

**School of Design and Built Environment
Faculty of Humanities**

**Material Engagement Model—A Study of Spatial Designers'
Lived Experience of Unknown Materials**

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Declaration

To the best of my knowledge and belief, this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

Human Ethics (For projects involving human participants/tissue, etc) The research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council National Statement on Ethical Conduct in Human Research (2007) – updated March 2014. The proposed research study received human research ethics approval from the Curtin University Human Research Ethics Committee (EC00262), Approval Number # BE 09-210

Signature.

Date: January 30, 2019

This thesis is dedicated to my darling daughter Bella.

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ABSTRACT

In the process of designing spatial outcomes, a designer seeks the appropriate materials towards an intended goal. A spatial outcome will involve a relationship with materials through its presence or its absence. Knowing what to apply forms the foundation of the material knowledge that the spatial designer puts into practice in selecting a material to achieve the desired result. This thesis examines the lived experience of this engagement with the knowledge and use of a material. Increasingly advanced materials, which may be unknown or of which there is limited knowledge, are presented to the designer, so it is essential to understand the phenomena of this unknown material in order to employ it in practice. A phenomenological analysis grounded on the work of Heidegger and Merleau-Ponty provides insights into knowing through unconcealing and through the embodiment of perception. These ideas were reinforced through qualitative research with a diverse set of international spatial designers, whose practices involve advanced materials. Their insights reinforced the theoretical ideas in the literature. Through the semi-structured interview process, the participants were each presented with an unknown material. It was at this crucial moment in the process of engagement that they demonstrated and discussed what they were experiencing. All of the insights from the participants were analysed with the literature and were applied to the Reversal Theory model of Apter in the development of the Material Engagement Model (MEM). The Material Engagement Model (MEM) provides a heuristic model for understanding the telic and paratelic processes that occur when spatial designers encounter an unknown material. The theoretical framework of this model presents opportunities for the spatial design to understand their process of engagement. They become aware of the ordinary that is extraordinary.

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Chapter 1:
INTRODUCTION

Background to the Study and Research Domains

Our society is profoundly influenced by advanced materials and technologies. Materials have helped to raise our standard of living, but new challenges steadily emerge and novel materials and properties are demanded, representing a key element of the commercial success of tomorrow's industrial products and competitiveness of European industry.

—Bart Romanow and Helge Wessel

When Romanow and Wessel opened their European Commission report—*From Advanced Materials Research to Innovation and Growth*—with these comments (2017, 4), it hardly came as a surprise to the design world. More than a decade earlier, the UK-based Materials Innovation and Growth Team noted that the annual turnover of £200 billion for companies that produce and process materials represented 15% of the GDP (Department of Trade and Industry, UK, Materials Innovation and Growth Team, 2006). Designers are fully aware of new materials in their fields, as application of these materials allows their work to be seen as innovative and different, thereby placing themselves on the margins of design (Julier 2001; Verghese 2009). It will be argued in this thesis that their explorative engagement with materiality is an essential aspect of the practice of spatial designers who want to challenge the boundaries of material application in their work (Weston 2003; Beylerian and Dent 2005; Brownell 2006, 2008; Zijlstra, 2008).

Not only is the scale of the industry expanding, the literature about advanced materials is vast and it establishes the context of the meteoric explosion of technological research breakthroughs with advanced materials that are altering spatial design and the built environment. This progress in material science has produced an expanding array of materials with advanced properties. Moskowitz (2009) describes these materials as exhibiting an unparalleled range of applications, due to their physical and chemical properties, which are developed from new and different internal compositions than those of similar materials. Access to these materials has prompted a shift in design practice towards

offering new materials for alternative outcomes to spatial and product design briefs. Many organisations, material resource libraries, specialised design practices, research journals and conferences, professional journals, and academic courses, have all developed from this interest in technically advanced materials. The literature that defines this growth is discussed in the thesis. *Advanced materials* represent an element of the first of three key components of this thesis, yet it is the spatial designer's engagement with the unknown or advanced material that is the focus of this research.

This thesis was originally inspired by the exponential use of advanced and novel materials in the world of spatial design, but as the research progressed, the very notion of *advanced* became questionable, and what has transpired is a more inclusive term of *unknown* material. It will be explained in the thesis, that the term *advanced* material—although acceptable in practice as a material demonstrating material properties that differ from other materials in the market by offering enhanced capabilities or aesthetic options previously not available—is a term that is particular only to the knowledge-base of the designer. It is therefore not a universal term that can be used to describe new materials that are experienced by the spatial designer, albeit they are in a subset of the world of materials. The term *unknown* material best suits the material engagement as experienced by the spatial designers, as all materials are either known or unknown, with some that demonstrate material properties that, in a performative or structural sense, excel others.

The second key component of this thesis is *the spatial designer*. Understanding that a spatial designer may address their practice in a multitude of ways, the research examines how a designer is involved in the description, instruction, and/or the manipulation of material matter to describe or enclose space. Such practice would normally be found in the disciplines of architecture, interior design, exhibition design, and landscape design. Each of those disciplines asks the designer to prescribe an experience for users through the arrangement of form that either surrounds them with a space or asks them to confront a space.

It is arguable that the variation of spatial experience is dependent on the distance between your skin and a material enclosure. Therefore, it can be said that the traditional spatial disciplines are not the only ones that define spatial outcomes, for installation art, interaction design, product design, and fashion design are other disciplines that engage with material in and around space. Whilst acknowledging that a wide range of disciplines shape our spatial interactions, this thesis focuses on research participants who come from the architecture, interior, furniture, and exhibition design disciplines.

It is also essential to respect the importance that materials played in the shaping of the spatial environments that have been the cornerstone of civilisation (Manzini 1989; Weston 2003). Everything that we see was once a thought that was realised in form through the application of materials. So, understanding how we engage with materials is an essential aspect of the design process.

The third (and final) key component of this research is the *lived experience* of the spatial designer. This connects the other two components through an examination of their engagement with unknown materials, in particular those that are advanced. The work of Heidegger and Merleau-Ponty inform the research that examines the lived experience of designers phenomenologically. Their heuristic views examined the observer as embodied in the world and not separate. This engagement was best captured by Merleau-Ponty, who understood perception as embodied, so that when we see something, we rediscover it (Hale 2017).

Given the phenomenological significance placed on the qualities of materials, it is equally significant to understand the qualitative nature of how designers initially engage with materials. This research addresses this issue of an embodied relationship with new or unknown materials by examining how designers engage with them. Despite the speed of progress in the world of material science research, little time has been spent closely examining creative,

human engagement with materials; we have been quick to develop new materials but slow in understanding how designers work with them.

The context of defined knowledge domains: architecture, interior design, industrial design, furniture design, exhibition design, design process, advanced materials, innovation, lived experience, practice, and phenomenology will be presented in the literature review.

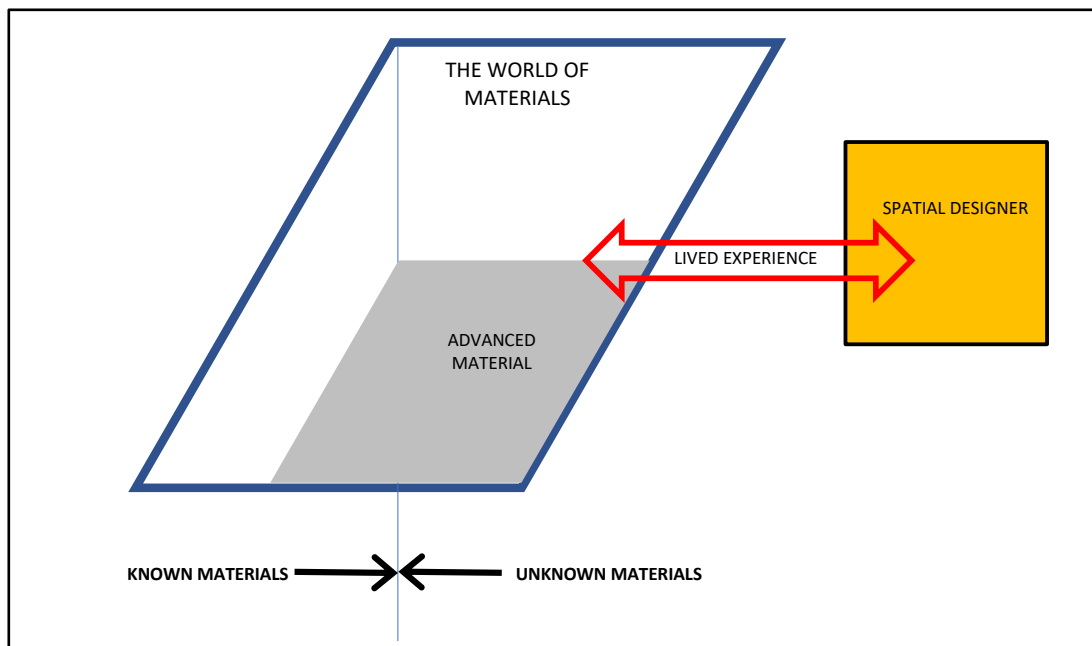


Figure 1.1 Diagram of the Research Context
The initial core aspects of the issues that frame this thesis and define the research domains.

Research Question and Purpose of the Research

The research question is: *What is the lived experience of spatial designers when they engage with unknown materials, with particular reference to the phenomenon of willingness to take creative risks in their work?* To examine this question, qualitative research was undertaken using Interpretative Phenomenological Analysis as the methodology.

The purpose of this research is to gain an understanding of how spatial designers engage with materials that are—at the moment of introduction—unknown to them. It will provide insights into the variety of influences that

affect the *selection* of seemingly ‘unknown’ materials, and into the *process* of using materials in unusual or unexpected ways. When I use the term ‘unknown’ materials, I refer to materials that designers have not used or encountered before. When I talk of ‘unusual’ or ‘unexpected’ ways, I refer to a way of designing with materials that the design field (practice) would consider as innovative or atypical.

In examining Merleau-Ponty’s relationship to architecture, Hale (2017, 69) notes: “...what we have actually experienced is not simply the thing in itself, but rather our own bodies in the act of experiencing the object.” This research examines this embodied process of material engagement. What occurs at the moment of contact, and what learning (and ‘un-learning’) needs to take place during the subsequent process, has not been examined elsewhere. Current literature has bypassed this crucial moment of engagement. This intimate relationship between the spatial designer and materials is explored in the thesis by examining the working material knowledge of the designer and their material ‘awareness’ and ‘unawareness’. In doing so, we gain a deeper understanding of material engagement as an essential part of the design process. I argue that understanding this process of *how* designers encounter previously unknown material will help to enhance methods of design ideation for future material encounters. The thesis provides insights into a process that can enlighten future designers with an explicit understanding of how they engage with materials. This will add to the body of knowledge of understanding designers’ engagement with materials.

Research Process

This thesis falls into the category of descriptive research (Alevesson 2013) and aims to understand, not solve, a problem; it therefore clearly aligns with a phenomenological approach. The research question emerges from understanding the purpose and the contextual problem that faces designers in knowing about a material that is unknown through their engagement with it. Researchers in phenomenology (Van Manen 1990; Moustakas 1994; Lester

1999; Moran 2000; Groeneweld 2004) suggest that there is no problem, just an observation that seeks to understand the experience. It must be understood that the term 'problem' is misleading, as there is nothing to solve; however, the work does refer to the problem that designers have in the process of understanding an unknown material. So, this thesis will provide insights and propose a way of understanding aimed at enhancing future experiences of material engagement. An extensive literature review of the research domains and the theoretical perspectives of phenomenology informs the approach to the research methodology.

This descriptive research is exploratory and can largely be understood by looking at the past; as Van Manen has explained, "Various thinkers have noted that lived experience first of all has a temporal structure: it can never be grasped in its immediate manifestation but only reflectively as past presence" (Van Manen 1990, 36). Qualitative data from semi-structured interviews was analysed using textual descriptions to reveal the lived experience of nine spatial designers. They were selected due to their deep interest and experience in pushing the boundaries of material application. This disposition leads them to have the propensity to take creative risks with materials or express them in innovative ways. The thesis argues that an explicit knowledge of different ways of dealing with an unknown material can be gained from insights presented in the analysis of textual descriptions provided by interviewing designers.

As I will explore in the thesis, there are intrinsic factors (or internal influences) that define the designer and their work. At the same time, the spatial designer practices in a real world filled with extrinsic factors that impact on the process of engagement with unknown materials. Both intrinsic and extrinsic factors are dealt with by designers to varying degrees of commitment that are dependent on the context of a design problem.

The interviews used in this thesis provide insights into how spatial designers experience materials. A particular "designerly" event took place at the end of the

interview when the participants were presented with an unknown material. Their lived experience was experienced live, and how they interacted and engaged with the material was noted, discussed and examined. All of these insights informed the development of a model of engagement aimed at enhancing existing process models. The Material Engagement Model (MEM) emerged as a way of understanding and working with an unknown material and may be applied to existing working processes or methodologies. Details of how spatial designers engage with materials through stages of *introduction*, *classification*, *exploration*, and *utilisation* are explained in detail in the research findings of the thesis. The MEM shows how designers ‘unconceal’ knowledge of materials and their subsequent ability to take creative risks during this unconcealment reveals a particular personal approach to the design process.

Understanding Material Unconcealment and Embodiment

The research domains that are expressed in the diagram in Figure 1.1 raise epistemological issues that can be addressed by an exploration of philosophical enquiries into the nature of experience and the acquisition of knowledge of the material world. These ideas provide a foundation and a deeper understanding of the issues for this thesis.

What makes phenomenology so fascinating is that any ordinary experience tends to become quite extraordinary when we lift it up from our daily existence and hold it with our phenomenological gaze. Wondering about the meaning of a certain moment of our lived life may turn into a phenomenological question: we may then wonder and ask, what is this experience like? (Van Manen 2014, 38)

Understanding the process of unconcealment, described above, and that of the phenomenological gaze, addresses a philosophical examination that this thesis undertakes. How a designer begins to ‘know’ the material world and then turn this knowledge into an appropriate design answers the question of why this study is important: it addresses a gap in the body of knowledge.

The investigation of the process of making something known that is concealed when we are first introduced to it is discussed in the work of Martin Heidegger, who notes, “Bringing-forth brings out of concealment into unconcealment” (Heidegger 1977, in Krell 2002, 317). This in turn leads the enquiry to how the process of making known is understood by a designer. The social constructs and knowledge that guide a spatial designer in practice are articulated in this thesis—in particular, the inquiry into the importance of material memory.

