turkey – unless you build it yourself, unless you've got a contractor firm and you build your own work, there's no... Nobody pays for design here... I said "this is ridiculous", you know, people are clearly willing to pay for design, because if you buy a Christian Dior handbag, 60 percent of what you're paying for is design... People are willing to pay for design; it's just that maybe they don't have the designers to pay for yet... I think that was the only thing that I can say we impacted the design culture here – it is to say "now look, there's another paradigm that really says that design has a value and people are willing to invest in that. It is not only good design, but it's good professionalism and you're competent"... They can really believe in it, and you advocate for transparency, and sincerity and those things... At the same time, there is a much more informal way of doing things here which is very... Let's say, it's very much design-build, there's very little foresight in how things are done, so you have to be very agile to change... Fortunately both Murat and I have a very parametric education from early computation, and it's that... You have to see that your design is a parameter and not be so deterministic... Actually if you look behind the philosophy that goes on behind the early computational thinking, it's just that: how you set up a system and how you set up those parameters by which your system is dynamic and yet never erodes the virtue of the design principles... You have to have many solutions to the same problem... Because at some point you will realise the solution that has been foreseen and the assumptions you've gone in with are not relevant at that point... or the changes... I don't know, they might find a new piece of land... [Laughter] or in some instances I'll be the marble supplier so I have go from ceramic to marble... You just have to deal with these things, I don't know... MS- The important thing is to continue that collaboration spirit into the design and also having really great command in this whole process... And the design is just a part of this process... AS- And having the clarity, you know, there is a point...// MS- //... you almost set the vision – and for everybody to achieve this vision,

	you have to work with them, and keep the vision clear...// AS- That's what I said, from very early on, we tried to counter the negative aspects of the design culture or the building culture you have here and we set very clear principles... And that helps everybody to give a decision, like at the end of the day, if this does not meet our principles; it's not going to be decided on... So we helped all the group here in the building culture to a decision making framework... so at one level you have to be a very open... system to let everybody put something in, but at some point you need... it can't just be anything and everything... Too often what you see happening is the architect in the building culture loses control because, they lose control with anything and everything and then at some point all of the building culture just takes over the project... But also it's very hands-on, so you have to say that something... What's also very nice about Australia is that the relationship between the very top decision making and the very bottom decision making where the team of craftsman is really immediate. And that's really great. And because it's very immediate, you have a high level of control to enhance their craft and take them further and they really use their capabilities in a very immediate way, to get some very exciting results that I don't think are possible in advanced economies. EK- Hmm. How about in Turkey? MS- In Turkey I think some of the things are very possible, that was what's inspiring about the Australian observation... We find that... there are other people dealing with similar difficulties... The Turkish economy has developed through contracting, so construction has surpassed design work... So there's lots of construction but there's no architecture in the last thirty years. So it's slowly progressing and this progress is evolving in such a way that still, people are product driven, not process driven. So when somebody comes to you and says "I just want a good product", I always say, "we don't have a good product, we have a good process"... Either they believe it or they go to somebody who promises them good product. We are for education and process and work with four very valuable offices with experiences in them too... Good process delivers good product, but good products never come out of badly thought out processes. That's for sure. And we try to stay away from that... And I think that that is also something that controls our working environment, because typically we find ourselves in these types of environments...
[0:39:51]	
	AS- And I also think that... I mean I know that you are more interested in the crafty issues and we've been talking about some broader problems but the important thing is that I think that everybody has this pessimistic attitude, but what we have found is if you set the standard high, everybody meets those standards and everybody is excited about living up to this expectation... [0:41:08] And I'm thinking this very trivial example of... in Doluca Factory, to kind of answer the second question... This is a project that was given no favours, in terms of budget, or in terms of craftspeople... All of the craftspeople that are on the Doluca project had come from Çerkezköy. Not at all foreseen in the high end Istanbul architecture community – which can be questioned as well... But this is all local Çerkezköy

labour... Top to bottom, materials, everything... and also budget... Ok, so that's where the collective knowledge comes in: we developed very very specific details for all of the solutions for example... and we have geometrically, to a certain degree, let's say, solved it... 95 percent, right? The contractor, knowing our high expectations, went on to interview different people there and tried to find somebody who really was excited and wanted to add value... So they had found a

[0:42:30] steel company that works there, I mean this is your local, small town, you know, steelmaker... and you know they did the most beautiful, beautiful, <u>beautiful</u> steelwork and they were so engaged... Not only would they do everything with 200 percent passion to do it – and they were very complex things– but they would come with their own knowledge and suggestions of how to also do it better; like how to bring this metal mesh with that, or how to kind of integrate the wood, and in very very difficult geometries mind you... Then on top of that, the wood people, then would solve other things... So the people that are doing all the wood form, which is not also very easy because it goes over all the steel work, has to integrate this big kind of, bold, massive and, long, planar geometries at an angle, they also did the most *beautifully* crafted thing... And the reason is because people have purpose, they take part in what they're doing it very very well... And the result demonstrates that... this idea that if the process is set up for, and everybody is part of that process, all of these craftsmen will not only kind of live up to it, but they will then add a knowledge to it that the architect and the contractor and the client

[0:43:53] didn't have in mind... and I think it's...//

MS- //...I think all of this experience brings us back to... perhaps this is a very old, traditional way of working with the trade, or trades, and putting their expertise, leaving all this room for their development, their expertise, their heart and also their capabilities and their talent into... there's always this issue of pride: I think that everybody feels proud...//

AS - //... and it's also translating the problem into things that people already know... I mean to the contractors from the eastern part we finally said "Stop and think of it as a concrete, think of it as stone – you know stone, you know how stone works... go get stonemasons, go get concrete people. And now that it is poured and done, no longer is it concrete, wipe it out of your mind, and as long as you can see it as a solid stone, OK." Then they can deal with that... And engage that. So, you know, they can then start working with stone people and that's something they know very well... I mean stainless steel, it's the same thing, I mean I can never do certain things; I can never do Russian folk houses... That's not something I can do, it is not part of me, I can't know how to replicate it... You have to work with the craftsmen – you have to work within what they are familiar with and are in command of... If you ask them to do something exotic, not only do they feel

[**material translation: working within the boundaries of**

insecure, but also of course they can't, because they don't have an in depth understanding of the examples from a cultural point of view or from an aesthetic point of view and so they're set up for failure and then we blame them for failing... So we try very hard to maintain this idea of where their cultural understanding, meaning their ethical culture, their building culture is coming from and we need to

what the craftsmen know]	shift it – so in order to do something new, we try to shift it into things they already know: like concrete to stone or you know...
[0:45:58]	§ **MEMO:** **<u>Translation</u>**: not only from drawing to building but from one known skill/procedure to an equivalent one: Mardin interviews showed some of the stonemasons transferring their building knowledge to constructions in concrete. In this way, even when materials have completely contrasting characteristics and behaviours like stone and concrete, knowledge achieved within a specific medium can be translated to another. In this way craft knowledge seems to be quite fluid. §
	EK- Hmm, that's very interesting...
architect +client +contractor relationship	MS - And also I'll say their learning curve... that keeps us also excited. EK- Normally this is an antagonistic relationship, right? Between the tradespeople, the designers and the people who give you the commission... How did you build up that passion? Because it seems very difficult – what were your specific ways to incite passion in all the parties involved?
[collaboration: designer's will]	AS- No I think it is more important... It's not our... We are not driven by our will. We are driven by doing good architecture. And good architecture is not done by an individual's will; it's done by everybody that makes it. I think that's also why we don't go into things like product design, or into housing where that's very important... We very much feel that we represent the people that are going to use it, meaning like the city people, or the daily people that are going to use it, we see as our clients. We have our core client, whom we empathize with... I mean these people are investing a lot in us, they're investing a lot of their resources into this, and the builder is going to make everybody successful. MS- With the builders, I mean with the tradespeople, it is also important if you can present them how to make them, you can convince them: you have to work with them... There's a period when you have to explain how to make things – you have to figure out the geometry, and then you should go on site and put the geometry together for them. EK- Right... And at this stage you use mock-ups...// MS- //... mock-ups, yes, or we just go there and do it ourselves...//
[0:48:18]	AS- //... oh we do it in sketch-up for them too. Or models...//
[tools of translation / tools of application / practical geometry]	MS- //... models, and we send them to the site. In Doluca, we sent a paper model...// AS- //...You can see the model there actually... I'll show you a model that we did – they couldn't figure out the bridge geometry, so we built a larger model of it, of how it works, and we have it just out here... The sole purpose of this model really was to help them understand this very clear geometry inside these four bridges and how they go together...// EK- //...And once they see it, it's fine...// MS- //... Yeah, yeah. Then they can do impossible things, like we could never think...For example that staircase... I went to Doluca one day and there was just

[0:48:53] Murat Sanal has to leave – says goodbye, and leaves the room. [**respect**] [**risk**]	this string in the space and it was being held by just two ends as a guide to the geometry, the guy had just made the model 1:1 himself... AS- I think the important thing is that again, we're very very against this antagonistic relationship – it's a crazy thing, and I always find it very interesting like... maybe that's how... I think... I care so much about what I do... I think all my clients are very smart people, and if I didn't, I would probably not take the commission. EK- OK, yeah. AS- I don't know, I don't want to work for stupid people. [Laughter] Building spaces for stupid things... You know, so I have a lot of respect for my clients, I think they're really smart really creative people, and if they have thoughts that are kind of naive, it is because they are naive on architecture, so if you can articulate it to them, they understand it more often than not... and I find that they come with very good insights that I was very naive about... uhm, so, it's the same with the contractors, they are under huge, huge, <u>huge</u> financial risks and you are the one responsible for giving those instructions, and they're gonna make mistakes and you're gonna make mistakes... and these mistakes cost thousands of dollars and so the more you build a team based on mutual respect, and uhm... it works really a lot better... and if we find that we're not there, then either we are not the right architect for the client or... also with the builder, we have to come up with a management system to make them successful.... That's not to say it always works; usually there's one person or one group on the team that are kind of like wild cats and are around to kind of just get through it... You know, I don't know... So it happens.

[end of Alexis Sanal 1.wav> 0:51:03]

[start of Alexis Sanal 2.wav>0:00:00]

collaborators	EK- Who are your specific in your projects of, let's say, last five years? AS- Yeah I think we've kind of covered this before but I'll go over it again... So we still work very closely with different expertise, like collaborators... Each project has a different group of collaborators... The collaborators are both the knowledge group... I would include the kind of user investment group as the collaborators and I think the third group of collaborators are the builders in the process, so... I think the more and more we get into institutional work or into urban design work, the collaborators get more complex: there are more stakeholders so to say, you don't get just the client, but you also get... I don't know, I'm thinking of the BU (Bosphorus University) restoration, the dormitory, you have the dorm user, you have the dorm managers, you have the university itself and then you have the investor. So these are all your collaborators in that sense and they all have different agendas. The collaborators for example in OTIS included the graphic design team, that included of course the mechanical, and electrical groups... Then again another very important collaborator for Doluca was also these, these local "usta"s[502] that we worked with... and we would see it that way and that they would come up with their own solutions... You know the contractor is always a collaborator because

502. In Turkish, the term *usta* is used to refer to a master tradesman.

more often than not, they get the economic burden... So you have to work with them to make them economically successful... So that you give them the leg to also propose materials or solutions so that they can come in and uhm...

§

MEMO: **Working together**: What it means for architects and what it means for stonemasons/ how do these groups define collaboration/ working together as a means of producing collective knowledge / with what terms and processes does this knowledge get defined? / How is it passed on to the next group of collaborators? / accumulating knowledge and know-how.

§

change in the collaborator profile during the past years

[reading from the interview guide] And how did they ?