The work of Heidegger examines the questions of technology and that of unconcealment. His phenomenological approach and that of Merleau-Ponty can be described as an interpretive heuristic direction. This aligns to Interpretative Phenomenological Analysis (IPA) methodology, used in this research to understand the lived experiences of the spatial designer. Merleau-Ponty provides a deeper understanding of embodiment through this work on perception. These ideas inform a crucial moment in the process of engagement.

The embodiment of material knowledge experienced by the spatial designer engaging with an unknown material lies at the heart of this qualitative research. Each person has accumulated knowledge over their lives, yet each has a different story to tell of that knowledge, due to: their ethnographic diversity; their personal concepts, education, beliefs, and the taxonomies to which they prescribe; and lastly, as Bourdieu (Bourdieu 1977, 1990; Grenfell 2010) would describe, their cultural capital, practice, field and habitus. Trusted (1997) explores the relationship of knowledge and perception and notes that the latter can only inform us and can provide us with the opportunity for an opinion that may lead to knowledge.

Personal Relationship to the Study

The genesis of this research began when I was a child, even before I enrolled in formal design education. The relationship to the dynamic nature of materials began without a conscious understanding of my future profession, nor did it predict the research that I would undertake and present here in this thesis. As I

was dislocated from my birthplace as the family moved, I can claim to be a third-culture kid (TCK) or global nomad; the former term was coined in the 1960s by Drs Ruth and John Useem, and the latter term by Norma McCaig in 1984. Both generally refer to a person displaced from their birthplace through relocation (McCaig 1994; Tanu 2012; Schaetti 2018). Without going into the experiences and details of the journey, I have come to recognise that this 'disconnection' led me to constantly seek out new experiences, knowledge, and artefacts.

My formal education was at an architectural school that strongly connected technology and architectural science to the design process. This was later reinforced by my postgraduate research degree in industrial design. Both of these educational experiences formed my early relationship with materials, particularly as that very first class in design school was in a polymer lab where the exploration of material tactility was required. My journey into practice led me through architectural offices, interior design studios, and industrial design companies. With each experience, I began to assemble an approach to design that was always about exploration of new ideas and how the use of materials can impact the form and function of the outcomes I designed. This led to the role of an academic in a design school that educated others on a process of material exploration.

Within the university roles I occupied, I began research into materiality and advanced materials. This thesis will draw on that earlier inquiry into advanced materials and the knowledge of materials within design, and in particular on the knowledge(s) found in spatial design, design process, and advanced material innovation. This exploration of the new frontiers of materials was inspirational and reinforced my ethos of discovery, which was best captured by Peter Brook in a statement that has grounded all my work: "But it is only by searching for a new discrimination that we shall extend the horizons of the real" (Brook 1980, 108).

As my professional activity, research, and academic experience resided in the discipline of interior design, architecture, and industrial design, the common connection was to explore the spatial designer that encompasses all of them. Here, the more inclusive view of the term covered more than just architecture and interior design. The term is used to examine all disciplines that generate designed outcomes that define and enclose space.

This sketch of my background forms a bracketing that supported stage one of the research methodology, which examined the data through Giorgi's Descriptive Phenomenological method. The background also provides a context that helped to interpret the text through the IDP method that took the data further with the textual descriptions.

With a personal background in practice and academia related to advanced material and design process, many of the participants short-listed for were known of through their reputation, publications and community contacts. Their selection will be discussed later in the thesis. Yet it is my background that allowed me to approach this topic with an awareness and appreciation of their insights into design and material engagement.

Summary

This thesis examines the phenomenological lived experience of spatial designers' relationship to unknown materials. This chapter introduces the context and identifies the research problem, the purpose of the research, and the research question. It also comments on the key elements of the research and the findings.

In the following chapter, the literature review covers the three research domains of spatial design, unknown materials, and lived experience. It also provides an examination of the philosophical ideas from Heidegger, Merleau-Ponty, Bourdieu, Schön, and Lefebvre, who address the intersection of the known and the unknown, and enhance insights explored in my research.

Heidegger and Merleau-Ponty give guidance and insight into the phenomenon of being acquainted with the *unknown* through embodied perception. The *unknown* here refers to the process of uncovering, revealing, and unconcealing the true essence, or *being*, of a material, and has emerged as a foundational element of this thesis. The work of Bourdieu, Cross, and Lawson all provide a framework for understanding the research domain of design practice. As spatial designers practice in the dynamic world of design, their lived experience of materials occupies a significant part of their design process and practice. Such process or practice may relate to a specific project (client) brief or may exist as part of a continual personal exploration of material learning undertaken by the designer. Existing research into the design process negligibly addresses the designer's material engagement process and, currently, only addresses the technical process of selection (Ashby & Johnson 2003; Dorst 2006; Borden 2014). The literature review concludes with examination into process and practice.

As the purpose of this research project is to understand how various designers approach their work in terms of material engagement, particularly how they engage with unknown materials, it was concluded that the research needed to adopt a phenomenological methodology to understand this dynamic context. Chapter Three covers the research methodology and defines the boundaries of the study.

The next two chapters provide textual descriptions from the designers, which are interpreted to form two different themes: intrinsic and extrinsic. This primary research produces insights and findings that are synthesised into a proposed process model.

Huge advances have occurred in material technology, yet studies on designers who were tasked with the role of engaging with such materials (incorporating them into their design outcomes) have been limited. Their intimate relationship to either previously unknown materials—or materials seen to be 'advanced' in

their material properties (for example, applied graphene materials or nanomaterials)—is also very limited. This thesis addresses this gap in the body of knowledge. I propose a *Material Engagement Model (MEM)*, which, I argue, demonstrates an embodied process of material understanding and engagement. Its purpose is to provide a heuristic tool to incorporate and enhance the practice.

Chapter 2:

LITERATURE REVIEW

Overview of Literature Review

The purpose of the literature review is to elicit an understanding of current research into areas that address the research problem, leading towards defining the gap in the existing body of knowledge. The research problem and primary focus of this review is to examine the lived experience of spatial designers with an unknown material. This statement defines the three main areas of concern of lived experience, spatial design practice, and unknown materials.

The literature review examines the spatial designer's lived experience of materials through the process and practice of spatial design. The review explores the relationship of how material knowledge is attained through the lived experience of the act of spatial design, forming the prime focus of the review and of the thesis.

As this thesis looks at how designers engage with materials, it understands that the same material may be experienced by designers from different disciplines, and their engagement may or may not exhibit similarities, yet it is when the material is applied in their practice will the notation of a specific discipline become noted. Although an understanding of unknown or advanced materials is important in this review its purpose is about the intentionality of the engagement with the material through the lived experience. Yet in order to contain the scope the subset of spatial designers was selected.

This thesis is about understanding how the spatial designer engages in the process of design through their research into and discovery with materials. Since the designer's discovery process has a purpose, there is a need to review the principles of the design process as they apply to material knowledge. This review will constrain the focus to only examine the implications of the relationship of material knowledge on the design process. It is important to understand that the design process undertaken by a spatial designer is iterative and is part of the experience and practice of being a designer. The review provides insights into the design process to complement the literature presented on spatial designers involved in the act of spatial design. The key

point is that although the review discusses the act of spatial design and identifies the principles and examples of spatial design outcomes, the focus is primarily on the designer's lived experience with unknown materials.

To understand the complexity of the problem the chapter is divided into five parts. Part A describes the terminology and framework used in the literature review. The definition of terms and descriptions of the influencing factors provide the foundation for the text that follows in this literature review. Part B deals examines spatial design as the context in which this experience occurs. Within that context, outcomes are achieved using advanced materials—considered in this thesis as a subset of unknown materials—that represents Part C of this review. Prior to examining the lived experience of the spatial designer, Part D is presented in this review to offer theoretical insights that will inform the aspects of the lived experience. Part E deals the lived experience of the spatial designer through the three key phases of design knowledge, design process and design application. Finally, Part F presents the evaluation of the gap in the literature and the conclusions of the review. This review aims to demonstrate clarity of the necessity for the research by providing new insights into our understanding of the body of knowledge.

PART A: Terminology and Framework

Literature Review Process

This literature review is based on data collected from secondary resources of scholarly peer-reviewed references, together with data from a variety of specialised sources including reference books, internet searches, dissertations, conference papers, government reports, industry journals, and technical papers. The keywords used in this research were framed by four key areas: material innovation (materials, advanced materials, innovation); design practice (spatial design, architecture, interior design, interior architecture, and the design process); and theoretical insights (lived experience, phenomenology, Heidegger, Merleau-Ponty, Reversal Theory, and Bourdieu).

Nomenclature

It is necessary to start with definitions of the three key terms to facilitate a deeper examination. The understanding of these terms will be enriched through the literature review as an examination and exploration of these terms will illustrate their interconnectedness with each other.

Definition of Spatial Design

Spatial design is a relatively new and evolving term used to define a way of examining and understanding the world and deals with the “...transformations, perceptions, and actions and interactions that take place there, and the experience of passing through the space” (Fassi et al 2018, 851). Yet it has existed in practice as architecture and interior design for hundreds of years. Whilst other views will be discussed later, the premise for this thesis is that space is articulated from an enclosure of materials, and the scale is not limited.

Spatial design can be generally defined as any type of active spatial appropriation, whether it is a room or a landscape. At the center of this group is space as a relationship, perceived sensorially and cognitively, between things, bodies, or elements of the activated nature. (Exner and Pressel 2009, 9)

Architecture, interior design, and industrial design have all adopted the term of spatial design, but it can be applied to a variety of disciplines that utilise materials to prescribe a spatial outcome. The term spatial designer or designer would be used in this study understanding that the actual practice of architecture and product design is different, as to is the practice of interior design or landscape design.

The Action Agenda for Spatial Design 2017-2020—a document produced for the Government of the Netherlands—extends the domain of spatial design to include urban planners and landscape architects (Ministry of the Interior and Kingdom Relations, the Ministry of Economic Affairs, Agriculture and Innovation, and the Ministry of Defence, 2012).

However, spatial design has evolved over time, with architects examining the experiential nature of spatiality and not just the static nature of form. It should also be noted that there are many theoretical and philosophical perspectives on spatiality that span a variety of approaches (Hubbard et al. 2004). Deleuze's writings on Difference and Repetition (Deleuze 1994); and his ideas on events and spatial folds (Deleuze 1993) are important insights to note here. His approach presents the view that bodies, actions, and expressions defined by territories of space productively interact (Buchanan and Lambert 2005; Deleuze and Guattari 1987; Deleuze 1993)). This interaction allows the idea of space to flow as it is relational in a world that is "...constantly being territorialized, de-territorialized and re-territorialized in unexpected ways" (Hubbard et al. 2004, 9). These ideas will be expanded upon in Part B.

Notwithstanding the theoretical views of flow (Deleuze 1993) and the insights of spatial representation through the relationship of power and knowledge (Foucault 1984, 2007, 1995), together with Lawson (2005) discussion on space as a language and Wise (2006, 392) view of space and our "...lifeworld is flooded the variant radiance of milieu", the perspective that this study examines is that

of the practice of spatial design providing artefacts and boundaries that frame a space.

Definition of Unknown or Advanced Materials

Within our society, technological advances are seen in multiple industries (Berylerian and Dent 2007; Gessinger 2009; Moskowitz 2009; Quinn 2011). Many of those advances are propelled by innovative materials. Advanced materials have a particular nomenclature that is captured by Dr. Javier Peña in the European Commission Report: *Design and Advanced Materials as a Driver of European Innovation (DAMADEI)*.

An advanced material is any material that, through the precise control of its composition and internal structure, features a series of exceptional properties (mechanical, electric, optic, magnetic, etc.) or functionalities (self-repairing, shape change, decontamination, transformation of energy, etc.) that differentiate it from the rest of the universe of materials; or one that, when transformed through advanced manufacturing techniques, features these properties or functionalities. (Peña 2013, 25)

Although this definition captures the essence of the technological component of what an advanced material is considered to be in various disciplines, it is contingent on the notion of differentiation between other materials. This research explains how this definition of advanced materials is problematic, as it defines the term by differentiating it from the rest of the materials in the universe of materials. When the material is known, and therefore not differentiated, it ceases to be advanced or new. It then takes its place alongside the rest in the universe of materials, yet the material properties remain unchanged. For the majority of users, the material, for all intents and purposes, may be considered advanced in terms of its properties. However, that title, 'advanced', is dependent on social acceptance and use of the material, which would, in the duration of time, become knowable to designers. This temporal relationship will be explored in the thesis.

The material knowledge that the designer has developed through practice and experience means that the notion of ‘advanced’ is particular to the knowledge any one designer. It is not possible to define what is known and unknown for each designer in a literature review that is based on existing knowledge and aimed at discussing what is known in the context of materials. So, as a means towards understanding the unknown material, a category of potential unknown materials—advanced materials—was selected for this literature review (See Figure 1.1 on page 5). The review examines advanced materials with the understanding that when the designer engages with an unknown material, that material may or may not possess advanced properties. However, an advanced material can be used as a test case for an unknown material as, at the moment that the designer engages with the material, it is unknown. The longevity of the term ‘advanced’ is dependent on a variety of factors that this thesis will discuss.

This research uses a definition of new and advanced materials as those that will have properties that are unknown to the person experiencing them, and they will have material properties that differ from those of materials that are known. The material may have advanced performance properties or alternative aesthetic qualities that render the material different from other materials. The means of creating this material is not dependent on the latest technology, although the utilisation of advanced technology to produce the material is a likely scenario.

Definition of Lived Experience

Van Manen explains that at the core of human science lies lived experience, as “... human science begins in lived experience and eventually turns back to it” (Van Manen 1990, 35). He continues that reflexivity and self-awareness are able to fully comprehend the lived experience. Van Manen cites Dilthey (1985) when he states: “... that in the most basic form lived experience involves our immediate, pre-reflective consciousness of life: a reflexive or self-given awareness which is, as awareness, unaware of itself” (Dilthey, cited by Van Manen 1990, 35).