Well, I think one of the big things is that more and more we are able to make an argument for more sophisticated design teams actually, and for the clients to invest in that - like invest in the landscape design, invest in the graphic design, invest in, let's say, a mathematician to optimize things... [0:02:14] invest into a retail consultant even... invest in an environmental engineer, so not just the mechanical, and the electrical engineer, or invest in a façade designer... So I think one of the things that has really changed over the past years with the complexity of knowledge collaborators is that they're much more sophisticated, so that's nice, and very exciting for us... For us it's very important because we feel that we have a knowledge and that we value that knowledge and that's not graphic design...You know, I can do graphic design, I did it, we all can do it, but you know it's... It's done intuitively. It's not done with the kind of expertise and precision. That's what we really found - people are coming to us because they see that we have this competency and knowledge and creative enthusiasm... And they also can see that these small investments into a graphic design team or into a landscape design team or a façade designer add such a value to their design early on so more and more they like the foresight method of working than the hindsight method of working. I must say the one of the big collaborators in all these projects is, because of the impact it has on economy, is... Let's say who gets the façade contract... let's say aluminium company A, wood company B, these companies have a set of products and solutions that they want to do, and you have to, to some degree, learn these products and solutions very well to make them successful and innovate within that you can't, force them into a new system... So I would say one of the bigger economy collaborators are the product manufacturers... You have to work within their things... because they are the ones that get the subcontract, and they are the ones that are willing to do it on time, and they have their own craftsmen team that are trained... So that would be another big one.

MEMO: Reasons for Collaboration: [**determining boundaries of expertise**]

[**foresight versus hindsight**]

[**innovating within an available product and solution range**]-

[**harmonizing the work process**]

[**having a team of skilled workers**]

EK- And do you have an impact on their product development when you're working with them? What I'm asking I guess is how do you impact each other? How do your goals change as the profile of your collaborators change?

AS- Yeah, I think so... Because again we are very good listeners, and we are also very determined to not let the design reduce because this is the only product or the solution available, or that the design reduce because somebody... I mean it's the same thing, if somebody comes up with their own will, is too wilful you

[**wilfulness as an unwanted collaboration approach**] [**working together for optimising building performance according to the design intent**] [0:07:06] [**specificity**] [**identifying <u>collaboration</u> and <u>innovation</u> as <u>distinctive traits</u> that are advantageous**] cross-pollination between skills [**relating office to size investment in software**]	know... It's not always the manufacturers doing this full stop; you also get designers doing this full stop... And it's not a great approach. So in both cases, we like to think that we have a great influence and they have a great influence on what we do in a kind of positive way; that we are kind of improving each other's knowledge... In Doluca Façade, we worked with them a lot to get those really deep fins with the façade designer. They hadn't done it before, we looked at with them... they made a lot of different mock-ups, they made a lot of details to get those fins, make sure that the water would drain off nicely, but also to get them to be kind of stable so that they would be able to be there for the next ten or fifteen years... So you have to work with them because they also have things that they have to deliver, because you're not responsible for the ten year warranty, so if you can't solve something that they feel comfortable with for their ten year warranty, then you would not agree with them and they would say no. We also work with major furniture companies to say "Look you have a great product line, but why isn't there, you know...// EK- //...there's this gap... or something...// AS- //...yeah, there's a big gap - there's lots of big gaps. And we go and work with them in, say, product modification and we say that we're not furniture designers and we don't need to invent a new piece of furniture necessarily, but we need to make <u>within</u> your system something for this specific problem… So I think again what we try to do is make it problem based and therefore you also eliminate people... People that are not interested in innovating a new product line won't come to the conversation... I mean it's pretty simple that way, you know? [Laughter] EK- And has there been a cross-pollination between your skills? Have you used software that your collaborators normally use? I am asking this very specifically about the media of communication that is used by different parties... Have you used specialist software for lighting or something like that after you have your discussions with the product manufacturers for example? AS- Yeah the simulation software is probably one of the best for everybody: for both an understanding of the performance based things as well as for trying to build arguments for why something is a good solution... So live simulation software like with the lighting people, they do lighting simulations, or vice versa they would send us their lighting parametric and we'll put it into our 3D models... EK- Right... AS- So we get that, and the file to factory, interestingly we found that, at least with all the producers that we've ever worked with, they want... they can do the, you know, CAD CAM environment, but interestingly enough, they want the CAD set up in a very traditional way... They don't want the kind of, optimized things that way... They really want to lay it out in a very traditional way, like ... “can you lay it out for me?” They don't have, let's say, optimization software, and we are not of the size to invest in such things... § **MEMO:** <u>Builders adopting computer technology</u>: using CAD CAM environment

	without its full potential / resisting optimization / making do with the barest minimum necessary to stay in the game while still trying to maintain a recognizable working environment/ Compare with the data from Bruce Allen interview / communication technologies also a part of the discussion / discuss in different subheadings. § To be honest with you, the biggest miracle is Sketch-up...
[**easily accessible and user friendly 3D software**] **finding an easily accessible software platform to use as a common communication platform at the lower end of the spectrum**]	EK- Really? AS- I swear to you, I do... Even the graphic designers use it: they put all the graphic design into the Sketch-up model, everybody can use it, anyone can understand it... The best thing about Sketch-up is that it's not photorealistic so clients do not feel intimidated by it... EK- Yeah, yeah. AS- But also the graphic designers can use it, the mechanical engineers can use it, the carpenters can use it... It is really the miracle in simulating things... Because you can print out things, builders can understand it, you can explode things, uhm... [tapping fingers on the table] What else is there? I mean we get a lot of samples to the office - I don't know if that would kind of qualify... we get a lot of profiles and things, I don't know, I can show you on the way out, but uhm... I don't know, I read an article about putting mesh in the glass, for a façade where they couldn't maintain operable louvers... I just asked the aluminium guy like "Can you do this?" and he was very... you know, clever, and he said "Oh, it sounds
[**standard/ non-standard**: expanding existing standard details]	clever to me too, and I will try and make a sample of it"... and we all played with it... I don't know, these weren't very standard things... Tooling stuff... yeah, we know tools that furniture maker doesn't use, doesn't know, so I ask them whether they can use a specific router and I will do the research and find it for them, and then ask them to order them from the German company and so on...
[**tooling / proposing new tools to collaborator teams:** expanding their repertory of tools]	EK- OK, yeah... AS- So those things happen... And we know that they have a really nice CNC, routing machine, they only have a few bits; we asked them if they could use these other bits, and they said, you know, why not, and they said "we can't get them in Turkey", so I helped them find out... So there's those things too... Or they would come back and say, you know, "this doesn't work this way or work better, our tolerances are these, can you do that?"...// EK- //...So your practice is really very research based in that sense...// AS- //...yeah we help them find those things because it's... Because language is a barrier in a lot of these companies - the craftsmen don't speak enough English, or German or French or something. So when the suppliers are English they can't reach them...So it's very hard for them to also access certain things... EK- And have you observed that they use these tools later, after they finish their collaboration with you on a specific project? Do they use them for other projects, have you had the chance to hear about it? AS- Yeah... I think that with suppliers and things I think they can do things that they didn't think about... That's happened with the steel person, also the wood person that we work with a lot... He is really excited because he'd bought the

	machine to do the kind of ornate tooling, and he was able to push his machine much further... He could see how far, or what the tolerances really were or what the problems were... So I think that they... we've seen that more, than anything... So being kind of supposed what they can do, or what the machines could do when working with them in that way...
	EK- So they built on that knowledge further...
[0:13:08]	AS- Yeah...
selection of materials	EK- My next question is about materials - I am sorry I am taking so much of your time - how do you select materials, like what are the considerations? And do these choices evolve during the construction?
[**using materials symbolically to communicate a design concept**] [**favouring local materials and local labour**] ongevity [0:14:50] economy [**sequencing the experience with material use**] [**comfort**]	AS- [Referring to the proposed factors affecting the selection of materials from the interview guide] I'll say all of these things that you have full stop... I mean, a lot of it has to do with, let's say, as we said before, it starts with the design concept, and the cultural concept, what material supports that thing that you want to communicate you know... In a novel company you want to use the materials in an innovative way, if you are a traditional group, you want to keep it to traditional themes or... What is the narrative you want to tell... For all the obvious reasons and ethics of environmental design, we always always always prioritize local materials and local labour to avoid any type of absurd transportation like shipping stone around the world... So I'd say symbolic aspects like familiarity I'd say, more than anything, things that people are familiar with is very important to us... And we only use symbolic aspects when we are trying to create a sense of drama or trying to create a very specific message or reaction from things, and then we will really move that way... [Reading from the interview guide] Longevity, of course... Because our main thing is we want these places to contribute to the communities, so longevity is a very high performance criteria for us... Most important, generally, to be honest with you, is economy... The economy limits and then how do you prioritize what... If it's really important to have wood, which is a very valuable material, then we limit it and only use it in certain places, for the rest we use a more affordable... we use a lot of paint and plaster... One of the reasons why we can keep our projects on budget and under budget for a lot of times is we make very very strong arguments for clients to... for general things using very simple flooring and use very simple paint... and then when we come to the places really special, then we can really spend four times the budget then you were thinking... So a lot of the materials have to do with sequencing the experience and therefore designing the economy around sequencing that experience... So you're not diluting your budget on making, I don't know... And also tearing that ugly roof - I mean "you are a no-nonsense company so you should have a thirty square or a forty square foot office... If you do, you're countering, you are sabotaging your own intention"... Or you know, invest in art rather than wood walls... So that's been a big thing: "what is the message that you're trying to deliver? What is it that you want your visitors or your user groups to understand? What are your values? Is it... straight and simple?" I don't know, like this computing centre, they have a lot of engineers... So how do you make engineers feel comfortable? Do they want high

	performance spaces? You know, they care very much about technical things - so invest in good lighting and invest in a good floor, and they'll be very happy... They don't need wood desks or something... EK- I wanted to refer to your presentation at Bilgi University, where you talked about your use of the first coloured concrete in Turkey... What led to your decision to select that specific material? AS- That goes to this kind of "what is the message?", "who are you?", "who are you communicating to?" and "what is the performance criteria?"...That building had to be reinforced concrete, to meet the ...security standard; at least 50% of the building needed to be reinforced concrete... So what we did, we did reinforced concrete - OK, that's one thing. But you represent the government and you are also representing the Istanbul Technical University: what is the message you want to send by doing a reinforced concrete building? [0:17:59] Ok, we can clad it, we can do other things, they're fine, but you're also supposed to be the leading material scientist in the Faculty of Civil Engineering in the country... So why is the most, kind of, ubiquitous construction material hasn't been innovated on for years? Are you really sending that message that you are an innovative university if you would then do reinforced concrete in a poor way, especially if you're required to do it... Now this would have been a different thing if it wasn't a requirement of the building... So, in that case, we said "You're forced to do a
MEMO: Advocating for innovation:	concrete building and if there's anybody to innovate on concrete it should be you - you've been preaching to all these young students, and you're saying that you know this, then how could you really deliver a compelling philosophy for the future if you yourself are not willing to invest in it?"... So that was basically the intention... Then what is the message? The message is you're, you know, a university that is at the forefront of knowledge and material sciences, you're trying to advance the country's industry, one of its major industries, which is concrete, and you're willing to invest serious resources and risks in doing it... And if you absolutely fail at all this, you are going to be in the same place you were before - meaning that you're going to do a reinforced building and you'll paint it... But you're asking all these students to risk themselves to advance knowledge, so, it's a very important message that says you take the risk as well... That was one reason; the second reason, which was also a very nice thing was that the client, the actual client
[**engaging the client in material innovation**]	themselves, they wanted something of the earth: either to be brick cladding, or terracotta cladding, or something... They really had this thing, they wanted it to be stone and warm and they were really tired of all these university buildings being made out of metal... and ceramic... they just said "we want something really warm, and familiar and of the earth". So this concrete also did that... You know, it was better than cladding the whole thing in brick, or something as well... To be honest with you, there were lots of thoughts about it too, people are going to criticize this, it's going to be different, you have to bear it and believe in it... And they were very actively engaged in it... For all the concrete colours, we compared it with the earth
[**referring to the local**	colours, we decided that this was a colour that would look nice on the Bosphorus, and there was an argument about why a lot of the old houses on the Bosphorus are