In his introduction to the *Phenomenology of the Social World* by Shultz (1967), Walsh provides the context in which various thinkers such as Rickert and Dilthey were discussed who opposed the positivist views of John Stuart Mills who maintained that moral science was backward. Rickert noted that understanding individual cases led to meaning and cultural science. Dilthey was concerned with content and meaning behind the cultural products and institutions that led to the science of the mind, with the mind being the most important aspect. This led to his belief that *Erlebnis*—lived experience or immediate experience—was essential to understand (Shultz 1967). Shultz built upon these ideas and those of Husserl to examine lived experience in detail. He begins his investigation into a meaningful lived experience by referring to Bergson:

Let us begin by considering Bergson's distinction between living within the stream of experience and living within the world of space and time. Bergson contrasts the inner stream of duration, the *durée*—a continuous coming-to-be and passing-away of heterogeneous qualities—with homogeneous time, which has been spatialized, quantified, and rendered discontinuous. (Shultz 1967, Loc.1512)

This is a particularly valid point of the temporal nature of experience that Shultz investigates thoroughly in his work. This relationship of time expressed by Bergson is seen to be inspirational to the work of Deleuze in his views of the temporal nature of the world in which spatial design is seen as part of a flow.

Any discussion of lived experience always goes back to the writings of Husserl (1999, 2012)—a philosopher who offered a radical departure from the view that the world is something to view from the outside.

I am aware of a world, spread out in space endlessly, and in time becoming and become, without end. I am aware of it, that means, first of all, I discover it immediately, intuitively. I experience it. (Husserl 1913/2012, 51)

Both Husserl and his student Heidegger issued the call to go back to the things themselves, and both rejected the views of Locke who explained knowledge as internal mental representations of the external world (Moran 2000). Merleau-Ponty expresses this thought as, “The world is not what I think, but what I live through.” (Merleau-Ponty 1945/2004, xviii).

Phenomenology viewed the world as one based on lived experiences that demonstrated a shift away from the academic discussions of nineteenth-century philosophies that saw consciousness as separate from the world. (Moran 2000). Key philosophers and ideas that describe this radical approach to philosophy is discussed by Moran (2000). It is radical in the sense that Moran claims: it is a practice rather than a system of trying to describe a phenomenon (Moran 2000). Phenomenology is not a system of dogmas, and hence is a radical departure from other philosophical frameworks, in that it is focused on the phenomenon and how it appears to the experiencer. It is this relationship to experience that makes phenomenology appropriate to any investigation of the encounters that the designer will have with materials. “Lived experience is the starting point and end point of phenomenological research. The aim of phenomenology is to transform lived experience into a textual expression of its essence...” (Van Manen 1990, 36).

Streubert and Carpenter (1995) define phenomenology as the science whose purpose is to describe a particular phenomenon, or appearance of things, as lived experience. Romdenh-Romluc (2011, 4) describe phenomenology as a “...philosophy that investigates experience from a first-person point of view, that is, as it is presented to the subject.” The lived experience, as Van Manen explains, is the experience of consciousness (Van Manen 1990). Husserl (1913/2012) describes in detail the relationship of consciousness, intentionality, givenness, and the lived experience in detail as he laid the basis of phenomenology in *Ideas*. More recently Pascal et al (2015) refer to assessing the lived experiences through investigation and description that allows access

into understanding the meaning of another person's world. These and other writers have expressed that lived experience is a core aspect of phenomenology, these ideas will be discussed in Part D of this review.

To adapt this thinking to the design domain of this thesis, the lived experience is concerned with design consciousness, and not the consciousness *of* design. That is, it is not thinking *of* a design, but rather the lived experience is comprehended with a consciousness *with* design. Through a particular focus on materials, this framework could be considered to be concerned with material consciousness and not the consciousness *of* materials; so, it is seeing the world *through* materials, not *of* materials.

Research Domains

The investigation of spatial designers' lived experience of unknown materials could lead in a variety of directions, but the decision was to focus on the three key research domains of: spatial design; lived experience; and unknown or advanced materials. The categorisation of the research domains and boundaries that define this research problem is indicated in Figure 2.1. They fall under two areas: spatial design; and the lived experience of materials in spatial design.

Spatial design defines the context and the first of three research domains. The disciplines of spatial design ordinarily include interior design, architecture, and exhibition design, and could arguably include furniture design, and industrial design. It must be appreciated that each of these components of the domain constitutes a huge spectrum of ideas, individuals, projects, and principles, that have established a body of knowledge of design. As a result, only a sampling of spatial outcomes that demonstrate a deliberate engagement with materials through innovation will be examined.

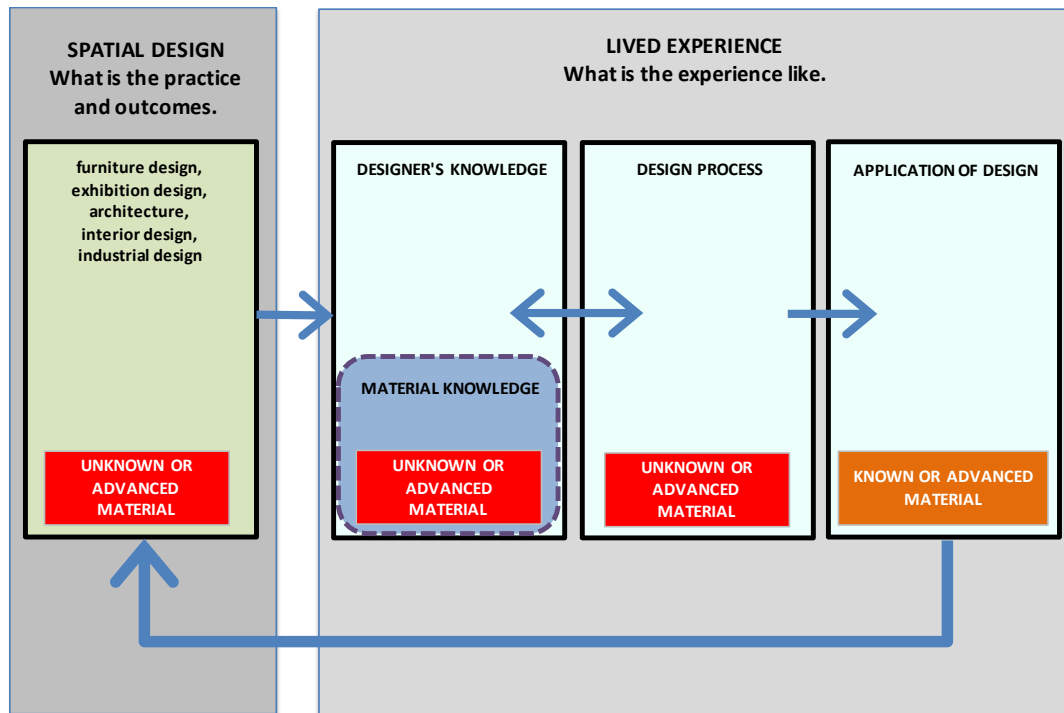


Figure 2.1 The Relationship of Research Domains
 The three domains of spatial design, lived experience, and unknown or advanced material and their relationship to each other.

The second research domain is that of unknown or advanced materials. This sits independently and simultaneously in conjunction with the other domains. As seen in Figure 2.1, the domain resides in the context of the world of spatial design, and also in all three categories of the lived experience. When viewed in the process of going from a project brief to a project outcome, as described in Figure 2.2, the unknown or advanced material sits outside of the process. Here, the manufacturers provide the material to the spatial designer at a particular stage in the design process. This separation is only diagrammatic as Deleuze (1987) described that it is all part of the flow of materials (Ballantyne and Smith, 2012).

Understanding that the research domain of lived experience is vast, for this thesis it will involve three distinct phases of concern: knowledge, process, and application of materials in design. Each of these phases occupies a large spectrum of research. To align with the intent of this thesis, this review aims to

maintain the boundaries of the research problem by focusing on the relationship to materials engagement. All three phases of concern are related to the lived experience of the attainment of material knowledge that supports a design process leading to the application of the design. Of the three areas, attainment of material knowledge (how that knowledge is gained) and then utilised is the core of this research.

The first phase of the lived experience research domain examines the impact that spatial design outcomes have had on the designer's knowledge of materials. These materials—known or unknown—may impart a material memory on a designer. This review explores whether or not material memory adds to the material knowledge of a designer. The literature presented will indicate that material memory is part of the overall knowledge that a designer needs within their lived experience (Bachelard 1971/2014; Lydon and Moore 1994; Stewart 1999; Zumthor 2005, 2006; Dernie & Gaspari 2016; Reckwitz 2017). All the knowledge that the designer gains, directly or indirectly, influences the design process that they undertake; material knowledge is only a component of all the knowledge that is needed, and establishes a sub-set within the research domain.

The literature review of the design process—the second phase—is focused on the relationship between material knowledge and the part it plays in the development of a design. This review examines the different aspects of the process and how a spatial designer engages with materials within their practice. This research will examine design process —known to be highly iterative (Miller 1995; Pile 1995; Laseau 2001; Dorst 2006; Lawson 2010; Makstutis 2018; Martini 2020). Understanding that the discipline is constantly evolving (Brooker & Weinthal 2013) and explores the boundaries with design thinking and human-centred design—all ultimately related to experiences. This review discusses how the lived experience of materials—which were introduced to the designer through the context of the world of spatial design to increase their knowledge base of materials—has contributed to an iterative process of design.

The final phase of investigation in the lived experience research domain is that of the application of design. During this phase the material has been transformed from an unknown material to a known material. It may or may not exhibit advanced performance characteristics and be called an advanced material. This category will only be briefly reviewed, as it is project-specific, yet the principles are discussed. It is here that the application of materials resides in a research domain of material science and application.

This research captures the implications of how material engagement is translated through the lived experience with particular emphasis on the design process in which the overall sequence of engagement involves the spatial design entering the world of design outcomes with applied advanced materials, resulting in observation, inspiration, and growth in the material knowledge of other designers who encounter the outcome. This broader awareness of materials that were previously unknown would lead to an enriched design process that would and ultimately to improved outcomes.

Many scholars over the years (Hubel and Lussow 1985; Miller 1995; Mitchell 1996; Lawson 1997 and 2010; Leupen et al 1997; Laseau 2001; Brawne 2003) have discussed the design process, and later in this chapter this review will capture the key aspects of this thinking as it relates to material engagement.

Factors Influencing the Study

Whilst the research domains establish the meta-framework of concerns, there are other factors and relationships that need to be defined. The diagram of the relationship of the research domains (Figure 2.1) shows the engagement of an unknown or advanced material at all the stages from the world of spatial design through the iterative design process encompassed in the three phases of the lived experience of the designer.

A Design Project Pathway from Brief to Design Outcome

Sitting simultaneously to this transformation of familiarity of an unknown material is the standard design pathway (Figure 2.2) from a project brief to the

outcome (Hubel and Lussow 1985; Miller 1995; Laseau 2001; Ashby and Johnson 2003). This pathway encompasses the starting point and termination of a project, which lies in the sphere of lived experience. Yet this may not always be the case (Lawson 1997, 2010; Hudson 2008) as a material can play a different part in the process. This thesis will explore the embedded pathway of engagement with materials to examine its congruency amongst other designers who are introduced to unknown materials. This research will examine if a designer has their own way of working with materials, and their own material knowledge that defines their approach to their work and establishes their core disposition or habitus to material usage.

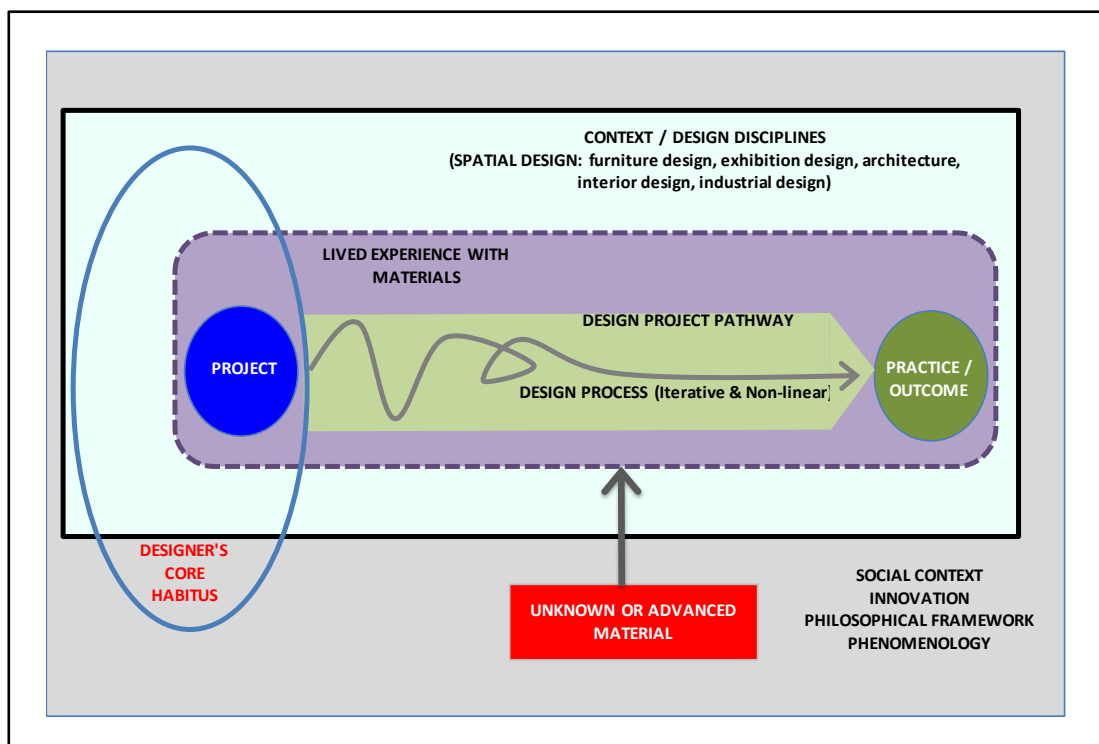


Figure 2.2 Factors Influencing the Research

Within the social context resides the context of design disciplines. In that context a project exists that will lead to an outcome or a refinement of practice that is achieved along a project pathway. The designer addresses the project through their core habitus and will undertake a design process that is iterative and non-linear. These all occur in the designer's lived experience with materials. From the social context of innovation, an unknown and advanced material will have an impact on the lived experience of the designer.

Cultural and Theoretical Context

This literature review will question whether there are other influences that impact this design pathway. Although the lived experience of the designer exists in this world of spatial design and is driven by the project that aims at reaching an outcome through an iterative design process, it also sits within a cultural context. These theoretical ideas that provide insight into how to understand the process of engagement is presented as a separate part of this review that will ground the discussion on the lived experience. An understanding of the key concepts of phenomenology will be discussed in this part of the review as the framework highlights that lived experience of the spatial designer.