material history] weathering evolution of material choices during construction [**waiting**] [0:23:03] [**decision making**] transferability of construction skills	earth colours, that they liked the warmth of it... We looked at different kinds of treatments of it, so that it does not have a shiny look, doesn't really look like stone for them, so they had a lot to do with it as well... So that was it... EK- So has any of your material choices evolved during the construction? You know, according to the weathering process...// AS- //... Yeah...// EK- //... Are you open to experimenting on the site? AS- Absolutely, we have to... [0:21:41] It is the thing about agility... You can frame the design problem, and then you can have many solutions - but you have to stand your ground too, don't get me wrong... Every person that comes on the site will try to sell you, or present to you, or tell you how to do it better, cheaper, whatever, so it's about balance... We are very open to it... I mean, I cannot think of a specific example at the moment, but we are, yeah... At the last moment, we would change something - but we would evaluate it very very carefully... for all these other reasons, like is it the right message; does it reflect the value of the company; does it have longevity; does it, you know, do all of these things... You also have to stick your ground, because some things clearly fail at first, and part of it is making those failures successful... Not to throw out the baby with the bathwater so to say... And also waiting, you know... You have a long thing, it might not look perfect at first, but if you put furniture on it, nobody's going to see it... Don't give it so much importance...Those things happen…Or bigger systems change: I mean, I know it's not part of your research, but whole mechanical systems change... For example, that is happening in one project right now... You know they want to do this very good, passive low energy system, but it's a beast of a space thing, and it calls for a huge structural change, an upgrade... So these are things that cost probably 2-3 million dollars, and changes along the way are a small percentage of that, so it's not just always material changes, and it's an ethical change so we are very supportive of it, and we've done the studies for it… So architecturally we studied it, and decided that we can change it; then structurally they studied it… So each knowledge group will do an analysis, and evaluate it; and then there will be an economic evaluation and then at some point, we will give a decision… So that's usually the process. EK- You are a very process-driven firm; have the skills developed during the construction of your projects been transferable? Do you…// AS- //… Yeah…// EK- //… So you further your skills along the way and…// AS- //…Absolutely…I mean, a hundred percent. Some of these things are also like… That's why I don't know how people can have adversary relationships with the clients… I don't know…I don't want to say we experiment with the clients, we don't, but you know, they're the ones who want to go out there and do these things sometimes and so, uhm… so we learn from them and in every project we'll try something new, and we'll try one step further – whether it's playing with light, or whether it's uhm… working with a new material like coloured concrete, or whether it's doing these trees, the glass part of it, or whether it's trying to, you

[0:25:36] Construction sites as sites of invention	know whether it is learning lighting design, or whether it's trying to play with a new idea of compressing and expanding space, but we always learn from our projects… [Referring to the interview guide] And yes, they're always sites of invention, I mean everyone is very much cumulative that way… EK- I just want to refer back to your presentation at Bilgi; you were talking about things like mock-ups and rehearsals and you'd made a tripartite distinction between models, mock-ups and rehearsals, right? I mean, I just wanted to quote those definitions for my research that's why I'm asking it again, to put in on record… § **MEMO**: **Epistemic Environments**: Models, mock-ups and rehearsals as epistemic objects/ formulate a scale based on intelligibility: what stakeholders respond to which types of epistemic objects / what does it mean to have an abstraction that is intelligible across many decision-making platforms/ apart from practical considerations how does the selection of media of communication affect the formation and handing down of design knowledge?/ these discussions lead to the discussion of an epistemic environment and heritage issues. §
[**models, mock-ups, rehearsals**] [**getting everybody involved in the realization**] [**polysensorial stimulation**]	AS- Yeah, it's part of it, right… And it's also part of this idea of transferable knowledge that you're creating, like **model** is trying to… It's an abstraction; it's a great abstraction in different scales… You use the different scales to communicate some type of a production whether… you know, to help the client understand what is happening, for them to communicate to other groups… for solving the geometry so that everybody can understand… to study lighting… but it's always a great abstraction and has much more to do with geometry and massing and contextual relations I think… or material connections and stuff… And also bigger ones do that as well… A **mock-up** is a full scale illustration of what is going to happen so to say, and therefore everybody agrees on the final performance of it; that it has this finish, and you know, the colour is right, and so on… It's like a proof of… A model I'd say, is like a proof of a concept, whereas a mock-up is, uhm, the proof of a system… And then the **rehearsal**, which is the most important, which is confused with the mock-up, but it isn't; is where everybody rehearses what is going to happen: so all the different people that are going to influence it, meaning you know, and even the user, can come and rehearse; tell us it is going to work… I mean you can build a platform and see how big a window is, or you can look out the window and say "OK, it's too high" or "too low"… Or you can get the aluminium guy to get coordinated with the electrical guy to coordinate the window opening, and you can get the curtain pocket tonight, and sabotage it and so on… You can get everybody involved in realizing it, and you play it through once… And therefore everyone who comes to do it, like a rehearsal, everybody has, at one point, had a chance to interact with each other, and ask each other what's going to happen… so I think they're all very very important parts of it… In such a tactile culture, it is very important to kind of feel and touch and hear things… And it takes away this idea… I mean in visualization, putting things into 3D, is that and simulations as opposed to visualisations; I'd add to that too… [0:28:47] they're

[**creating the collective mind**	just all part of creating the **collective mind**…of what's going to happen...: …and everybody to have a shared understanding of what is going to be achieved and an opportunity to input into it…
	§
	MEMO: <u>**Creating the Collective Mind:**</u> Note how these different aspects of knowledge intermingle and affect each other / distil an attitude from this: how does the collective mind form? How does it compare to the individual will of the designer? How does it compare to the collective aspect of craft culture in the pre-modern period?]
	§
loci of the collective mind	EK- And where do they happen? I know it sounds like a silly question, but I think the model happens either in the office or virtually where you just send the client the 3D model; and the mock-up happens either in the workshop or on site, but the rehearsal is invariably on the site of construction… Is that correct, or…//
[**self-reflexive practice /making explicit for oneself and for others /identifying tools and media that make this possible**]	AS- //…Yeah, exactly.
	§
	MEMO: <u>**Making Explicit:**</u> This narrative relates to Latour's article "Visualisation and Cognition" on tools and their impact on the generation of knowledge. A clarification of the main purposes of different techniques used during the design process is necessary: such asmaking the decision making process more transparent and easily accessible to other collaborators, including the client.
	§
replacing risk with trust	EK- It's perfect – I love this tripartite classification… One of the most important aspects of your process seems to me to be the act of building trust… This is my last interview, so it's a more in-depth interview than my previous ones, that's why I am taking so much of your time… But, anyway, during my research, I've always come across this question of replacing risk with trust, because people are taking huge risks and you have to establish either a fixed group that you always work with, or fear, because you know the risks and the capabilities involved… It seems that you are working with different groups each time for each project… I don't know, maybe there is some continuity, but you seem to be favouring local groups and local capabilities, so how exactly… I mean it is a really important part of your process, this process of building trust… how do you do it… through what medium? Is the medium of negotiation the full scale models? You already talked about this quite a bit, but I would just like to take your final comments…
	§
[0:30:54]	**MEMO**: <u>**Building Trust 1:**</u> Compare present day practices to the traditional crafts guilds, and how ethics was a strong and integral part of the crafts education / that way the guilds made sure that the members understood the importance of honest conduct and that would then be reflected in their working relationships
	§
	AS- No, the trust is everything… It is a long relationship, everybody can… And it just works better… I mean full stop. It just works better… It takes less time when people trust each other, it takes less communication, and we… I think it also goes back to what we… we decided to be a design firm and we decided to be a true architectural practice in that we represent our client, or we represent some group…

[**trust: assessing capabilities**] [**trust: assessing one's own capabilities**]	And in that sense… therefore we cannot… we always have to be objective to what is presented to us: so the client may come with certain people, right? We have to be open-minded, if that's the mechanical engineer you want to work with, then OK, that's what we will do. So we're trying to be objective in choosing the team, and really go through and base all these things like wanting to be: "they trust these people; OK, well, that's fair enough"… And a lot of times in those local relationships, these people may be helping them finance it – for example this mechanical engineer may be willing to, in the application, also help them with payment… So you have to work with these things… You may not have the best people in the world, maybe there are better people, but somehow there's another relationship that I can't control, or I understand, so you have to… So one of the things with trust is assessing what everybody is capable of first; so you are not asking also unreasonable things with people…And vice versa… I think it is also… One of the things important in trust is realising what <u>you're</u> capable of too…I think that's also... that we're a small office, so we're not capable of doing certain size projects, that's just a fact, so… or we're in this context, we're not capable of doing certain technologies… So, having just said that, these are very simple kind of contextual things, the trust comes from the most, you know, old-fashioned way; talking to people and listening, and sharing… §
[**talking and listening**] [**sharing values**]	**MEMO:** **<u>Talking and Listening:</u>** Refer to Malcolm Turnbull's Talk, Templates and Tradition chapter / refer to Kemal Aran's comment on the importance of a <u>shared world view</u>, and how it filters through everyday conversation I mean we always try to make sure the people… we bring people on the big picture thing first, we share the values… This is what is being expected from the project; the project needs to be whatever, be able to sustain for fifty years; we need to prioritize passive design systems; we need to make a good impact on these things; we need to have high security…etc. You go over all these things and make it very clear for everybody what the priorities are, and what the priority list is so that people can have some type of a decision making understanding. And then the other thing is just again trusting each other to some degree, and it's mostly verbal communication… And it's a lot of meeting people, a lot of, you know, being available when something's wrong, or being understanding of things… But also I think that trust comes from sticking your ground, and really being competent and championing things that can be sabotaged, too. I mean it's leadership… is also a big part of trust… Really being out there and being willing to put yourself out there as well… I mean that's another big thing: you are advocating for these people, and so you… [**0:34:30**] and so part of the trust… I mean everybody thinks it's pleasant relations, but... and I can name dozens of times that we had serious... battles of wills... and at the end of the day, if you are doing it because you have purpose... if you're doing it because "I'm the architect, it's my will, it's my decision and f* off to anybody who doesn't agree", no, you're not going to build people's trust, or their respect... but if you're doing it because you really have... purpose, and that purpose can be just "I want people to come here and be inspired by the light", that's not my will; that's my advocacy that I think everybody

	walking through here should be inspired by the light... and if you come in, and want to take away my light, you've ruined my fundamental principle for to have somebody enjoy space for the next thirty years, so if it's about the mechanical system, and you can't solve it, then don't call me until you can... or let me help you solve that: tell me does this cost more, does this cost less, or do my people burn under the skylight... I don't know... But I think the other thing is to put it always in the question of "this needs to be solved", and not "this is my way" and they say it's fine... you need this, I need this, tell me how to do this... So I think that is leadership. I think leadership has a lot to do with it: it's not being warm and fuzzy and kind to everybody I think...
	§
	MEMO: **Building Trust 2:** Trust is based on shared values; in the lack of a common value system that is shared by everyone in modern times, taking the time to piece together the big picture and providing the collaborators the opportunity to share and input to this value system is one of the most essential aspects of building trust. Compare this to the pre-modern period where shared valued were not a problem
	§
set of tools + relation to latest design technologies	EK- So moving on to the technology part: what is your set of tools? What kind of instruments do you use in your design process? Which of those are becoming more prevalent, which are becoming redundant? Do you follow the latest technology?
[**feeling privileged in comparison to the "digital natives"** / **recognizing digital tools as just tools, not as practices**] [**assumptions behind the tools and the condition of the market**] [0:37:59] [**not being**	AS- Murat and I are both trained in a very traditional architectural education, before there were computers; so we know that system very well, and at the same time we were of the first generation of young professionals who knew computer aided design – and I think that's a privilege. So we understand the benefits of tools better than, I'd say, the generation after us, because we can see these as tools and not as kind of... practices. I mean I'm kind of a little tech junkie and geek, so I'd say yes I follow the latest technology, cause maybe I'm a geek that way... The problem is just that certain tools are designed under certain assumptions – and I think that until you have those assumptions in your market, they often don't make sense... For example Revit assumes that people make decisions with foresight, well people don't make decisions with foresight in Turkey, so it doesn't... I mean no matter how great of a tool it is, it doesn't make sense here because nobody's deciding those things in the schematic design... They decide them on site, and they decide them based on the economy of the moment, then so... Although there are certain things that I'd really like to move into like those systems, and we've been investigating it a lot and trying to start finding projects that make sense for it, the tools you choose, the process you choose, and the culture of building that you work with has a lot to do with it… so, that's where I found Sketch-up to be very funny, like, I would have never, ever thought... you know, Sketch-up... but the thing's great, really great... We are not so romanticized by tools as well, like, even though I wanted to do some things, like we do some kind of software development for some of my work on 3D mapping and like listening to the cities and stuff; at the same time it is the same as I feel like tools and technology and process are kind

romanticized by tools]	of like tools and technology and construction... I think, I don't even need to be able to pour concrete, or be a concrete contractor to be a good architect – to design for concrete; it's coming to the same with a lot of software design... Like I'd rather work with mathematicians and so they can design software and I can work with them to figure those things out... So in that sense we are trying to stay... really take this kind of interesting attitude to say that architects, if they understand what their purpose is, can always change their tools and knowledge groups, with the focus on not becoming that knowledge unless we want to go into that expertise... And then there are things that you learn out of it... So I think that's how we approach technology and tools: it's more with purpose than having those technologies and tools determine what the purpose is... So we start with purpose and then we try to define the correct... and now that science is here – [referring to the interview guide] I feel sad that we don't have science and technology here... The correct sciences... and with that the correct technologies... because you know, concrete is a science;
[attitudes towards craft / concepts different architects attribute to craft]	it's a chemical process and the technology to pour it is something else... OK I know that you are much more interested in the crafty end of the stuff, but it's a thing, like, you know, it's a science of manufacturing... if you really want to go on in that way, having somebody really knowledgeable on industrial design processes is as valuable as the tools... and if you invest too much into the tools or the technology, your purpose is to advance that technology as a kind of... cultural expression, which I respect, but we are not formalists, so we're not so interested in that part of it... I think people who are more like interested in form and formalism,
[formalism / interest in latest design technologies]	are very interested in them, because they get very much into new forms or new ideas about new forms through the technology, but technologies or ideas or materials or processes determines certain forms; so if you're very romanced by form, or if you're very interested in form itself as a kind of thing, that makes a lot of sense; but form for us is a consequence of the purpose or the intention of the project... I find a lot of people that now take the technology and tool that seems to
[technology as a culturally contingent notion]	work in every situation like... [Laughter] This technology and tool formworks are so that they work in Saharan Africa; in Istanbul they work, and in Denmark they work... So this form is the all encompassing solution for every single thing, and that to me sounds... somehow I am always very saddened by that... I think my main problem with formalism or people that are using tooling result in formalism... I think you lose the sight in that... It is a very pushed... It is a very wilful thing... EK- So what's your medium of communication within the core group? What is it? I am asking really specific, mundane details...
[0:42:57] [tools/ formalism/ wilfulness]	AS- Yeah... We have very very, exhaustingly specific protocols for CAD management and file management system... We use mostly AutoCAD... 3D work; we use mostly 3D Max and Sketch-up... We keep talking about going into a BIM system, probably more CATIA, because we would see ourselves as doing more fabrication work than Revit because of again this foresight thing ... We still do a lot of hand drawings and scan them and we're kind of meticulous about how we do the file management ... and archiving... So anyway, so we don't have any kind of sophisticated information we call data systems... we talked about a lot for doing

	schedules for example, that's a big thing... furniture schedules or lighting schedules... We use Excell but somebody came and wrote us a program we can use and are very happy... I talked to a software engineer to help us with that... and also data management... we like the idea of doing a lot of prototyping, you don't do it as architects, you do it as industrial designers... we want to do lots of model making types we've done like 3D printers, and building... we tried to do a lot of off-site manufacturing so you can assemble it better on the site... and again, because it's such an obvious thing to do, we don't... so we use a lot of CAD CAM systems…
	EK- Do you have an in-house model maker?
	AS- We don't... we...//
	EK- //...you do sketch models within the office...
	AS- Yeah. We'd usually hire somebody in to do that. There's actually a woman we work with a lot to do the sketch models... And then we work with a model maker to do our professional models. And this woman would do in house models project-based... we did a lot of cuts, and then we got them sent to us... It is actually most of our... I can show you those models... we actually have a group cut everything, the printing and stuff, and then they sent it and we assembled it... So that happens a lot...
biggest challenge	EK- And the final question is: what is the biggest challenge in your current position?
	AS- Time...
	EK- Yeah?
[**managing firm and designing/ time constraints**]	AS- It really is... I have just not enough time... Because you want to keep... in our position, maybe it's different in other positions but I never wanted to own my own firm because I wanted to be an architect... and what do we do? Like, most of our time is spent trying to make... to keep our communication... we need a lot more time to do the... we like doing design work... so I'd say our biggest problem is that...
	EK- Thank you so much…

[**end of Alexis Sanal 2.wav>0:46:07**]

END OF INTERVIEW

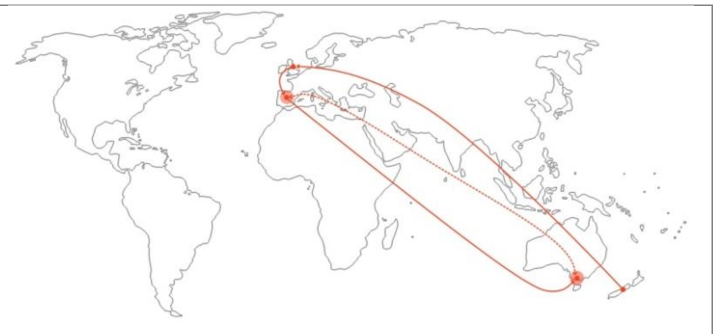
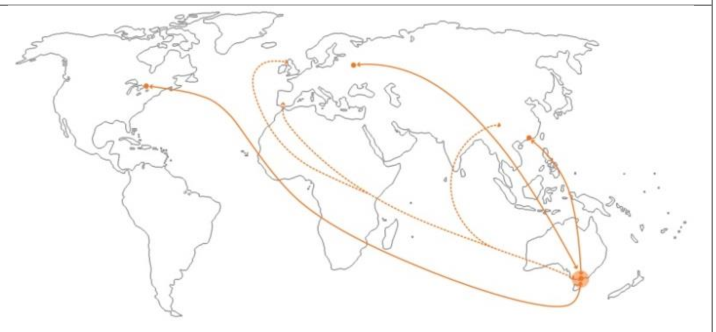
A.8: Sample Detailed Memo | Architect Interviews

MEMO: "Global Apprenticeship"

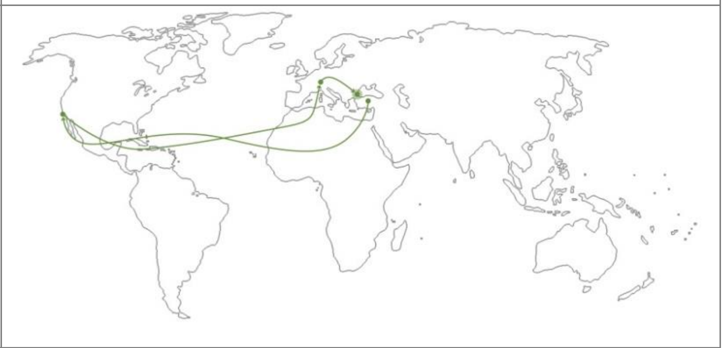
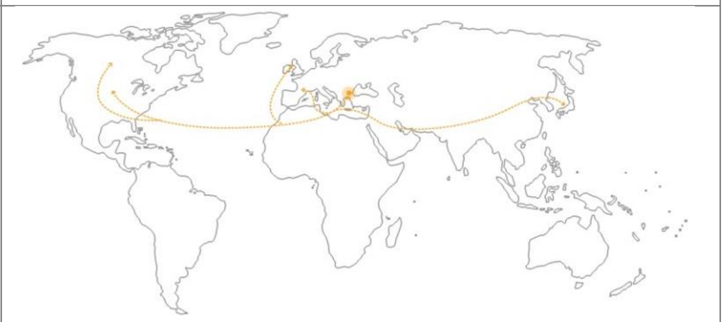
"So it's been, I like the challenges of working in strange places, you know, where there's more than just the design of the building involved."[503]

In response to the question on their educational and practice background, the small group of my architect respondents emerged as a „globalised" tribe. Among the ten interviewees that I decided to include in this research, only two have constantly stayed in their country of origin, while the rest were either educated abroad, worked as an expatriate architect for a while, or both. In fact, three of my respondents, were practising as expatriate architects at the time of their interviews. Although not a generalizable characteristic, this exposure to different sites and practice environments on the global scale clearly affects the attitudes of the architects as evidenced in their responses related to the impact of local building culture on their design approach. The responses to interview questions illustrate that interacting with more than one building tradition and experiencing different working cultures foster a nuanced sensitivity towards the peculiarities and potentials of a given building context. The practice maps below only show the architects who have referred to their practice or education experience in another country.[504]

PRACTICE MAPS

Mark Burry Originally from New Zealand, Burry received his architecture degrees in London, the UK, later travelling to Barcelona, Spain to study Gaudi's la Sagrada Familia Basilica [SBF]. Burry is an expatriate architect based in Melbourne, who has so far lived in four countries; practices in two cities, Melbourne and Barcelona, spending at least 3 months a year at the *SFB Design Office*.	
Bruce Allen Based in and originally from Melbourne, Allen received his postgraduate degree in Toronto, Canada, and has practised in Hong Kong, Europe, Moscow, the UK, and most recently in China. A former expatriate architect, he has lived in six different countries.	

503. Excerpt from Bruce Allen interview, Melbourne, 2008.
504. Paul Minifie did not refer to any such experience in his practice or educational background, therefore, is not represented in these maps.

Antoni Caminal A native of Barcelona, Spain, Caminal resides and practices in Barcelona, Spain, and has visited trade fairs in Verona, Italy, and Nuremberg, Germany. As part of his practice, he routinely visits various quarries in Spain.	
Mehmet Kütükçüoğlu[505] Originally from Ankara, Kütükçüoğlu received his postgraduate architecture degree in Los Angeles, US, and Ticino, Switzerland. Currently based in Istanbul, Kütükçüoğlu is a former expatriate architect, who has lived in three different countries.	
Alexis Şanal Originally from Los Angeles, US, Sanal practised in Los Angeles, received her postgraduate degree in Boston, and is currently an expatriate architect in Istanbul, Turkey.	
Han Tümertekin Based in Istanbul, Tümertekin teaches in the States, and has practice involvement in the Netherlands, Canada, the UK, France and Japan.	
Burçin Altınsay Ö. Based in Istanbul, Turkey, and originally from Ankara, Özgüner has received her postgraduate degree in conservation in London, the UK, subsequently moving to Istanbul to practice. Özgüner mentioned a previous collaboration with the municipality of Barcelona..	

505. After a recent competition win for the new Izmir Opera, Mehmet took the project team in his office to a tour visiting opera buildings around Europe.