Understanding what an unknown material is when it is presented to the spatial designer, regardless of whether it is a material that demonstrates advanced properties, is viewed as a process of *unconcealing* the inherent traits of the material. The work of Heidegger forms a solid foundation to understand the notions of *unconcealment* (Wrathall 2011; Heidegger 1977, in Krell 2002) as his views are relevant to the lived experiences of the designer who is engaging with an unknown material. Heidegger's work is supported with a review of the pertinent work of Merleau-Ponty (phenomenology), Schön (reflective practice), and Lefebvre (placemaking); together with Heidegger, these theorists provide a theoretical framework for the thesis. These ideas inform the research domains and is presented in Part D of this review.

At the heart of this thesis question—the first moment that the unknown or advanced material has an impact on the lived experience—is graphically indicated in Figure 2.2. It is argued in this thesis that this crucial moment of being introduced to the unknown material is a gap in the knowledge and can provide a deeper insight into the design process.

PART B: Spatial Design

Introduction

There is limited current research on the lived experience of spatial designers' engagement with materials. Therefore, it is necessary to examine the components of the problem to understand the whole. In this part of the literature review the focus will be on the context in which the research domains reside. In the review of the world of spatial design the focus will be on *what it is*. A description of the core attributes of spatial design provides the context that the designer turns their attention to in their lived experience of materials.

Understanding the domain of spatial design in both a historical and a theoretical sense provides the framework in which the outcome of a spatial design process will reside. This contextual framework goes towards establishing the scope of the literature review as being the relationship the spatial designer to material innovation and utilisation that generates human experience in a spatial outcome.

Throughout the history of spatial design, practitioners have manipulated material to achieve a spatial experience for its inhabitants and users. Understanding that there are other theories of spatiality, the one selected will deal with the spatial entity that encloses space through material compositions aimed at providing users with purposeful experiences. Through the process of reviewing the literature on the context of the world of spatial design, the *act* of spatial design will be examined.

Spatial design as a term is relatively new, but the practice has existed for a much longer period. Malnar and Vodvarka (1992) comment on how the enclosure of space is what can be considered as the essence of architecture, and that the substance, or material, that enclosed it was discussed by the Roman and Renaissance architects, Vitruvius and Alberti, respectively. Their work discusses the theoretical and historical aspects of spatial enclosures and the separation of

interior and exterior, together with the theoretical aspects of interior architecture and the components that define it.

The research domain of spatial design involves many different disciplines that are involved with outcomes that engage a user within a spatial experience. Their efforts are directed towards enclosing space with materials to elicit a behavioural response from the outcome. Architects concerned with the design of spaces focusing on the atmosphere created in their enclosed spaces have evolved the understanding of spatial design (Zumthor 2006; Exner and Pressel 2009). Their ideas were reinforced by contemporary philosophers who explored the lived experiences through phenomenology (Bachelard 1958/1994; Merleau-Ponty 2004). The behavioural experiences of the users in the space became the central element of the design idea for many spatial designers (Malnar and Vodvarka 1992; Grosz 2001; Exner and Pressel 2009). Yet it can be argued that architecture—the discipline at the core of spatial design—has always consisted of understanding that the user is the measure of all things (Malnar and Vodvarka 1992). Manipulation of matter to enclose space was always for a reason; whether it was for protection or stimulation, the human experience was the prime motivational factor, which was supported by materials that performed to meet these needs.

Drawing from the writings of sociologist philosopher Michel de Certeau—considered as an original thinker in the area of spatial practice (Taylor and Preston 2006)—the writer of this architectural design blog succinctly captures a definition for his/her architectural audience.

Spatial practices are the acts, routines, rituals, actions, movements, and uses that are carried out by people in their daily lives. This is meant to go beyond the idea of considering people as ‘users’ – the anonymous, neutral, blank people that are imagined to live in architectural proposals. Spatial practices go beyond function and use, and as such must include social and cultural identity.

(Anon (thesleepofrigour), December 22, 2012;

<https://architecturedesignprimer.wordpress.com/2012/12/22/spatial-form-spatial-practice/>

Although it comments on the relationship to continuous movement in the void of space, and in relationship to the solid material of space, this definition lacks the breadth of considering all spatial experiences. A more inclusive approach will be explored later in this chapter together with a further examination of de Certeau whom the author does refer to earlier in their text. In doing so, they link the pragmatic relationship of materials that enclose space to the theoretical constructs that provide insights into how spatial design can be understood.

A comprehensive study of the entire world of spatial design is beyond the scope of this thesis, as the focus needs to be on the engagement with an unknown material. Within this scope, an ontological understanding of the term will provide a starting point from which the core conceptual principles and theoretical insights will emerge to provide a foundation for the thesis.

Ontology of Spatial Design

Space is fundamental to human existence, and much of the spatial environment is designed by people. Day-to-day life always takes place within a space, whether it is a landscape, a city, a house, or a room. ... People perceive space with their senses directly, individually, and always in a new and fresh way. (Exner and Pressel 2009, 9)

The term *ontology* refers to a branch of metaphysics originating in ancient Greece and the work of Plato and Aristotle, which deals with the logical definition and nature of being and existence. With many definitions of the term, this thesis turns to Thomas Gruber's (1993, 2009), as it closely relates to this research in that it examines shared knowledge and conceptualisation. Gruber provides a clear definition, as cited by Storga et al. (2010, 428): "Ontologies are defined as an explicit formal specification of a shared conceptualisation." Gruber (2009) also notes that a model of a domain of knowledge can be defined by an ontology. The nature of reality is addressed by ontology (Denzin and Lincoln,

1994) and as (Storga et al. 2010) describes the fundamental category of being is determined philosophically by its ontology.

As earlier mentioned, many have provided philosophical theories and theoretical insights into spatiality and the understanding of space and spatial design (Foucault 1984, 2007, 1995; Deleuze 1993; Lawson 2005; Wise 2006; Fassi et al 2018). Malnar and Vodvarka (1992, 66-67) discuss three different views of space being that it simply exists and is understood through a Cartesian system in which case it becomes a particular space. They also discuss object-space in which space is defined by the relationship of objects in the space. This has a relevance to the position I am taking with this thesis in which space is defined by the materials that enclose it. They also discuss body-centred space that address the relationship to haptic and visual experiences.

Exner and Pressel (2009) present specifications and clear concepts that define spatial design. Their work defines the ontology of spatial design as that which focuses on the ephemeral sense of place defined by materials. This research examines how spatial designers become acquainted with an unknown material, and through doing so they strive to understand this expanded reality and how materials coexist in space.

It can be said that the true nature of the reality of spatial design, or the ontology of spatial design, lies in relationship of the participant with the negative or 'void' space and the positive or 'material' space. The ontology, or true being, of spatial design lies in the relationship of the space with the material space that defines it. Space exists through its definition by materials as experienced temporally.

Core Principles of Spatial Design

The term *spatial design* may be seen today appearing in the name of re-organised design schools who are intent to explore beyond their normal discipline boundaries (Salama 2017). The focus of their approach to spatial design is the understanding that a temporal spatial event experience is

generated from the atmospheric qualities of the space that is informed by materials. These core principles that define the act of spatial design are:

- Principles of behavioural experiences in spatial design
- Principles of atmospheric qualities of spatial design
- Principles of material relationship to spatial design

These principles are inherent in the work of spatial designers, regardless of discipline, yet they may or may not state that they are explicit in their own design process.

The provision of behavioural experiences within a defined space defines how we wear a garment, walk through a space, or sit on a chair. Most commonly, with spatial experiences, we walk in and around a particular space, yet the experience is not limited to this. This provision gives rise to the resulting ephemeral spatial and atmospheric outcome that demonstrates the relationship of the *void* space and *solid* material. The void of occupancy is countered in a symbiotic relationship with the solid material that constructs the design. Spatial design is the relationship between these parts, and not restricted to just the material space, or just the negative space of the void that is occupied by the user (Exner and Pressel 2009). As a spatial design outcome at a moment in time requires boundaries to define it, the principle of the relationship of materials to the spatial design is essential to understand. It is this principle that is closely examined in this thesis, whilst recognising an alternate view can co-exist as outlined by Deleuze.

Principle of Behavioural Experiences in Spatial Design

Human behaviour in space is central to all the disciplines that define spatial design. Alexander (1977) methodically outlines aspects of pattern language in the design of homes, towns and communities and indicates the nuances of human behaviour in those spaces. Exner and Pressel (2009), outline the basic elements, parameters, and types of spaces that contribute to developing spatial experiences that are perceived by the user. As a primer and introduction to the topic, their work is ideally situated. They present valuable insights into the sensory aspects of space, noting that humans have up to thirteen senses, which

include the commonly associated senses of sight, smell, hearing, touch, and taste. They claim that the other senses are not perceptible to everyone (Exner and Pressel 2009). They argue that these senses are essential for the human being to navigate and orientate themselves in the world, which in turn guides their behavioural experience.

Perception is not objective, as the individual perceives space differently according to their own sensory abilities, and also to their experiences and socio-cultural background. This is a key idea that indicates two different areas to discuss: phenomenology and the work of Merleau-Ponty, and also related ideas of inter-objectivity and inter-subjectivity.

Whilst these two areas will be discussed in Part D of this review, it is important to note now that Husserl and Merleau-Ponty viewed consciousness as intentional (Moran 2000; Merleau-Ponty 2004; Morris 2008; Husserl 1913/2012) and Merleau-Ponty expands this view through a thorough phenomenological examination of perception highlighting bodily space that relates spatiality to the body-in-action (Merleau-Ponty 2004; Cerbone 2008; Hale 2017; Halák 2018; Carman 2020).

This break from the established view of consciousness been separate led to the challenges that phenomenologists had with intersubjectivity as they viewed the lived experience or *lifeworld* (Husserl 1913/2012) as a central tenet to their thoughts. Whereas Reuther (2014, 1001) provides a definition as being: “Intersubjectivity, most generally, attempts to move human meaning and understanding out of private internalized worlds to shared, social practices of meaning and action.” Latour (1996) provided an alternative through his description of interobjectivity that relates objects to humans. Summat & Moghaddam (2014, 991) state, “Subjects and objects thus come to coexist in a collective of humans and nonhumans. And insofar as human relations are framed by objects, they can be characterized as interobjective.”

Principles of Atmospheric Qualities of Spatial Design

Zumthor discusses his views on architecture, in which he highlights the importance of atmosphere: “So what moved me? Everything. The things themselves, the people, the air, noises, sounds, colours, material presences, textures, forms too—forms I can appreciate. Forms I can try to decipher. Forms I find beautiful” (Zumthor 2005,17). His architectural projects reflect this understanding of the object and materials imparting an atmospheric quality to the work that imparts an emotional response from the participants.

This principle is related to the quality of the experience that the user receives through their engagement with the space. It goes beyond the core provisions necessary for the user to function in the space or have a sensory awareness of the space. While the phenomenon of experiencing a spatial design is dependent on the composition of materials that describe the spatial outcome, it is the relationship of the void space to the solid space occupied by the material that provides an appreciation of the atmospheric qualities of the space. This principle deals with the relationship of the void and the material space.

Elizabeth Grosz (2001) discusses the importance of temporality in relationship to spatial design. Attiwill explores these ideas further:

In many ways, temporality is emerging as a defining element of current practice. From an interior design position, this offers much to consider and rather than interior as always already inside something – inside a container – it suggests an interior as produced through the spatialization of matter by time: an event. (Attiwill 2004)

This synthesis brings the perspective of temporality and spatiality together that is defined by materials. It reinforces the philosophical view of Deleuze in his writing on flow and folds, that will be detail below. These views are not in opposition to the object-space perspective that I am presenting here. Space does flow and is captured temporally within a configuration of matter. The manipulation of material matter around a space defines a spatial design within a flow of spatiality.

Exner and Pressel (2009) provides critical commentary and a valuable introductory study that establishes the terrain in which spatial design resides. The authors comment on how essential the atmospheric nature of space is to the balanced human being, but at the same time they acknowledge that “... it is difficult to precisely define or to gauge and can only be partially justified using analytical methods” (Exner and Pressel 2009, 15). Their work also investigates a variety of spatial typologies, from residential spaces to work environments, and religious spaces to public areas. Their analysis discusses theatrical spaces and public art—both having a degree of non-permanence. These studies all examine how the spatial envelope encloses an area in which an atmosphere is created to elicit a user experience in relationship to spatial and temporal flows.

The work of Exner and Pressel (2009) clearly establishes the connection with phenomenology, and with experiencing atmospheric spatial outcomes—a notion that aligns with placemaking. Many authors have explored placemaking through a theoretical lens or a practical lens (Alexander 1977, 1979; Tuan 1977; Malnar and Vodvarka 1992; Kurtich and Eakin 1996; Casey 1998; Lefebvre 2004). Tuan explains how space, place, and experience are linked through practice and through our very nature.

Human beings not only discern geometric patterns in nature and create abstract spaces in the mind, they also try to embody their feelings, images, and thoughts in tangible material. The result is sculptural and architectural space, and on a large scale, the planned city. (Tuan 1977, 17)

The sense of place is highly important in understanding spatial design and will be expanded upon later in this chapter. However, the crucial aspect—in terms of this thesis—that comes out of Exner and Pressel’s work is their comments on materials in spatial design. “Material dictates spatial construction options and therefore influences spatial form. Materials also determine how one approaches certain details of workmanship, span width lengths, and the type and quality of the space’s borders” (Exner and Pressel 2009, 43).

In this initial comment on materiality, Exner and Pressel state the influence that materials have on the development of spatial design—an idea that is central to the argument of this thesis and noted by other scholars (Malnar and Vodvarka 1992; Kurtich and Eakin 1996; Pile 1995, 2000). The understanding of the complexity of factors that influence the engagement with material in creating atmospheres for human experiences leading to an atmospheric outcome and a sense of place is the aim of this thesis.

Principles of Material Relationship to Spatial Design

Japanese architect Yasuo Kondo examines his relationship to the design process, space, and materials. He notes “A material has its own world, and it has a strong power that may require a space” (Kondo 2003; 53). He also notes that “A ‘space with anything’ must be created by something. At the moment when ‘something’ was chosen, the design of the space was determined” (Kondo 2003, 44).

Exner and Pressel (2009) discussed a variety of parameters and spatial strategies to consider, one being spatial scale and dimension. At this point, I argue, that they did not seize the opportunity to legitimately widen and enrich the scope of the spatial design domain. If spatial design is understood to involve the experiences of a user of the space—enhanced through a response to the atmospheres derived from the relationships of materials that direct, support, and enclose performance and movement—then the core issue to examine is the relationship of the body to the material enclosure. The upper limits of what is generally considered within the confines of spatial design have included the disciplines of landscaping and public art. However, the lower limits were not expanded on in their work.