Tom Daniell[506] Based in Kyoto, Japan, and originally from New Zealand, Daniell has received his architectural degree in Wellington, NZ, subsequently moving to Kyoto, Japan to practice. Frequently visiting Melbourne, Australia for his PhD, Daniell is an expatriate architect teaching and practising in Japan, who has lived in three countries.	
Paul Minifie Based in Melbourne, Australia, and practising in Melbourne, Minifie is an architect working in his native country.	

506. Since the time of the interview, Tom Daniell has relocated to Macau.

A.9: Collated Results | Architect Interviews

Information on the Participant

	Interview Location & Date:	*Qualifications*	*Current Position*	*Area of Expertise*	*Working Environment*
Mark Burry	Melbourne, Nov 2007	Architect, MA, Full-time academic	Director of RMIT DRI, team leader SFB	Design build experience + CAD	**on-site and office based**: biannual site visits to SFB / one of the offices in university
Antoni Caminal	Barcelona, Feb 2008	Technical architect / *Apparellador*	Technical architect, SFB Design Office	"specialist of materials": Stone+ *stereotomy*	**on-site w frequent site visits** to nearby quarries
Mehmet Kütükçüoğlu	Istanbul, Feb 2008	Architect, MSc, part-time academic	Director of his own firm / PT studio tutor	cannot describe	**office based** / aims to get more involved with the construction stage / long conversations and visits to the manufacturers **Office size: Nine** full-time employees + additional part-time employees hired on a project basis.
Burçin Altınsay	Istanbul, Feb 2008	Architect, MSc, conservation expert	Local director of Fener-Balat Rehabilitation programme	restoration and conservation	**mainly on-site** with periods of **office-based** work **Office size: Eight** full-time employees; **site surveys** / preparing shop drawings / working on public property / relations with community
Han Tümertekin	Istanbul, Feb 2008	Architect, MArch, part-time academic	Director of his own firm / PT studio tutor	architectural design / spatial design	**office based** **Office size: Ten** full-time employees + additional part-time employees hired on a project basis.
Bruce Allen	Melbourne, May 2008	Architect, MBA, part-time academic	Director of his own firm / PT studio tutor	small boutique practice working on most type of buildings, teaches professional practice	**office based** with frequent **site and factory visits** **Office size: Four** to **five** full-time employees + additional collaborators on a project-specific basis.
Thomas Daniell	Melbourne, Jun 2008	Architect, MEng, Full-time academic	Director of his own firm / FT academic	design architect / residential buildings / concrete / renovations / writing on architecture	**office based** with frequent **site visits** when projects are under construction / office in university **Office size: One** full-time employee + additional part-time employees hired on a project basis.
Paul Minifie	Melbourne, Feb 2009	Architect, MArch, Full-time academic	Director of his own firm / PT studio tutor	"Architects don't have expertise": direct the company and design and document buildings	**office based** with "industry standard involvement on site" **Office size: Seven** full-time employees + additional collaborators on a project-specific basis.
Alexis Şanal	Istanbul, May 2011	Architect, MSc (City Planning), part-time academic	Director of her own firm	cultural impact of material environments / **adding value**	**office based** with frequent **site visits** to make sure the information is communicated correctly **Office size:** A core team of **four** to **six** employees (all architects) + additional collaborators on a project-specific basis.

Project Specifics

	Past Project Involvement	Current Practice	Impact of Local Building Culture on Practice	Impact of Practice on Local Building Culture	Impact of practice on Design Approach	
Mark Burry	design build experience / SFB / Aegis Hyposurface	executive architect and researcher at SFB	**yes**	N/A	**yes**: geometrical basis of complex forms	original motivation for researching Gaudi (Burry interview p.5)
Antoni Caminal	residential arch, libraries public spaces	technical architect at SFB	**yes** "un motor per l'arquitectura "	**yes**: establishing precedents in terms of work processes	**yes**: "sorpresa, interest, aprendre cada dia... Es un projecte al que no et pots acostumar"	talking about different components of the building as separate projects
Mehmet Kütükcüoğlu	various / also **competitions**	director of own firm	**yes**: economy, culture, habits	**yes**: establishing precedents / local and wider scale /leading by example /breaking habits /reflected in cost	**some**: mutual learning through dialogue	resistance to change on the part of contractors
Burçin Altınsay	conservation projects with EU and the World Bank	director of Fener- Balat Rehabilitation Project	**yes**: quality dependent on local skills / knowledge of traditional skills, using traditional materials / contractor and subcontractors have great impact on the success of the project	**yes**: impact on the way the contractor works; larger impact remains to be seen	**some**: technical rationale / functionality	**transfer of know-how to the local community** is an aim of the rproject
Han Tümertekin	various institutional and commercial projects	director of own firm	**yes**: "a balanced impact" / directed use of local materials, skills and construction techniques	**yes**: establishing precedents / builders reassessing their skills from a different perspective after working with an architect	**some**: dialogue and process driven approach: extending people's repertoire;making use of local knowledge	**use of local skills and materials as a necessary aim in some projects**
Bruce Allen	various projects apart from health facilities; **affordable housing** research project with the Ministry of State; **urban renewal** in China	director of own firm	**yes**: shortage of specialized skills, keeping to a fairly restricted range of materials and construction techniques	**some**: injecting creativity / ideas into everyday practice / streamlining planning / advocating for high ceilings etc	**no**: "design consequences of cost saving appalling"	work in China was an investigation into the building industry/ where to find materials with respect to local logistics
Thomas Daniell	private houses, renovations, small art galleries / urban **competitions**	director of own firm	**yes**: licensing / huge but invisible (*Q)	**some**: very respectful relationship a give and take relationship that is open to change	**yes** (renovation projects): **reliance on a skilled team / learning to improvise on site** / development of a close relationship with carpenters	
Paul Minifie	National Museum of Australia with ARM architects, small to medium sized institutional projects. built projects: VCA Centre for Design Ideas and Australian Wildlife Centre at Healesville	director of own firm	**yes**: "a fair bit": projects coming out of a "local conversation between a number of different architects over a number of years..." "part verbal and part through published... theoretical works, and part of it has been through the actual constructed buildings, and so in fairly particular ways, (the built projects mentioned) are results of that conversation"	**some**: hard to measure that impact / projects cited in publications / projects "acting as participants in the conversation"	**some**: (quote from p.2) although not interested in an "authentic relationship to materials and processes"	
Alexis Sanal	worked in small to mid-size practices in the US for 6 years	director of own firm	**yes**: taking on the specificities of a building culture as a challenge		**yes**: collaborative effort / favouring local workforce / translating design intent into what the builder knows via different means of communication	

		Collaborator Profile	Change in Collaborator Profile	Cross-pollination of Skills	Notes
Collaborators	Mark Burry	**project specific**	**yes**: conventional vs experimental / collaborators at SFB evolving	N/A	*Aegis Hyposurface*: "practice collaboration / forming teams around an (experimental) project: engineers / fabricators/quantity surveyors
	Antoni Caminal	architects, engineers, manufacturers, machinery makers	**yes**: "those who cannot adapt cannot work at the SFB"	**yes**: it is the aim / stonemason extending his repertoire / SFB definitely influences the way Barbany works on his other projects	
	Mehmet Kütükçüoğlu	**project specific** / aiming to start with engineers	**yes**: based on proficiency and logical use of technologies	**yes:** dependent on the collaborator	**collaboration as research**
	Burçin Altınsay	Ministry of Culture, Universities, Contractors+teams, local builders*	**yes**: attitude change / consciousness about conservation	**yes**: material use /impact on civil engineers' practice: more sensitive towards the pervasive use of RC / emergence of hybrid techniques like carbon fibers	*decided as a requirement for the Fener-Balat project for the **local accumulation of knowledge**
	Han Tümertekin	engineers, local contractors,technical consultants, customer representatives, furniture designers	**yes**: bigger projects, bigger contractor organizations, leading to loss of specificity	**yes**: it is the aim / builders extending their repertoire through collaboration / (one-way transfer)	
	Bruce Allen	**project specific:** structural engineers, hydraulic engineers, quantity surveyors, preferred builders	**yes**: consultant teams outgrowing the firm (small size)	**no**: greater degree of specialization / builder teams resistant to change	favouring certain teams of collaborators, establishing a working relationship over time
	Thomas Daniell	lighting engineers, carpenters	**no**: same builder as in his first project in Japan	**no**: everyone specializes and respects each other's territory, while being open to dialogue	
	Paul Minifie	"not collaborators / **consultants**": standard set: structural, mechanical, electrical, cost, building surveyor, various professional engineering companies : within the office a fairly horizontal structure	**no**: not really, apart from personnel change	**no**: "specialization in an architect's office does not make sense until the office gets quite large"	contractual relationships / **a natural disconcert**: "asking an engineer to do something outside (of the industry standard) , no we don't do that, it's not really my scope of work."
	Alexis Şanal	small core team + **knowledge group: designers** and **user investment group: users, contractors** + graphics, interior design, industrial design, developers, mathematicians, software designers, landscape architects	**yes**: more sophisticated design teams, **convincing clients** to invest in landscape design, retail consultancy, environmental engineering, façade designers	**yes**: **listening** / improving each other's knowledge by **setting challenges** / **integrating specialist software** from a technical consultant like lighting software	

Materials

	Selection of Materials	*Structural Concerns*	*Local Availability*	*Symbolic Aspects*	*Longevity*	*Evolution of Material Choices*
Mark Burry	collaborative discussion	**yes**	**yes and no**	colour and quality / finishing	N/A	**yes** CAF - fragility / seismic regulations
Antoni Caminal	artificial and natural stone: 25 different stone types are used in SFB	**yes and no** (concrete structure)	**yes** in Gaudi's time, **not now**: stone coming from China, Iran, Italy, Argentina	**yes**: especially porphyry	yes	**yes**: more stone types / evolution of material strength and performance
Mehmet Kütükcüoğlu	conceptual continuity	**yes:** performative	**no**: practicality more important	on-site observation	not enough on-site experience	**some**: cost / procurement difficulties / lack of skills
Burçin Altınsay	originality / material analysis and understanding	**yes**	**no**		stone construction backward due to lack of demand	**yes**: but the margin of change is small / cost skills are also factors
Han Tümertekin	transmateriality			**yes**: according to the process and needs of the specific project		**yes**: agility and maneouvring according to the necessities of the process : budget constraints / constructability
Bruce Allen	contribution to design / **a palette of materials**	**yes**: testing and seeing on locations before using a new material	**yes**: preference for local stone / feedback from the guys on site rather than material catalogues			**not so much**: amendments where necessary
Thomas Daniell	impact of client's wishes / material honesty / preference for certain materials			concrete within a culture of wood / skilled carpenters / material expectations		**no**: advance specification with minor changes
Paul Minifie	cost / aesthetic or conceptual concerns / against full materialisation or authenticity		**yes**	against a discourse of authenticity around materials and craftsmanship		**some**: within constraints of contracts
Alexis Şanal	**comfort** / sequencing the experience / innovation: leading the industry	**yes**	**yes**: especially important to prioritize local materials and local labour	**yes: contributing to the local material history**	yes: important for contribution to communities	**yes**: **agility** dependent on collaborative effor**t, observation, reassesment, action** "making failures succesful"

Process		*Construction Sites*	*Sites of conservation*	*Sites of invention*	*Transferability of Skills*	*Evolution of Construction Sites*
	Mark Burry	**active engagement**	**yes**: SFB as a place of apprenticeship	**yes** /subcontractors inventing new ways of producing stone (p. 12)	**yes**	**yes**: from on-site to off-site production of stone elements
	Antoni Caminal	**active engagement**	**yes**: SFB as a second background	**yes** / he ransformed a diamond saw designed to cut marble to cut granite	**yes**	**yes**: from introvert to extrovert: dissemination of ideas through collaboration
	Mehmet Kütükçüoğlu	**limited engagement** / but recognizes its design potential	**some**: sustainability of project site	**yes** / site of innovation	**not enough on-site experience** / empathy / willingness to take risks	**yes**: more disciplines involved / better equipped teams
	Burçin Altınsay	**active engagement**	**yes**: sites of learning / reviving forgotten skills by creating the demand for them	**no** / since the subject is conservation innovation can only be retrospective, in terms of reviving old skills	**yes**: in case of informed clients keeping up the demand / great potential for using the principles of old buildings	**yes**: slow change towards more sensitive contractors and builders / builders solely trained on site do not understand the logic behind
	Han Tümertekin	**project based engagement**	N/A	**no** / discovery versus invention	**yes**	N/A
	Bruce Allen	**active engagement**	**some**: apprenticeship on site necessary to combat deskilling	**some** / subject to time and money constraints	**yes**: learning from tradespeople / "an evolving situation"	**yes**: health and safety regulations / simplification of old methods of construction / simple laser measuring device making a huge impact / also negative changes like deskilling in painting, bricklaying
	Thomas Daniell	**active engagement**/ supervision very important	N/A	**some** / experimentation with new materials / regulatory changes	**some**: carpenters making a come back thanks to changed regulations	**yes and no**: not in his experience: but definitely change in Japan
	Paul Minifie	**limited engagement**	N/A	**very little** / some resolution on site / some opportunities, but generally dealing with mistakes	**yes**: establishing precedents and convincing subcontractors	**yes and no:** dynamics of innovation interesting: in terms of cost saving but also a huge concern around it
	Alexis Şanal	**active engagement** / "good listeners on site" / locus of ***polysensorial interaction***	(nurturing local workforce)	**yes:** skills gained in previous projects are cumulative, leading to a more assured inventiveness	**yes**: learning from each project in different ways	N/A

Technology		*Set of Tools*	*Prevalent Instruments*	*Obsolete Instruments*	*Relation to state-of-the art technology* *Notes*
	Mark Burry	flexible modelling / texts	CAD / CAM / Parametric modelling	hand drawings	integrated use of manufacturing technologies
	Antoni Caminal	site visits / CAD / texts	CAD / CAM /CNC / geometry	hand drawings in 1:1 scale	integrated use of manufacturing technologies
	Mehmet Kütükçüoğlu	Mixed-media: Digital cameras, digital surveying equipment, GSM systems	CAD / sketching / model making	technical drawings done by hand	continued software use / interest in new design and drafting software danger of technological determinism **playing with tools**
	Burçin Altınsay	hand sketches / texts: reports / digital surveying tools / rectified photography	template drawings, silicon moulds		interest in structural modelling software some tools not work in a local context: rectified photography software not efficient in the roads in the historical peninsula
	Han Tümertekin	**dialogue:** face to face conversations / software of secondary importance			prioritising people using the software / setting aside funding for updates
	Bruce Allen	changes across the office: he does freehand drawings / pen/ yellow trace and computer for correspondence	CAD / usual programs for small offices / 1/50 to 1/100 simple cardboard models	shadow projections / hand-set perspectives	always interested, "taking close interest on building sites"; following publications; talking to builders: "they are always interested in what's happening" models convey the message really well to the lay person
	Thomas Daniell	pencils and pen / rendering by computer (Illustrator and Photoshop)	CAD drawings, sketches, physical models		would like to follow, but more interested in "archaic, hands-on stuff1
	Paul Minifie	books, internet, **research, precedents,** hand sketches, tracing paper, pens	CAD / 3D modelling / renders / scripting	not many obsolete, new tools get added to the old set: digitising tablets obsolete	keeping on top of what's available / against **retraining** the entire office "to follow every CAD paradigm"
	Alexis Şanal	drawings, papers, models, verbal, **mock-ups**, meetings, **listening**	hand sketches, detail models, CAD, esp **Sketch-up**, CAM, “anything to enable a **participatory process” /** 3D Max, **prototyping**		keeping on top, but not being romanticized by tools / planning to venture into BIM, CATIA, exhaustingly specific protocols for CAD management

Further Comments		Biggest Challenge	Related Concepts
	Mark Burry	Evolution of Gaudi's codex in relation to the new manufacturing technologies	[Reverse engineering] / Tools [Translation] / **Technological**: Design development
	Antoni Caminal	Teamwork	[Collaboration] / **Procedural**: Design development
	Mehmet Kütükcüoğlu	Establishing meaningful relationships with tools / breaking free from mannerisms /developing a technical rationale free from fads and fashions	Tools [Translation] / **Technological**: Design development
	Burçin Altınsay	Knowledge transfer: general lack of consciousness about the necessity of conservation efforts / lack of adequate regulation undermining their efforts and obstructs accumulation of knowledge by providing the line of least resistance	Knowledge transfer [Transferability of skills] / [Knowledge ecology] **Institutional**: Long term impact / Sustainability
	Han Tümertekin	Optimal office size: growing pains: how to keep the office in its present size and execute bigger projects	Practice characteristics / Office Size / [Collaboration] **Managerial**: Strategic development
	Bruce Allen	Remaining interested in improvement, in producing works of excellence ; maintaining design integrity / architecture as a commodity, "it's a challenge to make sure that it doesn't ruin cities, ruin the quality of design"	Design integrity / Office Mission /Excellence in design **Procedural**: Long term impact / Sustainability
	Thomas Daniell	Getting the next job, communicating with people	Practice future / Getting commissions / [Communication] **Managerial**: Strategic development
	Paul Minifie	Managing information: increasing complexity of buildings and contractual processes	[Translation] /[Communication] / Contractual processes **Procedural**: Strategic + design development
	Alexis Şanal	Managing time: a collaborative process takes a lot of time	[Collaboration] / Time management **Procedural**: Strategic + design development


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Figure 63. Article from a local newspaper, *AD Haagsche Courant*, about the residency, photo showing Elif Kendir, Hayim Beraha, Sinan Ilhan and Ceren Balkır Övünç from left to right, 3 February 2007.

This was an arts residency undertaken at the *Artoteek Den Haag* in The Hague, Netherlands at the start of 2007. I was invited by Sebastiaan Veldhuisen as a part of a longer arts project involving an intercultural take on the Ypenburg neighbourhood in the city of The Hague. I took the opportunity to collaborate with two architect colleagues[507] and a sculptor[508] with a heritage background to build a low stone wall to act as seating and barbecue area in the back courtyard of the residency building.

We used a kind of Chinese slate as the building material, and devised construction details according to the available size and type of stone. Although this collaboration did not provide enough material to be included in the main body of the thesis, it provided workable insights for developing the interviews, and is relevant in terms of illuminating the kind of preparatory study I carried out before undertaking the actual fieldwork with the stonemasons and architects.

507. Hayim Beraha and Ceren Balkır Övünç.
508. Sinan İIlhan.

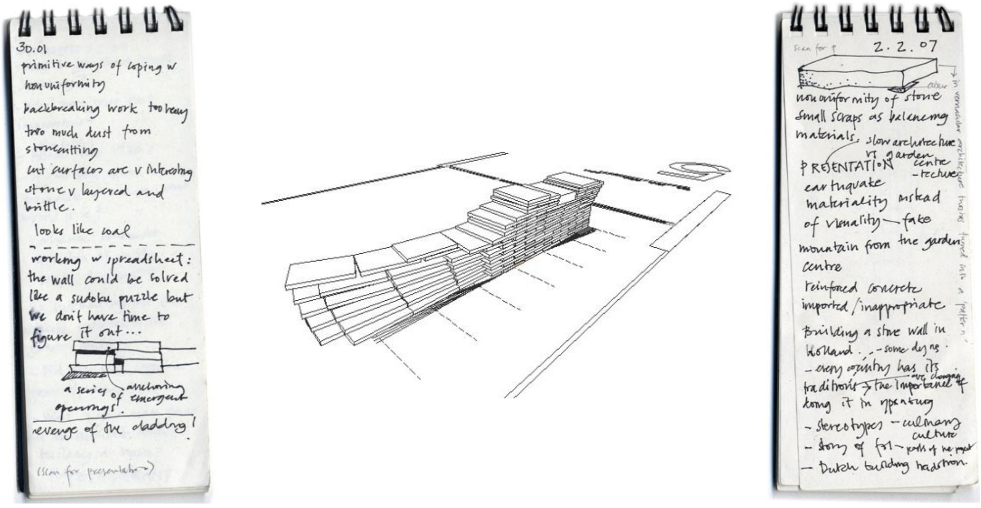

Figure 64. Axonometric drawing of the wall prepared by Ceren Balkır Övünç, in between two pages from author's logbook, 2007.

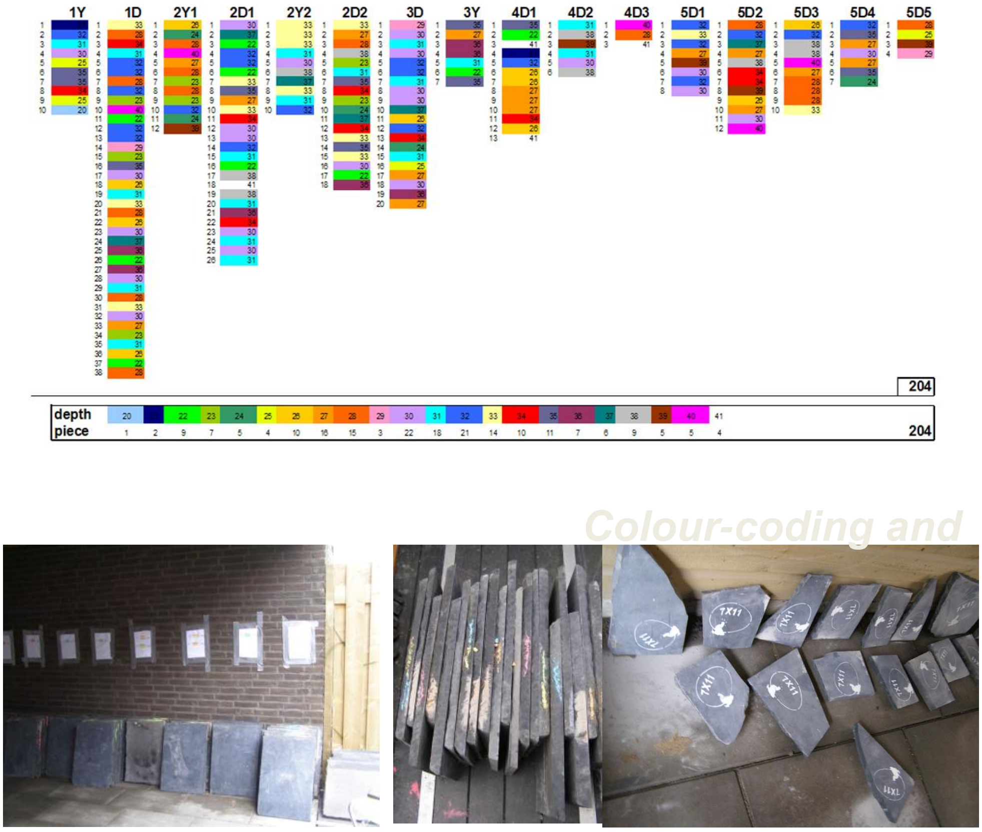

Figure 65. Spreadsheet prepared by Hayim Beraha showing the size and thickness of available stones, with photos of stones marked according to thickness, Ypenburg, The Hague, 2007.

Figure 66. Scenes from the construction of the slate wall: Top photo showing Hayim Beraha (on the left) and Sinan Ilhan constructing the wall, bottom photo showing (from left to right) Sebastiaan Veldhuisen, Ceren Balkir and Hayim Beraha having a break at the background, Ypenburg, The Hague, 2007.

A.11: Preliminary Research: Tools Studio at RMIT, 2009

In order to illustrate the nature of exploratory research activities undertaken during the development of this thesis, a journal article co-authored with Tim Schork on an upper pool design studio taught at RMIT University in 2008 is included in the appendices. While this research activity is not presented within the main body of the thesis, insights related to the dynamics of tool use in design activities discussed in the following pages informed the analysis of my main field work.