Exner and Pressel (2009) established a solid grounding for spatial designers. They carefully laid out a foundation for the relationship of the human body moving in space, which is defined by the standard view of a bipedal experience within a built enclosure. Yet, in his 1987 article, Robert Benson discussed the challenges and opportunities to put forward in a new vision of spatiality, and also addressed the range that could be considered:

By qualifying and ordering space at all scales—from the object, to the room, the building, the site, the city, the region, and beyond—architecture determines and visualizes the place of the individual in a continuum that comprises a range from the space of the atom to the space of the universe (Benson, 1987 6)

This idea is worthy of exploration, but the focus currently needs to be on spatial designers' engagement with an unknown material. I conceptualise an expanded notion of spatial design in this thesis by accepting that practitioners can (and do) define their spatial practice beyond the confines of just architecture and interiors, extending to the world of product and furniture design as legitimate spatially designed outcomes.

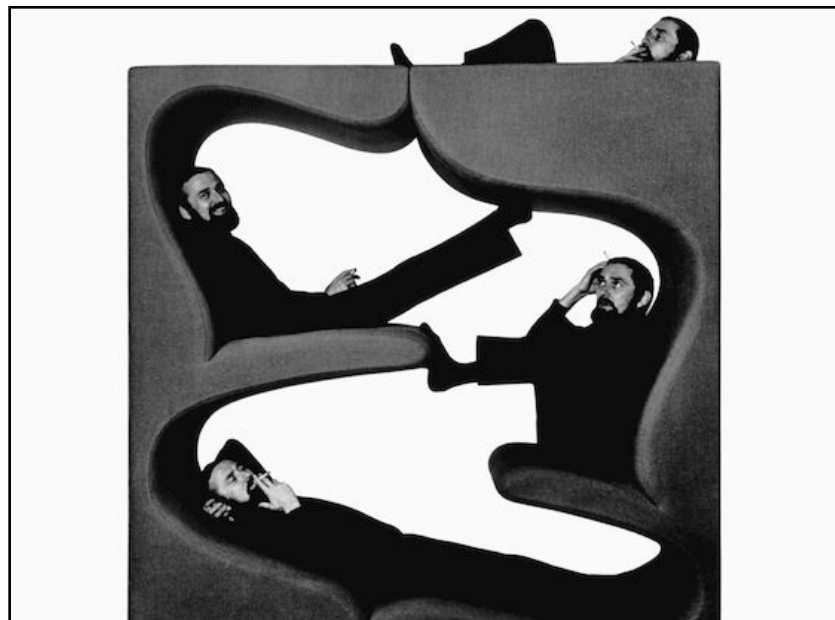


Figure 2.3 Living Tower Furniture Sculpture (1968/69)

(Image source: <https://www.vitra.com/en-au/corporation/designer/details/verner-panton>)
Panton's furniture pieces created "spacescapes" for the Bayer Visiona O Exhibition which demonstrates that the furniture defined the spatial condition for the users.

The materials that define an urban setting or landscaped environment are further from the individual than the architectural envelope is from the user. Similarly, the distance between the body and the container of the built environment, whether it is a building or an interior, is much greater than the space that surrounds a passenger in a car, or a person on a chair. You could even

consider the space that is encapsulated around your body between your skin and your clothing as a spatial environment in which the body moves (Braddock Clarke and O'Mahony 1999, 2005; Seymour 2008). Verner Panton (See Figure 2.3) and Issey Miyake (2.4) immediately come to mind as spatial designers in furniture design and fashion respectively, who challenge the traditional notions of spatial design through their imaginative use of materials and form.



Figure 2.4 Minaret Dress by Issey Miyake (1995)

(Image Source: <https://anelecticeccentric.wordpress.com/tag/issey-miyake/>)

The exaggerated space around the body, demonstrated in Miyake's work, indicates that the designed entity of a dress also provides a spatial experience around a body.

Exner and Pressel also discuss the relationship of temporary and permanent space; this opens up an opportunity to include mobile or transportable space.

With this inclusion, and the discussion of scale and spatial dimension noted above, the disciplines of industrial design and furniture design can be included to join the typologies in the built environment. All are forms of material engagement of the user in the spatial composition. They will render an understanding of the space through the atmospheres experienced.

Spatial Flow

We have seen spatial design as represented by those viewing it as an entity that is observed as disconnected and viewed as an existence that the user experiences.

Space has long been regarded in two ways: on the one hand, at a microcosmic level, as the gaps between things which, as it were, keep them apart; on the other hand, at a macrocosmic level, as the larger container into which all things are inserted. (West-Pavlov 2009, 15)

Yet despite the importance of the macrocosmic view of assembling a spatial outcome from materials as an independent entity in space and time, there are other views to how spatial design can be considered (Grosz 2001; Hubbard et al 2004; West-Pavlov 2009). One important view is that of Deleuze—a philosopher of new ideas—who frames his views around difference and repetition that leads him to examine the world as a series of flows (Buchanan & Lambert 2005; Ballantyne 2007; Ballantyne & Smith 2012). Deleuze wrote on many topics, individually or with his co-author Guattari all of which challenge convention with their richness and complexity. However, this short commentary on Deleuze’s work is focused on his ideas around difference and flows. “The concept of flows, and the possibility of a space of flows, appears with some regularity in contemporary architectural thinking. The concept of flows is structured by the notion of eventual continuity and consistency...” (Ballantyne & Smith 2012, 203).

Everything is even more complicated when we consider that the internal space is itself made up of multiple spaces which must be locally integrated and connected, and that this connection, which

may be achieved in many ways, pushes the object or living being to its own limits...Everywhere a staging at several levels. (Deleuze 1994)

He examines a building and views how different ways of mapping the use would see a different understanding of that space which leads to a sense of the flow of individuals and activities in the space (Ballantyne, 2007). These ideas are founded on the principle of a dynamic world it which relates to the thesis in that the material held in the hand of the designer is a physical matter existing in that current state for that moment only, the material is in a process of flow. Leibniz's views of space and time are discussed by Benjamin (2000) as being interrelated and that space is relational. Deleuze argues that when we see a phenomenon, we are only seeing it at an instant, but the users experience it through time. (Deleuze 1993) explains his idea of event as something that is not self-contained but exists as a multitude so that space-time does not consist of points but of folds. In their examination of spatial flows, Ballantyne and Smith explore Deleuze and Guattari's relationship of difference, repetition and flow and make reference to the material world.

It's not just that the furniture is speaking, not only the linoleum and the telephone, but the buildings they're in, and the buildings outside, and the sawdust and the clay, and the rolled sheets of steel and the drawn copper wires, the cast concrete blocks and the polished timber floors. (Ballantyne & Smith 2012, 29-30)

“Space is at the heart of Deleuze and Guattari's thinking because life expresses itself in the creation of spaces” (West-Pavlov 2009, 180), yet as Harris (2005) discusses, Deleuze does not have a single text about space but his ideas are spread over a multitude of topics and publications and greatly influences architects (Ballantyne 2007). This diversity of thought aligns to his rhizomatic approach to his ideas, that does not have a single foundational idea that others are supported from, but rather like a root system that branches off in a direction and then returns (Buchanan & Lambert 2005; Ballantyne 2007; West-Pavlov 2009).

(Deleuze 1994, 37) states, “Difference is the state I which one can speak of determination as such...instead of something distinguished from something else, imagine something that distinguish itself—and yet that from which it distinguishes itself does not distinguish itself from”. This idea has relevance to this thesis as it lets us have in insight into perception as a process of recognising differences. Something is red because it is not blue (West 2019). Deleuze and Guattari comment that the idea of difference existing at different scales and that we tend to categorise these into molecular space, human space, ecological space when in fact they are all interconnected.

PART C: Unknown and Advanced Materials

Introduction

As the research domain of spatial design has described the embedded relationship with materials to define the spatial enclosure, the sub-set of unknown and advanced materials in the world of materials that defines such enclosures is the focus of this research domain. It is the inspirational core of this research, and as indicated previously in Figure 2.1 (page 24), it has an impact on the other research domains. It is the lens through which the other domains are viewed, as this thesis is not about spatial design, but instead involves the relationship of materials, particularly unknown or advanced materials, to the spatial experience. The lived experience of the spatial designer is divided into three inter-related segments: the designer's knowledge, the design process, and the application of design. Each is viewed through the relationship lens of the research domain of materials—unknown and advanced. Figure 2.5 (below) shows the relationship as a process, the temporal nature of the design process shifts our understanding of the unknown material to one that is known, yet it may still be categorized as an advanced material, due to its properties.

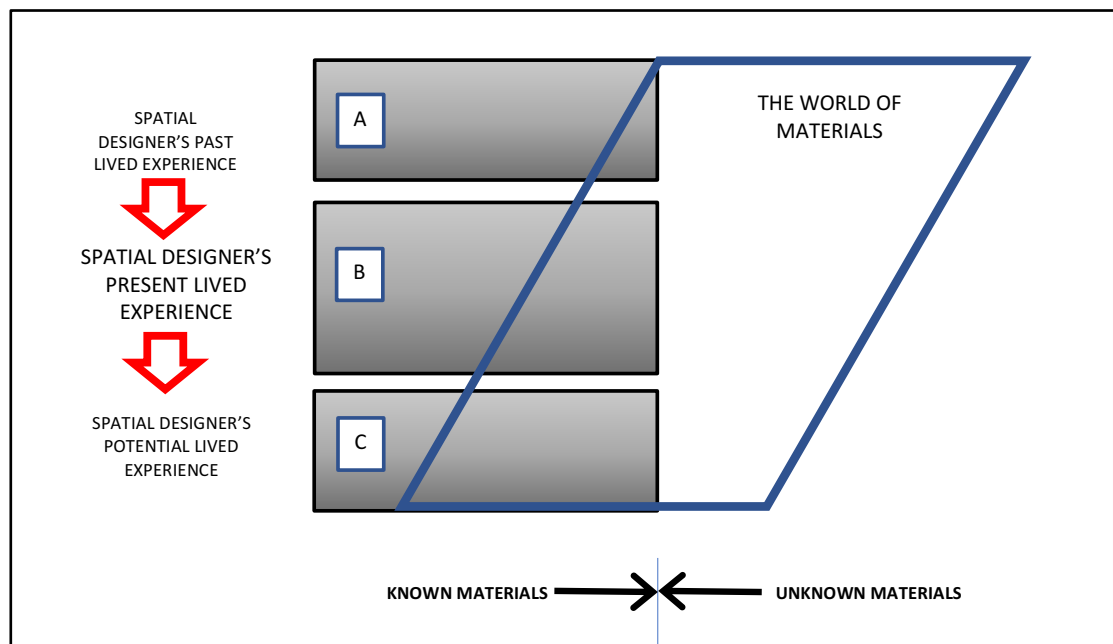


Figure 2.5 *Diagram of the Relationship of the World of Materials to the Lived Experience of a Spatial Designer.*

The progressive growth of material knowledge related to the spatial designer's experiences.

The term unknown material has been defined earlier which indicates that when a material is perceived it is not truly known as the comprehensive knowledge of its properties are unknown. Perception of a material does not equal knowledge of that material. As indicated earlier, the term advanced is used to identify an unknown material. To understand the term advanced material beyond the definitions, an understanding of the family of materials that constitute this group is necessary. The clarity of the classifications and how the materials appear in the world establish an understanding of this research domain.

Materials in the World

This research is based on the premise that the understanding of materials is essential for many designers, and that the full potential of accessing that knowledge has not been fully developed.

Materials are the core of the built environment: everything we touch and smell, and most of what we see and hear, is based on a material of some kind. Design is the practice of making those materials into products and environments that, hopefully, meet the needs and desires of the consumer. (Beylerian and Dent 2007, 17)

This quest for material knowledge is a core concept in educating many designers, whose whole life is about the indirect or direct acquisition of knowledge to utilise in their practice. An essential type of knowledge that a designer requires to participate efficiently in the world is the knowledge of materials. Figure 2.5 represents the lived experience of the designer's relationship with material knowledge. It is acknowledged that there are other factors that can equally be of prime importance for a designer who may want to focus on users, site, form, stakeholder engagement or technology.

Materiality defines our world—in all that we do and make, and in all that we experience (Ashby and Johnson 2003; Beylerian and Dent 2007; Coole and Frost 2010). Within our world is the practice of design, in which objects, experiences, images, and structures are conceived and constructed through the manipulation

of one or more materials. Pye (1978) describes design as the manipulation of matter and energy to get the intended results from what is controllable. Therefore, materiality within spatial design concerns the physical arrangement of matter that engages the participant in the experience of the composition.

In the process of manipulating materials towards a desired outcome, designers find themselves faced with a multitude of design decisions, each impacting another (Pye 1978; Lawson 2010). We know what design decisions are made about materiality, and who makes them, as demonstrated by the numerous design publications that describe the design outcomes (Sparke 1998; Jodidio 2001; Weston 2003).

We also know when decisions about material applications are made, and how they impact practice (Laseau 2001, Gessinger 2009; Van Bezooyen 2014). This aspect of the lived experience of design being applied is examined later in this literature review. Yet it is important to note that material engagement occurs at multiple touch points in the whole process. Karana, Pedgley, and Rognoli. (2014) discuss the ideas of material experience as being fundamental to design. Their research brings in numerous authors who discuss the total experience of materials from aesthetics to tactility, and from all the sensory implications to the exploration of use and functionality. They discuss the relationship of the history of materials to our view of materials in the future, and through this examination they look at advanced materials, sustainability, and bio-materials. Interviews with designers help to give a grounding in the practice of materials within design. Their research also examines the design process in relationship to materials. Aart van Bezooyen (2014) discusses the differences between material-driven design and material selection, where the former supports exploration.

In traditional design methodologies for product development materials are often considered at a later stage, resulting in only a few “good” materials being considered defined by the limitations of costs and manufacturing requirements. Bringing materials at the early

stage of the design process makes it possible to review a bigger variety of materials and explore its qualities. Exploring materials at the fuzzy front end has the character of an ongoing research in understanding the available materials and processes that surround us. (Van Bezooyen 2014, 277)

Further examination of this approach is reviewed later in this chapter, in which the exploration of materials is placed in the discovery phase of the design process. Karana et al. (2014) praise the insightful work Ashby and Johnson (2003) provided in their seminal book on materials. They discuss the overlapping domains that materials occupy in the process of design, one being the technical attributes, and the other being the creation of product personality. This process is not dissimilar to those within other spatial design professions that normally begin with a concept that continues with a design development leading to detailed documentation and production, with each stage increasing in its engagement with materials (Ching 1987; Miller 1995; Pile 1995; Coles & House 2007).