This paper was presented in the *CAAD Futures* conference in Montréal in 2009, and is published in the conference proceedings.[509]

509. Elif Kendir and Tim Schork, "Tools for Conviviality: Transcribing Design," in *Joining Languages, Cultures and Visions: CAAD Futures 2009*, eds. Tomás Dorta and Temy Tidafi (Montréal: Les Presses de L'Université de Montréal, 2009), 740-753.

TOOLS FOR CONVIVIALITY

Transcribing design

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ABSTRACT: This paper presents the outcomes and findings of a semester long trans-disciplinary design studio recently taught at RMIT University, involving students from the disciplines of architecture, industrial design and landscape design. The focus of the studio was to investigate the creation and appropriation of tools for innovative design processes. Drawing on craft theory and theories of design and computation, this paper illustrates how tools can transgress disciplinary boundaries and investigates how an understanding of the intricate relationship between tools, techniques, the media they operate in and the design outcome is the premise of a more informed design approach.

KEYWORDS: Craft Theory, Design and Computation, Design studio pedagogy, Tooling

RÉSUMÉ : *Cet article présente les résultats et conclusions d'un atelier de design transdiciplinaire donné à la RMIT University avec des étudiants en architecture, en design industriel et en design de paysage. L'objectif était d'examiner la création et l'appropriation d'outils consacrés aux processus innovateurs en design. S'appuyant sur la théorie des métiers et sur les théories en design et informatique, cet article illustre comment les outils peuvent dépasser les limites des disciplines qui leur sont propres, et il explore comment une compréhension de la relation complexe unissant outils, techniques et médias est la prémisse d'une approche de design mieux informée.*

MOTS-CLÉS : *Théorie des métiers, design et informatique, pédagogie en atelier de design, équipement*

1. INTRODUCTION

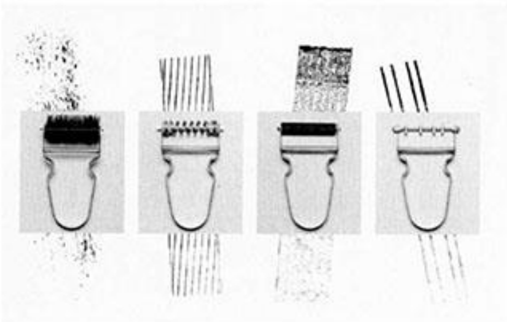
The process of designing is an intriguing area for researchers, with its vaguely defined problems and poorly understood procedures that lead to the final design outcome. More often than not, we come across the "black box" analogy, especially in reference to design ideation. However, the ideation phase in design has arguably become more transparent due to the impact of information technologies and the increased interest in design tools and techniques. We are at a period where our self-conscious attitude towards design tools and techniques results in an expanded formal vocabulary as well as a more informed assessment of our design intentions.

This paper presents the outcomes and findings of a semester long trans-disciplinary design studio recently taught at RMIT University, involving students from disciplines of architecture, industrial design and landscape design. The focus of the studio was to investigate the creation and appropriation of tools for innovative design processes across different design disciplines.

Drawing on craft theory and theories of design and computation, we discuss how tools can transgress disciplinary boundaries and investigate how an understanding of the intricate relationship between tools, techniques, the media they operate in and the design outcome form the basis of a more informed design approach. By focusing on the coexistence, polarities and tensions between analogue and digital design tools, we aim to illustrate how a new compositional logic can be developed through the nexus between traditional and advanced technologies and how these might influence material processes.

2. RECIPES FOR DESIGN: AN INQUIRY ON METHOD

FIGURE 1. *PETER JENNY'S REDESIGN OF ALFRED NEWECZERAL'S 1947 REX PEELER AS A DESIGN TOOL. (GÄNSHIRT 2007).*



One of the major inspirations during our conception of this studio was Peter Jenny's reconfiguration of Alfred Neweczeral's 1947 Rex peeler as a design tool. (Gänshirt 2007: p.96) Together with Bruce Mau's *Incomplete Manifesto for Design* (1998), where he invites designers to make their own tools, Jenny's redesigned Rex peeler quite aptly summarised our intentions—to analyse conventional tools from within and outside the domain of design in order to subvert their use and explore their potential for informing our design thinking.

As we intended the studio to be a self reflexive and process oriented experience, we sought to recruit students with a preliminary understanding of their individual design methodologies. The prospective participants needed to have already acquired a range of design skills—established a "comfort zone" in their design processes—so that we could challenge them to go beyond their conventional approach throughout the semester by exchanging ideas with students from other design disciplines. The vertical studio system of RMIT School of Architecture and Design, combined with our request for upper level students from architecture, landscape design and industrial design, facilitated the desired level of exchange not only between different design disciplines, but also between different levels of design skills.

2.1. "Destructive Analysis"

> "I want to fatten the belt with those instruments that tend us infinitely closer to the precise. If a tool is a refined prosthetic that evolves the self…the more we are introduced to, the further we can tread.
> I am curious about tools for designing and process oriented design, where designer is one step removed from immediate outcome. I like the education that a tool can provide in this instance.
> I want to script
> I want to print
> I want to boldly craft using techniques presently unknown to me."
> (Dominique Hall, studio participant, written comment on her expectations from the studio submitted at the start of the semester, March 2008)

The semester started with an intensive period of procedural analysis, where we asked the participants to provide us with a list of their individual design skills and to write up their motivations for joining the studio. There was an equal amount of interest in a traditional hands-on approach and computation, and the studio structure allowed for a training period in their design medium of preference.

The main challenge for students in the first half of the semester was to develop a critical distance from the design strategies to which they were accustomed. By asking for a design recipe from each participant, we aimed to estrange them to their naturalized processes, so as to provide the space for a procedural leap of faith. Polanyi (1958) calls this sort of estrangement from a naturalized skill 'destructive analysis', as it temporarily shifts focal attention to previously unnoticed subsidiary processes, paralysing the very use of skill during the analysis period. We allowed for this shift of attention during the first half of the semester, where we provided weekly instructions in the form of intensive design charrettes, focusing on different portions of the design process.

FIGURE 2. *DESIGN RECIPE BY PATRICK EBERLE.*

Our intention for the weekly design charrettes was to collaboratively build up a repository of analogue and digital design tool prototypes that would be used and developed throughout the second phase of the studio. After an intensive period of weekly presentations and discussions on collectively produced design tools, the students were required to develop and utilize their design tools within the context of a conventional design project for the second half of the semester.

The main strategy we utilised throughout the first half of the semester was to point out a range of possibilities for the designing of design tools. The brief for our first charrette titled *Seek, Destroy and Restore*, called for the analysis of a conventional tool of choice, which was to be subsequently decomposed and recomposed as a design tool. In this instance, we not only tested the students' understanding of a design tool, but also aimed to expand their cognitive capacities by challenging them to see different affordances in everyday tools.

According to craft theory, the decomposition and recomposition approach is a vital constituent of design understanding, where making and fixing become complementary parts of a continuum. When talking about an act of repair that changes the essential function of a tool, Richard Sennett refers to a "jump of domains" (2008:200). According to Sennett, this jump expands the tool's previous applicability, while the very act of repair provides the designer with a deeper understanding of its application.

Following the first charrette, we asked students to form groups involving different design disciplines in order to work on the remaining charrettes collaboratively. We also arranged training sessions to familiarise students with available modelling and computation facilities at the school of design. These training sessions involved sessions in the model making workshop, digital prototyping workshop and an introductory weekend workshop in Grasshopper, the scripting platform for Rhino, a popular 3D CAD package. Students were then asked to employ their new skills in the construction of design tools while exploring concepts such as measurement, pattern making, and generative algorithms. In exploring these concepts, they were encouraged to use both physical and digital modelling to develop their tool sets.

While the students produced an impressive set of design tools in the first phase, there was also heated debate about when a tool becomes a design tool. This ambiguity became evident at midsemester, when students were asked to reflect on the work they had done during the first phase and needed to speculate on which tool they want to use in the context of the given design problem. We were initially surprised to see how little students actually thought about why and when they use the tools they developed. However, this apparent lack of critical thinking makes sense within the context of Polanyi's (1958) discussion on focal and subsidiary awareness in skill formation. In this case, the students had temporarily shifted all their attention to the production of tools at the expense of the bigger picture which would have generated their design intent.

FIGURE 3. ANALYTICAL DRAWING OF AN EGGBEATER, CHARRETTE 1, MICHAEL LYON.

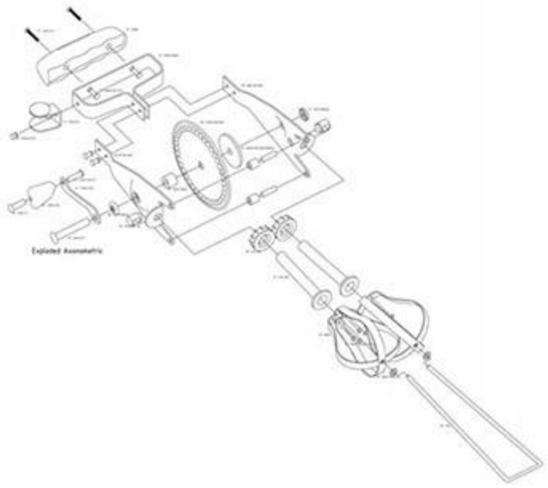


FIGURE 4. EGGBEATER RECONFIGURED AS A CASSETTE REWINDER, CHARRETTE 1, MICHAEL LYON.

2.2. Convivial Tools

> "Tools are intrinsic to social relationships. An individual relates himself in action to his society through the use of tools that he actively masters, or by which he is passively acted upon. To the degree that he masters his tools, he can invest the world with his meaning; to the degree that he is mastered by his tools, the shape of the tool determines his own self-image. Convivial tools are those which give each person who uses them the greatest opportunity to enrich the environment with the fruits of his or her vision." (Illich 1973)

Considering how contemporary information technologies largely depend on the dynamics of communities of interest and networked intelligence, we designed a wiki site at the start of the semester to be used as an online workbench for information sharing and asynchronous feedback. The students were then able to use the wiki as an active platform for information sharing, as well as a virtual studio space that enabled them to track each other's progress. This created a positive synergy among the students, leading to the production of an exciting exhibition and a well crafted studio catalogue at the end of the semester.

Our pedagogical approach was mainly based on the idea of collective intelligence. Through our studio teaching, we explored the impact of conviviality in generating an atmosphere that leads to an accumulation of innovative know-how. As the semester progressed, we were increasingly convinced about the critical impact of peer group interaction in the development of skills across design disciplines.

3. FROM TOOLS TO PROCEDURES

Critics of medium theory question whether the tools utilised and the media that they operate in actually determine the nature of the end product (Potts 2008). By focusing exclusively on tools, we risked being overly deterministic about the effect of techniques, while overlooking other factors in design like context or programmatic concerns. However, questioning the nature of a design tool provided us with invaluable insights on how we use procedures when designing.

By focusing on design tools, we introduced students to the concept of physical computation, and invited them to think about performative aspects of design by producing design tools with simple purposes. To some extent this helped us get rid of the "black box" effect, as we tried to unveil the mysteries of design ideation process by showing how small steps can lead to complexity in an end product. In some cases, even a simple geometric device was instrumental in introducing students to rule based geometry and parametric design.