Within the world of materials, there are only materials that are known to the designer, and those that are unknown. This relatively simple statement of opposing states of knowledge provides a key concern that is explored throughout this thesis. Figure 2.5 indicates that, as a designer experiences the world—a world of materials, their material knowledge increases. Early in life, the whole world was a world of unknown materials waiting for us as children to discover them. This relationship to a child's discovery process is important to note and will be expanded on later in the thesis. Those experiences of discovery form the foundation of our material memory, which we use to access recollections of material sensations that can be used in the present moment when we design. It is necessary to articulate this orthodox reflection of the learning process from the past to the potential future, and how spatial designers engage with the material world. This is important, as it is that moment of engagement when a spatial designer is faced with an unknown material that has not been investigated.

Although there are texts about material performance that identify what a particular material really can do (Ashby and Johnson 2003; Thompson 2007; Lesko 2011), there is a lack of knowledge about the question of why a designer will take a risk with a new material (Vergheze 2007; Gessinger 2009), and exactly what occurs during the initial moment of engagement with the material. There is a scarcity of knowledge about the designer's internal propensity to take creative risks, even though the designer may not demonstrate they are averse to advanced materials. The sense of creative risk-taking resides within the larger domain of the lived experience and the process of engagement with knowledge of an unknown material.

Material Classification

Materials used in the world have been classified in many ways, and the classifications have ranged from those used by Vitruvius in his *Ten Books of Architecture* to the current thinking of those who document, research, and work within the evolving world of material innovation (e.g. Brownell 2006, 2008, 2010, 2011, 2012; Ritter 2007; Moskowitz 2009) these approaches assist in putting order within the dynamic world of materials. This order allows the spatial designer to understand how an unknown material fits within a classification inside the world of materials that would inform their practice.

As a starting point to understanding the classification of advanced materials, the Material National Resource Center (Washington, USA) used a classification to define a list of types of materials. It is not comprehensive, but it does establish a starting point for this discussion. (See Appendix A).

A comprehensive taxonomy of material classification is beyond the scope of this thesis and the current taxonomies focus on what the material is and not on how to experience it, with the latter being the focus of this research. However, a summary chart of contributors to the classification and articulation of materials

usefully reveals the diversity (and similarities) across a number of sources. (See Appendix B).

Advanced Materials

Advanced materials have a particular nomenclature that is captured by the project team compiling the *Report on Design and Advanced Materials as a Driver of European Innovation* (DAMADEI).

Advanced materials can be defined in numerous ways; the broadest definition is to refer to all materials that represent advances over the traditional materials that have been used for hundreds or even thousands of years. From this perspective advanced materials refer to all new materials and modifications to existing materials to obtain superior performance in one or more characteristics that are critical for the application under consideration. (DAMADEI) 2013, 24)

This definition represents a similar view to others over the last few decades, which all connect to the issue of the performance of an advanced material. The US National Research Council (1993) referred to a more concise definition taken from the Advanced Material and Processing Plan (AMPP) as “... advanced means the most recent evolutionary developments within a class...” (US National Research Council 1993, 11, referencing FCCSET 1992). This definition is more suited to the evolving world of materials, as it does not restrict the inclusion of more traditional materials that have been enhanced with developments in their material composition. Yet, all definitions of advanced materials relate to the shift in performance from one state of performance required to another state of performance that elevates the material. There is an assumed position that the material performance of all known materials is understood by the spatial designer, so that the material to be labelled as advanced will offer an advanced level of performance. This research will explore if spatial designers take a broader view of what they would describe as advanced materials—materials that are novel or demonstrate superior performance based solely on enhanced properties.

Manzini (1989) discusses his concept of how new materiality represents the entire landscape of material innovation. It is not just the practitioners who are changing the material world, but also governments and private organisations, who are pushing for greater levels of innovation to enable economic growth (Gann 2000; Moskowitz 2009; Drexler 2013). The government initiatives, Commercialization of New Materials for a Global Economy (US National Research Council 1993) and the Australian Industry Commission on New and Advanced Materials (Industry Commission, 1995) have been followed by other moves to encourage economic growth. In 2011, the *Materials Genome Initiative for Global Competitiveness Report* (US Science and Technology Council 2011) to the White House and US government discussed how the advanced material technology revolution would change the economy in greater ways than the information revolution that developed out of Silicon Valley, California.

Today, unlike in the past, material compositions available to designers are not static, and can be changed at the atomic level (Mau 2004; Martin 2006; Quinn 2011; Drexler 2013). Through technological innovation, the properties of materials can be greatly altered to provide advanced characteristics not possible in the past (Lastres 1994; Gann 2000; Mau 2004; Beylerian and Dent 2007; Moskowitz 2009; Drexler 2013). For the last 30 years, there has been a huge growth in the area of advanced materials that represents a crucial moment in international industrial history (Antonelli 1995; Leydecker 2008; Moskowitz 2009).

There are many industries that use advanced materials (Beylerian and Dent 2007; Moskowitz 2009). To examine all of these industries in detail is beyond the scope of this research, but it is valuable to comment on one area of development that has demonstrated progressive advances in all areas. Nanotechnology represents a dynamic and diverse technology that is altering the built environment (Leydecker 2008). It is also prevalent in other sectors (Mau 2004; Beylerian and Dent 2005, 2007; Braddock and O'Mahony 2005; Ritter 2007; Seymour 2008; Moskowitz 2009; Sauer 2010; Drexler 2013).

Drexler (2013) discusses APMs (Atomically Precise Manufacturing) as a continuation of his 1986 coined term: *nanotechnology*. This is a whole area of advanced materials that will alter our world in its diverse applications across disciplines, driven by means and production techniques. Drexler identifies that the ideas were founded on research by Richard Feynman, who laid out the principles of large-scale, atomically precise manufacturing in research papers in 1959; but the work lay dormant for twenty years.

In his book, *Radical Abundance*, Drexler (2013) traces the development of APMs in various fields, and comments on how they will impact on our world. He notes that they will trigger a revolution in how the world will operate, and represent the fourth revolution that follows the agricultural, industrial, and information revolutions. He discusses how the fundamentals of developing a vision for future technology rests with being able to answer three fundamental questions: What can be made? What can I do? And, how much will it cost? These questions are key to understanding technological breakthroughs, as Drexler describes, and the same questions are fundamentally what the spatial designers seek to understand when they are faced with an unknown or advanced material. It is these encounters that I explore in the thesis, in an attempt to reveal the saliency of Drexler's fundamentals.

Exner and Pressel also identify nanomaterials and composites as materials that can alter spatial experiences.

New materials such as nanomaterials and composites are being developed constantly and are used in spatial design. Nanotechnology has made new material surfaces, coatings, and textures available that fulfil specific functions. The changes in surface structure are so minute that they cannot be discerned with the human eye. (Exner and Pressel 2009, 74)

Although Exner and Pressel refer to new materials and composites as if they both belong to the same family of materials, that is not completely accurate. It is true that there are many new materials that have been recently developed that

are composites, in which properties are combined to create a material that provides superior performance because of enhanced characteristics. However, the idea of composite materials goes back to some of the earliest forms of structure, such as the mud structure, and early concrete (Weston 2003; Arthur 2009). Despite the heritage of concrete, and the common understanding of the material (Gaventa 2001), there has been also been innovation in such a basic material. Such innovation has resulted in the use of fly-ash in concrete to make it more sustainable (Brownell 2010), and even translucent and transparent concrete (Van Onna 2003). Exner and Pressel describe this development in concrete: “... transparent concrete was invented while experimenting with new mineral aggregates. They are reinforcement with synthetic material instead of steel, which makes it possible to construct much thinner plates” (Exner and Pressel 2009, 74).

This thesis has its focus on the material knowledge that resides in the overall knowledge that the spatial designer engages in a design process. The act of engagement with materials—both known and unknown—partially lies within this domain of material knowledge that the designer requires to participate in the design process. Design is both a noun and a verb (Flusser 1999); it is the act of designing and the action of engaging with an unknown material that is the focus of this research.

The emphasis in the current literature and research is on the outcomes, the materials, and the consequence of material applications, and, although there is a body of literature on the design process and design thinking, there is limited examination of the designer’s engagement and lived experience with these new and advanced materials. This relationship needs to be understood.

PART D: Theoretical Constructs of Lived Experience

Introduction

This part of the review will discuss the literature that deals with the insights provided by the theoretical framework of phenomenology in relationship to spatial design. In doing so it discusses the ideas of Husserl, Heidegger and Merleau-Ponty in relationship to phenomenology, perception and the unconcealing of knowledge as it relates to material engagement. The relationship to acquisition of knowledge will also be reviewed as it relates to the research problem. Lastly, insights into the relationship of spatial design and place-making will be discussed.

An outcome of a spatial design is always enclosed, defined, contained, or constructed with materials through a process that the spatial designer undertakes. It is crucial to understand the foundation for the spatial designer's thought processes in terms of the theoretical issues that inform them. There are some designers who directly refer to works of philosophers and theorists to inform their work: Kuma, Eisenman, Tschumi, Jencks, and others (Nesbitt, 1996). Some practitioners tend to demonstrate theoretical constructs in-action and may not make direct reference to a theoretical construct. Nesbitt discusses various approaches to understanding a theoretical perspective to spatial design in the form of architecture. She identifies that the different approaches display four distinct attitudes to theory: prescriptive, proscriptive, affirmative, and critical (Nesbitt, 1996). She also notes the difference between architectural history and criticism and architectural theory:

Theory differs from these activities [architectural history and architectural criticism] in the fact that it poses alternative solutions based on observations of the current state of the discipline or offers new thought paradigms for approaching the issues. Its speculative, anticipatory, and catalytic nature distinguishes theoretical activity from history and criticism. (Nesbitt 1996, 16)

Spatial design has been influenced by many theorists and philosophers, such as Husserl, Heidegger, de Certeau, and Lefebvre. Their ideas are used to inform the theoretical foundation of this thesis, in particular the three phases of the lived experience as outlined in Part E. This literature review constrains the scope of theoretical enquiry to only consider aspects pertinent to the research topic.

Husserl's Phenomenological Foundation

A starting point in examining experiences is to look at the writing of Edmund Husserl at the turn of the twentieth century. Husserl established ideas that formed the school of phenomenology. The analysis of what is experienced is still referred to today as phenomenological study. Husserl based his ideas on the premise that our consciousness has to be of something, it does not exist independently (Magee 2000; Moran 2000; Husserl 1913/2012). The analysis of the of the individual's experiences in the world forms the core of his approach.

Husserl originally developed the school of phenomenology, as he was concerned with developing a level of certainty (Eagleton 1983; Groenewald, 2004). His approach was to treat realities as pure 'phenomena' and anything outside of the immediate experience is ignored, to allow the consciousness to retain only what is in the external world. Phenomenology is the study anything that appears that our mind is conscious of to allow us to investigate its essence. Phenomenology aimed to return consciousness back to the concrete reality. In connection to this research problem, the phrase that captured the essence of phenomenology is: 'Back to things themselves!' (Eagleton 1983; Kruger 1988; Moustakas 1994, Groenewald 2004).

Phenomenology, in its purest form, seeks only to describe and not explain (Lester, 1999). Recently Harman (2018, 152) states: "The basic principle of phenomenology is that philosophy should not speculate on hidden casual mechanisms or mysterious things-in-themselves, but simply describe what appears to us in all its magnificent subtlety". This principle was clear to Husserl, who sought to focus on the concrete reality of experience. Both Heidegger—

Husserl's student—and Husserl rejected the commonly held belief that the inner mental representation of reality is knowledge (Moran 2000). Husserl (1913/2012) concentrated on how experience impacted on consciousness. Husserlian phenomenology has been described as a view of science and the world as if it were a 'view from nowhere' or a 'God's eye' perspective (Moran 2000, 12).

Husserl was also interested in the individual's intuition, and it is this connection to a meta-understanding that he called eidetic intuition (Moran 2000). Husserl (1913/2012) explains that phenomenology is a theoretical view of the science of phenomenon and pure consciousness, so it is not a view based on scientific facts—he called this approach eidetic. Moving from the individual intuition to grasp the universal is what Husserl called eidetic intuition (Moran 2000; Husserl 1913/2012).

In terms of understanding the engagement with an unknown material, Husserl would view that the first encounter will be one of a sense sensation in which the material comes into the consciousness of the individual. He called this *empirical intuition* (Husserl 1913/2012). If a glance is directed towards a material, he called this *essential intuition*. He explains, "...to the essential differences of the intuitions correspond the essential relations between 'existence' (here clearly in the sense of individual concrete being) and 'essence', between fact and eidos" (Husserl 1913/2012, 13). This research investigates if designers are trying to find the essence of a material when they initially become engaged with the unknown material. Van Manen (2014, 229) adds, "From a Husserlian perspective, the eidos of a phenomenon are the invariations that makes a "something" what it is and without which it could not be what it is".

Husserl's philosophical approach is an enquiry into describing the phenomena, and that humans are motivated by what they perceive as reality. So, in order to see the essence an observer must put aside biases and preconceptions.

Husserlian phenomenology is based on two key elements, universal essences

for all individuals having a lived experience, meaning that there is only one correct interpretation of an experience; and, an autonomy resulting from limited impact from culture, society, and politics on the individual's choice. His focus was on the actual phenomena and not on the lived experiencing of the actual phenomena (Flood 2010).

It is important to note that Phenomenology is both a philosophical approach and a methodology. The latter will be discussed in the next chapter.

Phenomenology and the Lived Experience

As noted earlier in Part A, the definition of lived experience is explicitly linked to phenomenology. The lived experience perhaps has a stronger link to both Heidegger and Merleau-Ponty who differed from Husserl in that they viewed the individual experiences as essential in understanding the phenomena rather than Husserl's focus on the actual phenomena and its essence.

Heidegger felt that the focus needs to be on the lived experience rather than on the object, people or phenomena. His approach is one of interpretation rather than description. The experience of the human being situated in the world is a key point in discussing Heidegger's phenomenology. Flood (2010) refers to an analysis by Lopez and Willis (2004), "Hermeneutics goes beyond description of core concepts and essences to look for meanings embedded in common practices—what people experience rather than what they consciously know" (Lopez and Willis 2004, 9). This is a crucial insight for this thesis problem, as this research examines the process of engagement with materials as designers search for the embedded meaning or material being.

Hermeneutics can be described as a methodology of interpretation (Patterson and Higgs 2005). This approach has a clear connection to the research topic, as its best-known technique involves the hermeneutic circle or spiral. This involves the researcher trying to understand "the whole through grasping its parts and comprehending the meaning of the parts divining the whole" (Crotty

1998, 92). This iterative process is not unlike the design process of examining the whole and then the parts.

Flood (2010) notes that Heidegger's use of the term *lifeworld* moves away from Husserl's view of autonomy as Heidegger felt that social and cultural factors have an impact on the individual.

Lifeworld is a descriptive and/or hermeneutic research approach used to explore how everyday experience shows itself in the lifeworld of individuals. This approach strives to find the intentional relationship between the conscious, social, perceptual, and practical experiences by analyzing time, space, and the taken-for granted presentation of experience. (Tuffour 2017, 2)

Referencing Heidegger (1962), Flood (2010, 9) notes, "This represents a move from an epistemological to an ontological project, focusing on how interpretation is intrinsic to human existence—it is not simply that someone merely has, but what he/she is".

The eidetic process of reduction—the bracketing of biases to get to a universal essence—allowed Husserlian phenomenologists to focus on consciousness. Heidegger thought that Husserl's views on consciousness were too intellectual and restrictive in examining human engagement in the world, and considered that, to allow for objectivity, we have to shift to the human being as the site of the experience. This led to Heidegger's use of the German word *Dasein*, which is literally 'there-being' (Moran, 2000). The idea of *Dasein* clearly resonates with an investigation of the experience of the designer with materials, as this thesis looks at the engagement that they undertake through interpreting the meaning of an unknown material, as they search for the essence of that material.

Phenomenological Insights of Martin Heidegger

The work of the German philosopher Martin Heidegger is known for his connection to phenomenology and existentialism, although it is also highly

influential in a variety of disciplines, not least of which is the discipline of architecture (Magee 2000; Hale 2000; Stokes 2012; Wheller 2017).

One of the key contributions that Heidegger made to philosophy was his unique approach to philosophical questioning as a form of disclosure. He connects the idea of the search, and the process of the search, to the question, or the unknown entity. Moran comments on Heidegger's hermeneutical structure of the question: "A question seeks for certain information by addressing itself to something for some purpose. But in order even to be able to pose a question we must have some initial pre-understanding of what we are asking about" (Moran 2000, 236). This idea is central to Heidegger's essay on technology. He notes that "questioning builds the way" (Heidegger 1977, cited in Krell 2002, 311). As discussed earlier, the idea of questioning and revealing has led to the central question that is investigated in this research. Heidegger's insight into a phenomenological questioning of experience may be pertinent to the idea of a spatial designer experiencing an unknown material as they question the material to understand its material being.

Experience was Heidegger's main concern, and although he moved away from Husserl's emphasis on consciousness, he did give him credit in his early work. Heidegger felt that Husserl had been given a new way of seeing the world rather than a group of philosophical principles and standards (Moran, 2000). This research will investigate whether the spatial designers demonstrate a unique way of seeing the world in terms of their engagement with materials.

Bringing Forth out of Concealment—Martin Heidegger

At that moment of introduction to an unknown material, the designers begin the search for the essence of that material. Heidegger would call this essence the *being*. He noted: "Every questioning is a seeking. Every seeking takes its direction beforehand from what is sought. Questioning is a knowing search for beings in the *thatness* and *whatness*. The knowing search can become an investigation" (Heidegger 1927, cited in Krell 2002, 45).

Wrathall (2011) presents a thorough analysis of unconcealing, as expressed by Heidegger. He connects Heidegger's ideas of unconcealment to its roots in ancient Greek philosophy. Wrathall's clearly articulated analysis reveals the thoroughness with which Heidegger understood and expressed his ideas of truth, unconcealing, and being. He explicitly notes that Heidegger did not mean that unconcealment meant a (re)definition of propositional truth (Wrathall 2011, 15). Although Heidegger took the Greek term *alêtheia*—a term ordinarily referring to truth—he is often misunderstood in the connection that he made to these terms.

Wrathall bases his analysis of Heidegger on four key concepts, or what he refers to as planks (Wrathall 2011, 12-14):

1. Propositional truth (correctness, *Richtigkeit*).
An assertion or proposition is true when it corresponds with a state of affairs.
2. The truth (uncoveredness or discoveredness, *Entdecktheit*) of entities.
An entity is true when it is uncovered, that is, made available for comportment.
3. The truth of being.
There is an *unconcealment* (*Unverborgenheit*) of being when an understanding of the being or essence of everything that it is shapes all the possibilities for comportment in the world.
4. Truth as the clearing (*Lichtung*).
There is a clearing within which an understanding of being or essence can prevail, while incompatible possibilities of being are concealed or held back.

Wrathall refers to Heidegger's idea of clearing as a space in which ideas can be granted a space to explore the possibilities, he states: "As I have noted already, the clearing should be understood as something like a space of possibilities—it grants first of all the possibility of the path to presence, and grants the possible presencing of that presence itself" (Wrathall 2011, 33-34).

In engaging with the material, it will become evident in this research that the insights of Heidegger lead to a deeper understanding of what the designer seeks through the process of *unconcealing* the core being of the material. The designer's search corresponds to the planks that Wrathall describes above. In this process, the designers have a theoretical base for their actions of engagement with an unknown material.

In his 1953 essay, "The Question Concerning Technology", Heidegger addresses the issues around materiality and technology. In particular, the idea of revealing is central to understanding technology (Heidegger 1977, cited in Krell, 2002), and is essential to understanding the context for the designer's exploration of ideas and discovery of unknown materials. The spatial designer is constantly willing to explore new materials to increase their options when designing. So, when faced with an unknown material they investigate every aspect of the material to reveal the potential it has to offer in the future. What they seek is argued to be the being of the material. It is this material that will define the technology that articulates the spatial outcome. This idea of seeking infinite possibilities is described by Wrathall when discussing the ideas of unconcealment as prescribed by Heidegger.

In fact, there is, in principle, an indefinite if not infinite number of ways to characterize the properties of any particular thing. A piece of gold, for instance, has a colour and a weight and a texture and a shape, but also all sorts of other properties like being good (or bad) for making jewellery, gleaming in a way that seems divine, being directly in front of my favourite chair, and so on. When we decide what kind or type of thing this particular object is, we will do it on the basis of just those particular properties we are responding to, and these properties will be some subset of an indefinite or infinite set of properties we could be responding to. (Wrathall 2011, 32)

The design process reflects this idea of seeking infinite possibilities. It is at the core of what designers do when engaging with a design problem, and it is argued in this thesis that this is at their core when engaging with materials. In

Part E of this review, we will see how it can be explained that designers may have a disposition to the world which Bourdieu describes as their habitus, and which Wrathall explains as being disposed in a particular way to see the world and to interact with it. “Given that this is the case, before anything can show up as anything, we must have some particular, prelinguistic disposition or readiness for the world that leads us to see certain features as more important than others” (Wrathall 2011, 32).

It is important to reiterate that not all designers follow the same process; in fact, it can be argued that there are idiosyncrasies for all designers. Yet each is on a journey of discovery. The majority of designers tend to move from “...the rough ready general considerations typified by sketches to the precise detailed considerations typified by formal drafting” (Lawson 2004, 47). Lawson also admits that there are many that work in what may be consider an opposite direction, and notes the process of the architect Eva Jiricna as being a

...design process based upon working from the idea of a selection of materials, thorough an understanding of how to join them, to detailing where there are junctions and from this creating a vocabulary from which the overall arrangement is constructed.
(Lawson 2004, 48)

I would argue that Jiricna explores the being of the material and reveals the designed outcome that express that material, much like Michelangelo removed the stone to reveal the sculpture of David (Kurtich and Eakin 1996). The material’s being is revealed and expressed; it is through these creative acts of the process of acquaintance through to understanding, exploration, and communication, that the concealed being is revealed in a creative outcome.

Heidegger reflected that the character of revealing demonstrated in modern technology—a technology of the mid 1950s—is that of setting-upon, which is, as he explains, having a sense of challenging-forth (Heidegger 1977, cited in Krell 2002, 321). This idea of challenging forth has a direct relationship to this thesis, as designers are always challenging ideas and setting forth new ways of

assembling materials and forms to shift our perspective of the world. Heidegger continues with his thoughts on setting forth:

Such challenging happens in that the energy concealed in nature is unlocked, what is unlocked is transformed, what is transformed is stored up, what is stored up is in turn distributed, and what is distributed is switched about ever anew. Unlocking, transforming, storing, distributing, and switching about are ways of revealing.
(Heidegger 1977, cited in Krell 2002, 322)

Heidegger's description of revealing the unlocked that is transformed is exactly what this research aims to uncover.

The notion of revealing the essence of the material is captured by Chilean architect Gonzalo Mardones Viviani when he comments on his views towards materials and architecture: "There is something mysterious, but which is intrinsic to each material. The task of the architect is to reveal this mystery" (Mardones Viviani cited in Tidy et al. 2008, 252)

The clarity of Heidegger's thoughts is still valid, despite the rapid advances in technology (Mau 2004; Thackara 2005). Yet the period of contemporary modernism 75 years ago is now tarnished, with scholars stating that Heidegger's claims about technology are too abstract and contribute to a dystopian modernity (Feenberg 1996). Feenberg also critically comments on the lack of opportunity for future evolution of technology:

While Heidegger represents modern technology as a particular stage in a quasi-historical development, that development is contingent on a mysterious revealing of being rather than on human action. Furthermore, he seems to allow no room for a future evolution in modern technology which seems fixed in its eternal essence whatever happens next in human history. (Feenberg 1996, 3)

As with many scholars, critical reflection on their work is always essential to enrich the debate. However, Heidegger's work, *Being and Time*, remains

essential reading, and has influenced many theorists and philosophers to develop further insights.

Perception and the Lived Experience

Merleau-Ponty and Heidegger came from a shared perspective that within the realm of embodied experience begins knowledge (Hale 2017). Merleau-Ponty has said “To perceive something is to live it” (Moran 2000, 421). His view that the object and the seer are connected in the process of perception. Merleau-Ponty (1945/2004, 115) discusses “...spatiality of situation...”, “...the active body in the object...”, and “...the body as in-the-world”, all of which direct us to his view of a symbiotic relationship between body and the world. He also differentiates between ‘lived body’ and ‘physical body’ in which the latter deals with the physical and the former identifies that which is connected to the perceptual field (Vasseleu 1998). He extends this idea by stating, “We must therefore avoid saying that our body is in space or in time. It inhabits space and time” (Merleau-Ponty 1945/2004, 161).

The contemporary view of his time was that the body was a container for consciousness, but Merleau-Ponty explored an alternative:

“...one *is* one’s body. There is no ontological separation between the experiencing ‘I’ and the body as one lives it. Indeed, the lived body is one’s intentional opening to the world, through which alone one experiences meaningful things in the first place” (Morris 2014, 111)

The work of Shaun Gallagher (2013) who has recently noted some principles about cognition that draws upon the work of Merleau-Ponty in his views of embodiment and also current neuroscientific ideas. Gallagher explains “...how human thinking is not an isolated process ‘inside the head’, but rather happens in the curious nexus created by the interaction of brain, body and world” (Gallagher in Hale 2017, 36).

When discussing the convergence of diverse ideas such phenomenology, biology, psychology, and cognitive neuroscience Robinson and Pallasmaa (2015,

Kindle Locations 51-52) state, “... all human endeavours depend upon our brains functioning as organic members of our bodies, which are in turn actively engaged with the ecological, architectural, social, and cultural environments in which we dwell.” The idea of the body and its relationship to knowing is noted by Van Manen when examining the practice of phenomenology:

Perception through sight, hearing, and touch is first of all primal. Similarly, there is the body knowledge that guides us through what we do. And we do not always “know” what we know. It is the unknowing consciousness, a noncognitive knowing, that guides much of our daily doing and acting. (Van Manen 2014, 47)

Yet this relationship to the body, movement, knowledge and meaning is not just the mandate of phenomenologists, neuroscientist who are also seeking an understanding of these relationships (Johnson 2007; Robinson and Pallasmaa 2015). When discussing sensorimotor engagement such as projection, amplitude and linearity, Johnson states:

The meaning of these differences is known by the quality of our differing experiences, but that meaning is prepared and developed in our nonconscious bodily perceptions and movements. Subjectively, we would say that we feel these qualitative dimensions. However, they are not just subjective qualities. It would be a mistake to subjectivize these experiences of qualities of motion, as if they were locked up within some private inner world of feelings. On the contrary, they are qualities of organism-environment interactions. (Johnson 2007, 25)

Uncovering the relationship to the engagement with materials through a neuroscientific lens is a worthwhile investigation but beyond the boundaries of this research thesis. It is mentioned for readers to use to initiate a tangential study to this thesis.

Insights into Perception and the Body by Maurice Merleau-Ponty

Merleau-Ponty, unlike Heidegger, was never a student of Husserl but was greatly influenced by his work and extended Husserl’s view of consciousness

being intentional. His work like Heidegger was considered to be Existential Phenomenology as opposed to the Pure Phenomenology of Husserl. Merleau-Ponty's greatest contribution was his views on "...the primary experiences of human existence" (Moran 2000, 391). This is highly relevant to this thesis topic as the examination of the engagement a material that is unknown aligns with his views of primary experiences.

A vital part of any designer's process is their perception of the world around them. More than visual perception, this involves all the senses. Maurice Merleau-Ponty's seminal book, *Phenomenology of Perception*, clearly explores the nature of perception and offers valuable insights. In his writings, he examines how one can come to terms with the world through the body (Merleau-Ponty 1945/2004). This is highly relevant in terms of this thesis, as this foreign entity of an unknown material is examined.