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FIGURE 5. *ANALYTICAL DRAWING OF AN ELLIPSE DRAWING TRAMMEL, BY SCOTT CROWE.*

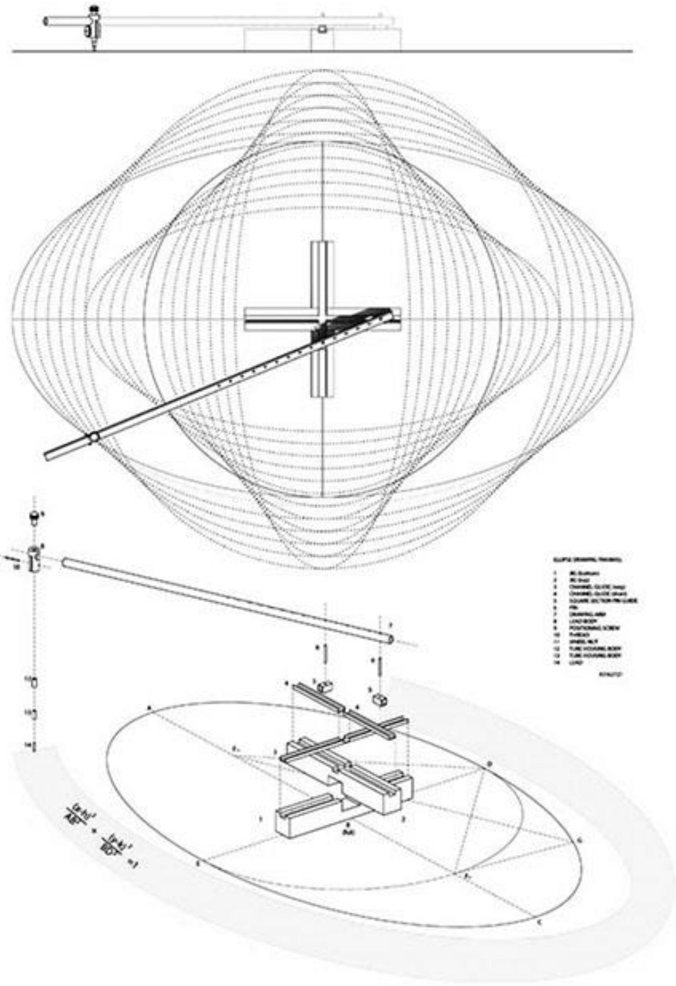
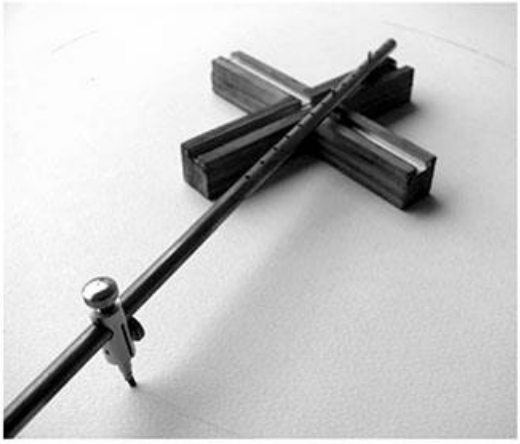


FIGURE 6. CONSTRUCTION OF ELLIPSE DRAWING TRAMMEL BY SCOTT CROWE.



Associative computational design models are not models in the same sense as cardboard or balsa wood models, but differ from their analogous cousins. They are procedural tools, in which implicit geometry is based on a network of interconnected entities which are described by a system of explicit and implicit design rules. Inherent to a parametric design approach is the initial necessity of having to explicitly define all parameters and rules of the system at the very beginning. This means that the designer first needs to conceptualise the design intentions and to de-compose the design task into discrete parts in order to be able to describe local and global geometric relationships by explicitly defined low level sets of rules and parameters.

By introducing these principles of de-composition and re-composition, we aimed to familiarise our students with a new aesthetic language that expresses a coherent and seamless adaptive logic. By using material or algorithmic tools, students initiated their designs with a governing procedure, a driver, that can be inflected and affected by a combination of contextual, physical and design based parameters.

4. ENGAGING PROCEDURES: FROM MATERIAL EMERGENCE TO ALGORITHMIC EMERGENCE

> "One thing we recognized when programming was the inherent scale change that is required when working. Because programming requires the explicit relationship between all objectives and outcomes, working with this interface it was very easy to get lost in detail (it is all detail). [...] To zoom in and out

of scales with the project was a major factor in creating something we sought from an entirely new technique." (Scott Crowe, studio participant, comment on his studio experience, submitted at the end of the semester, October 2008)

Over the past few years we have recognised that students increasingly make their designs software-dependent. Rather than developing a strong design idea and finding or creating an appropriate tool for its articulation, they tend to use readily available software tools. The idiosyncrasies of software increase the students' tendency to generate designs mimicking the latest style in vogue. This uncritical use of software often confuses style with design, resulting in a homogenised architectural repertoire where expert use of techniques displaces well articulated design ideas.

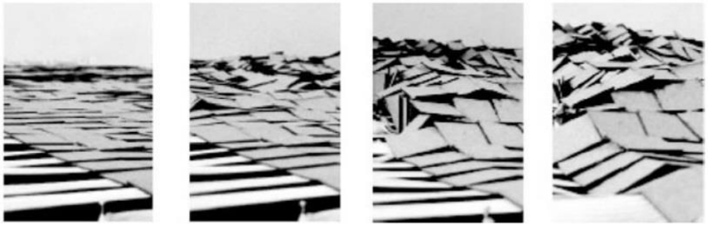
In his *Incomplete Manifesto for Growth,* Bruce Mau (1998) identifies software as the reason for the homogeneity of contemporary design and suggests avoiding software altogether. In our case, we did not go so far as to avoid the use of software, but instead raised the awareness that 'tools of representation are never neutral' (Pérez-Gómez 2002), and that they do not only change the way we work, but deeply influence how we perceive design problems at hand. We addressed this issue in the studio by intentionally suspending the design on the designated project site until later in the semester while challenging students to design prototypical design tools that could be used for a wide range of scenarios and would assist them in their design methods after the studio.

Without a testing ground of their applicability, tools of design lack the actual representation of their potential. The main focus during the second half of the semester was on testing the developed tools on a selected project site, which was an urban block in the city of Melbourne with a couple of heritage buildings, and a massive redevelopment scheme underway. We allowed the students to select the scale of their interventions, while working on different aspects of the site. In the end, the scales of intervention ranged from urban design to product design, all of which informed the resolution of individual proposals. In the following section, we briefly discuss two main strategies employed by the students through representative projects.

4.1. Material Emergence

One of our main emphases throughout the semester was on the use of physical modelling. Driven by craft theory, we insisted on the importance of workmanship of risk as opposed to workmanship of certainty (Pye 1995), inviting students to follow the emergent properties of materials. This philosophy of design is especially important in the current context of information technologies that increase the tendency towards more abstraction at the expense of embodied knowledge (DeLanda 2001).

FIGURE 7. *CONCEPTUAL SITE MODEL "ARMADILLO" BY SCOTT CROWE AND PATRICK EBERLE.*



In their initial explorations during the charrettes, Scott Crowe and Patrick Eberle produced a series of well crafted physical models. The model seen above is one of their initial site models, produced as an urban pattern making tool that is based on the idea of an elastic grid which changes according to different densities within the site. Following their literal take on the idea of an elastic grid, they produced this model with elastic bands of different lengths and resistances to which they attached pieces of cardboard to act as the non-elastic units of the grid. They then explored the emergent patterns by changing the lengths of elastic bands.

Although Crowe and Eberle moved on to scripting and agent based design towards the end of the semester, their idea of a grid changing according to desired densities developed through this model remained. They later utilised the different patterns created by this model as façade elements in their conceptual collages illustrating their final design proposal. That in itself is indicative of the way students regard their "tools" created for the charrettes – they continually subvert the initial purpose of the tool so that it conforms to their changing needs as their design ideas evolve.

4.2. Algorithmic Emergence

In their final project, 'Time Machine', Scott Crowe and Patrick Eberle successfully integrated and combined their design tools that they had previously designed and built in the charrettes. The intention of Crowe and Eberle's project was to make a programmatic analysis of the given site and to produce a system that would allow for the generation of new master plans while acknowledging both quantitative and qualitative aspects of the site. For their final proposal they developed a computational generative design tool that synthesised an agent-based system and a 3 dimensional Cellular Automaton in order to diagrammatically generate future urban design scenarios for their site.

In comparison to other students who embraced the computational approach, Crowe and Eberle were more adept in bringing their design proposal to the desired resolution. They were able to employ their abstract diagram for gener-

FIGURE 8. MASTER PLAN VARIATIONS BY SCOTT CROWE AND PATRICK EBERLE.

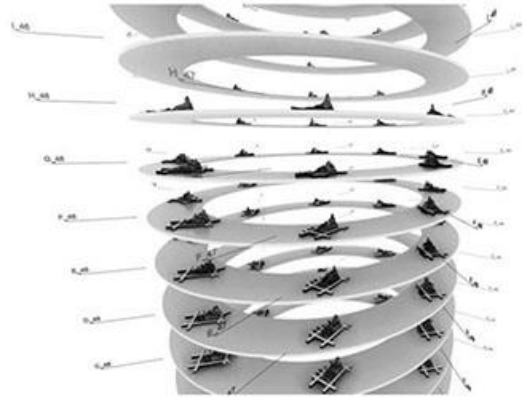
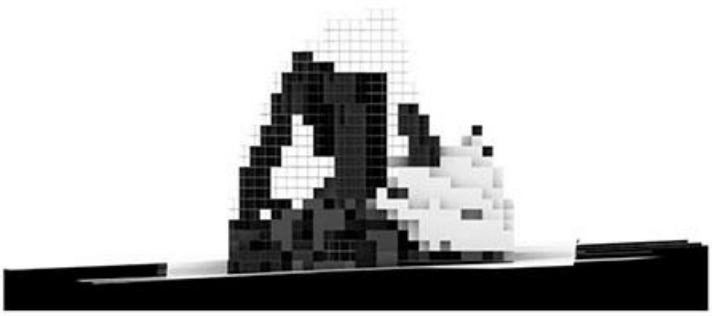


FIGURE 9. INSTANCE OF A 3D FUNCTION DIAGRAM BY SCOTT CROWE AND PATRICK EBERLE.



ating a series of future urban scenarios on the project site. In order to achieve more control over the output, they introduced a preferred set of spatial relations in conjunction with the functional proximity relations. Their preferred results were represented in terms of expressive collages, which further explored the spatial potentials of the emergent configurations on a more intimate scale.

FIGURE 10. COLLAGE SHOWING RESIDENTIAL AREA BY SCOTT CROWE AND PATRICK EBERLE.

5. CONCLUSION

During final presentations our studio generated a heated debate on the issues of tool biases, and whether focusing on the tools would undermine issues such as context and program. Most of our colleagues at RMIT commended the focus on physical modeling in the first phase, while noting that the translation into the actual design solution required further articulation. Another comment was on the positive impact of group work among students from different disciplines and how this enriched each student's skill base.

Although computational generative design methodologies and parametric design are increasingly being associated with digital software environments, we contend that these can be explored in analogue as well as digital media and preferably, through a nexus of both. This is where craft theory provides us with insights by showing simple tool use as the basis of procedural thinking. A compositional and poetic engagement with tools enables the reconsideration of design practice as a process based on iterative evolution and performance. This is by no means advocating a 'new' way to design – we just focus on one niche within a wide ecology of design thinking.

Recent design literature features a range of approaches to the concept of tooling in design (Gänshirt 2007; Aranda and Lasch 2006; Kilian et al.). While acknowledging the diversity of related stances, we aimed to show the possibility of an innovative approach within a broader technological spectrum ranging from hand built design tools to preliminary scripting, as opposed to focusing solely on cutting edge technologies.

As the dominant media change, our perceptive and cognitive faculties evolve to adapt to the changing environment. We believe that a grounded understanding of techniques supported by embodied knowledge would greatly support design disciplines in their pursuit of innovation. Changing technologies in design require new pedagogical approaches, and it is at these points of inflection that critical reflection on the familiar ways of doing things forms the basis of strategies for defining innovation in design.

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