I draw the object closer to me or turn it around in my fingers in order 'to see it better', this is because each attitude of my body is for me, immediately, the power of achieving a certain spectacle, and because each spectacle is what it is for me in a certain kinaesthetic situation. In other words, because my body is permanently stationed before things in order to perceive them and, conversely, appearances are always enveloped for me in a certain bodily attitude. (Merleau-Ponty 2004, 352)

In his chapter on "Things and the Natural World", Merleau-Ponty examines in great detail the everyday lived experiences of individuals and how they engage in the world. His analysis examines how shape, form, light, colour, and tactility allow him to return to his central message of the body as the receptor of phenomena. He connects the senses of sight and touch to being able to synthesise the essence of the experience. He comments that:

All tactile perception, while opening itself to an objective 'property', includes a bodily component; the tactile localization of an object, for example, assigns to its place in relation to the cardinal points of the body image. This property which, at first sight, draws an absolute

distinction between touch and vision, in fact makes it possible to draw them together. (Merleau-Ponty 1945/2004, 367)

This insight is particularly important in the research presented here, as it unpacks the ideas that may describe what occurs at that moment when the designer becomes acquainted with the unknown material. This research will explore how they react as a consequence of their lived experience of the unknown material. Tactility and vision work simultaneously to create an understanding of the material. Merleau-Ponty also predicts the type of visual examination that would occur through his discussion of the type of gaze that needs to be applied to the activity. He explains this way of looking as either a *passive* vision or an *explanatory* gaze:

But there is also passive vision, with no gaze specifically directed, as is the case of dazzling light, which does not unfold an objective space before us, and in which the light ceases to be light and becomes something painful which invades our eye itself. And like the explanatory gaze of true vision, the 'knowing touch' projects are made outside our body through movement. (Merleau-Ponty 1945/2004, 367)

Merleau-Ponty's *Phenomenology of Perception* is essential reading for insightful investigation into understanding the body in relationship to experiences. By bringing the body into focus, he addresses how the body is the "interlocutor in a sort of dialogue" (Merleau-Ponty 1945/2004, 373) with the phenomena of the world. He describes how the gaze or the tactile connection that the user has with the world arouses bodily movements:

The first philosophical act would appear to be a return to the world of actual experiences which is prior to the objective world, since it is in it that we shall be able to grasp the theoretical basis no less than the limits of that objective world. (Merleau-Ponty 1945/2004, 66)

Merleau-Ponty discusses how there is a difference between the visual experience and the tactile experience, and how the former pushes a sense of objectification, and the tactile experience allows the participant to experience

the thing rather than just the object. He also explains that the sensory experience goes beyond the sensation (Merleau-Ponty 1945/2004; Romdenh-Romluc 2011; Hale 2017; Carman 2020) and there is a communication between the senses to create a composite experience.

The senses intercommunicate by opening on to the structure of the thing. One sees the hardness and brittleness of glass, and when, with a tinkling sound, it breaks, this sound is conveyed by the visible glass. One sees the springiness of steel, the ductility of red-hot steel, the hardness of a plane blade, the softness of shavings. ... The form of a fold in linen or cotton shows us the resilience or dryness of the fibre, the coldness or warmth of the material ... (Merleau-Ponty 1945/2004, 266-67)

Merleau-Ponty adds a vital insight about an aspect of how spatial designers experience the world. Merleau-Ponty states:

Tactile experience, on the other hand, adheres to the surface of the body. ... I cannot flatter myself, that I am everywhere and nowhere; I cannot forget in this case that it is through my body that I go into the world, and tactile experience occurs 'ahead' of me, and is not centred in me. It is not I who touch, it is only my body. ... I am able to touch effectively only if the phenomenon finds an echo within me, if it accords with a certain nature of my consciousness, and if the organ which goes out is synchronized with it. (Merleau-Ponty 1945/2004, 369)

The research will examine if spatial designers engage with materials through a gaze to access the thing itself, it also allows us to see relationship of the body towards perception in which is the central focus of Merleau-Ponty's (1968; 2004) approach to phenomenology and an idea to explored in this thesis. To know whether a designer has a gaze that is different at different times as they explore materials will allow for an explicit understanding of how they practice. In his unfinished manuscript and working notes, *The Visible and the Invisible*, Merleau-Ponty expresses his concerns that his previous work still held a separation of subject and object (Merleau-Ponty 1968). This helps to explain his

view that *Phenomenology of Perception* still looked at consciousness as external (Evans 2014). He speaks of the “flesh of the world” (Merleau-Ponty 1968, 248; Moran 2000, 403) being the fabric of the sensory world, and that it is shared by the world and the world reflects it. “Flesh is not grasping of being in its reversibility but the inscription of difference in a chiasmic doubling/crossing. The chiasm is flesh in its intertwining...” (Vasseleu 1998, 29).

It is important to know that Merleau-Ponty does not mean that flesh represents anything tangible and that it grows out of the symbiotic relationship between the seer and the visible and becomes a “prototypical structure of all subject-object relations” (Vasseleu 1998, 26). Merleau-Ponty states:

The flesh is not matter, is not mind, is not substance. To designate it, we should need the old term ‘element’, in the sense that it was used to speak of water, air, earth, and fire, that is, in the sense of a general thing, midway between the spatio-temporal individual and the idea, a sort of incarnate principle that brings a style of being wherever there is a fragment of being. The flesh is in this sense an ‘element’ of Being. Not a fact or a sum of facts, and yet adherent to *location* and to the *now*, ... in a word: facticity, what makes the fact be a fact.
(Merleau-Ponty 1968, 139-140)

This idea of Chiasm and Flesh and how it allows for the unconcealing as there is nothing to separate the seer from the object becomes a valuable insight into how a designer might engage with a material. “The reversibility of flesh, ... implies that both bodies and objects should be seen as ‘living’ matter, at least insofar as they have an awareness of each other, in the sense that they can both register the results of their interactions” (Hale 2017, 83). The act of engaging with a material may be a way of understanding the moment of being presented with an unknown material and how the designer intertwines with the visible traits of the material and “the ‘invisible’ or ideality of flesh [which] is the concept before it has become conscious of self, or being whose existence resides in the language of sensibility” (Vasseleu 1998, 29).

Hale (2017) explores Merleau-Ponty's relevance to the world of architecture, although noting that Merleau-Ponty never wrote anything directly about architecture but his ideas are clearly relevant and has even greater relevance to the notion of material engagement. He states

...one of Merleau-Ponty's founding principles; the idea that intelligence is an emergent property of embodied engagement in the material world. It is this idea of gradual emergence through an ongoing process of exploration and discovery that we can see reiterated across different timescales in terms of both evolutionary and individual development. ... Each time we open our eyes on the world we are, in a sense, thrown back into a state of 'con-fusion', and our status as independent selves has to be continually rediscovered in the unfolding of experience... (Hale 2017, 36)

Together with Heidegger Merleau-Ponty provides key insights towards understanding the act of embodiment with materials. Hale (2017, 114) makes the connection to the material world with Merleau-Ponty: "It is this sensibility towards the inherent resistance of material things—the fact that all things, even concepts, have their 'grain', their patterns and their propensities—that should be the enduring legacy of Merleau-Ponty's overarching philosophy of embodiment".

Gibson's Theory of Affordances

Gibson (1986) offers an alternative view of perception that differs from the view of cognition based on thought, experience, and senses (Jenkins 2008; Hinton 2014). He aligns specific behaviours with the perception of environmental phenomena, providing a more definitive description of the behaviour. Jenkins described Gibson's work as iterative and evolving (Jenkins, 2008, 35), and in Gibson's seminal work, he stated:

Orthodox psychology asserts that *we perceive these objects insofar as we discriminate their properties or qualities ...* The psychologists assume that objects are *composed* of their qualities. But I now suggest that what we perceive when we look at objects are their

affordances, not their qualities. We can discriminate the dimensions of difference if required to do so in an experiment, but what the object affords us is what we normally pay attention to. The special combination of qualities into which an object can be analysed is ordinarily not noticed... (Gibson 1986,134 'original emphasis']

Chemero (2003) notes that Gibson's definitions are at times confusing, but there is acknowledgement of the importance of Gibson's work in understanding the difference between direct and inferential theories of perception.

Gibson's theories are not phenomenological, as they are based on the assumption that the relationship between the viewer and the objects exists whether it is perceived or not, as opposed to Heidegger's hypothesis that there is a direct relationship between the object and our perception of it (Chermero 2003; Jenkins 2008). Yet Gibson's ideas are useful to consider in terms of material engagement, as noted below:

... The meaning is observed before the substance and surface, the colour and form, is seen as such. An affordance is an invariant combination of variables, and one might guess it is easier to perceive such an invariant unit than it is to perceive all the variables separately. (Gibson 1986, 134-135]

An extract of Gibson's theory of affordances extends the relationship to material engagement:

The fact that a stone is a missile does not imply that it cannot be other things as well. It can be a paperweight, a bookend, a hammer, or a pendulum bob. It can be piled on another rock to make a cairn or a stone wall. These affordances are consistent with one another. The differences between them are not clear-cut, and the arbitrary names by which they are called do not count for perception. If you know what can be done with a graspable detached object, what it can be used for, you can call it whatever you like. (Gibson 1986, 126)

Gibson's work offers valuable insights into how material engagement can be viewed. Hale (2017, 83) also notes that the "...grasp of a material affordance is based on a similar sense of its possibilities and limits. What emerges from this is a kind of agency or 'aliveness' within the very fabric of the world..." This makes the connection with Merleau-Ponty's idea of flesh. His work lies adjacent to the boundaries of this research yet worthy of comment for other readers to explore.

Perception viewed as Interobjective and Intersubjective

Harman presents a detailed view of an Object-Oriented Ontology (2018) in which he expands on his view of the four aspects of an object, being a real object or sensual object and both of their qualities. Real objects exist in their own right while sensual objects and qualities exist only as the correlate of some real object" (Harman 2018, 80). His work presents a view that the knowledge of an object is not thoroughly explicit and may never be (Harman 2011, 2018; Kärholm 2014). This view is relevant to this thesis that examines the impact that the material will have on the designer. Latour established the term *interobjectivity* to represent the relationship between humans and objects (Latour 1996, 2018; Kärholm 2014). Kärholm (2014, 66) cites Harmon (2011) in how in the broadest sense interobjectivity could be defined as "... the relationship between objects, where object can be defined as 'anything that has a unified reality that is autonomous from its wider context and also from its own pieces.'"

Although this thesis examines the problem from a phenomenological lens, the idea of perception needs to briefly recognize the many individuals view the world as being something that is presented to them as objective fact (Summut & Moghaddam, 2014). The idea that the object has facts that represents a view of the world existing that our consciousness must assess. This Cartesian view was opposed by the phenomenologists who asserted that the internal world of the seer was connected to the external world. The concept of intersubjectivity aligned with the views of the phenomenologists (Busch 2008) in that they believed in the subjective relationship to the world.

This concept postulates the existence of a 'mechanism of interpretation' by which two or more people bridge the gap between their own subjective and isolated meaningful worlds by imagining what the world of the other person is like on the basis of their own self-understanding. (Summat et al, 2013, 3)

Merleau-Ponty relates the ability to see the world as intersubjective as being akin to how a child sees the world

The perception of other people and the intersubjective world is problematic only for adults...He has no awareness of himself or of others as private subjectives, nor does he suspect that all of us, himself included, are limited to one certain point of view of the world. That is why he subjects neither his thoughts, in which he believes as they present themselves, to any sort of criticism. (Merleau-Ponty 2004, 413)

This thesis will examine how the relationship with others subjective view of the world has an impact on the way in which a designer engages with the unknown material, and whether the designer channels their child-like wonder of the world into his engagement with materials.

Lived Experience of Space and Place

The attempt to create a sense of place is not a new endeavour, as the history of architecture will clearly show space has been enclosed to house experiences and human needs for thousands of years (Smith 1987; Sparke 1987; Malnar and Vodvarka 1992; Kurtich and Eakin 1996; Pile 2000; Bosoni 2002; Weston 2003). Within these homes, shelters, temples, cathedrals, offices and assorted building typologies, humans have experienced 'space'. Whereas architecture, (depicted in its history) has mainly concerned itself with the object that contains the space, spatial design is concerned with the experiences within that space, and with the dialogue that occurs between the user and the enclosure that leads to a recognition of 'place'.

Architectural theory is discussed by Hale (2000) in terms of ‘presencing’—a term used by Heidegger—as the point in which place-making begins, noting that this goes beyond the definition of space by boundaries and divisions. Hale examines Heidegger’s early work, prior to his shift back to the study of language:

... it was in his early writings that he turned the phenomenological methods towards ‘lived’ experience and away from Husserl’s abstract ‘essences’. The reason for this shift came from Heidegger’s overall intention to study the nature of ‘being’, not merely the nature of ‘knowing’. (Hale 2000, 98)

The psychological aspects of design have been well documented (Lawson 1997, 2010; Julier 2001; Norman 2013; Diyanni 2016) and form a vital aspect in the theoretical view of design. Designers practising today also intrinsically understand the relationship of design to the environment (McDonough and Braungart 2010; Brownell 2012; Papanek 2016). The experience of space is inexplicably linked with a sense of place with the particular relationship to elements of design and also with the more holistic view of the particular space within the environment. Both contribute to an understanding of place.

One clear principal of phenomenology is that of consciousness has to be of something (Magee 2000; Moran 2000; Merleau-Ponty 1945/2004; Husserl 1913/2012), and that intentionality is demonstrated through the lived experience. With spatial design concerned with outcomes, aimed at creating phenomenological spatial experiences; one perspective of space as that being contained by matter and material, a ‘something’ is provided to be experienced. What is experienced contributes to the notion of place.

The relationship of spatial design to phenomenology and place-making is supported in the foundational text on spatial design by Exner and Pressel. “The philosophy of phenomenology represents the theory that spatial experience is directly influenced by human perception, which means that human behaviour in the world is defined by sensory perception” (Exner and Pressel 2009, 14). They

claim that spatial design is important to human existence, and that it is significant to learning and to the development of knowledge (Exner and Pressel 2009). This relationship demonstrates a two-fold connection to the research problem, in that it connects spatial design to phenomenology, and through the foundation of spatial design dealing with atmospheric place-making outcomes that impact the senses. The knowledge gained through dealing with materials that impact the senses in a spatial outcome directly relates to exploring the lived experience of the designer when introduced to a material that is unknown to them. Secondly, by making the connection to the development of knowledge, they link spatial design to epistemology. This latter connection is valuable to consider but is beyond the scope of this research to explore fully. However, the former claim of the relationship to phenomenology will be discussed in this thesis.

The spatial designer is involved with creating spaces for active spatial appropriation (Exner and Pressel 2009). Space is considered fundamental to how we experience the world as humans (Exner and Pressel 2009). Designing, in relationship to space, is partly about defining a space through the use of building or construction materials to elicit a performative response to a programmatic brief. Developing a spatial outcome creates a sense of place for the users—an idea expanded on by design theorists over the decades (Alexander 1977; Norberg-Schulz 1980; Bachelard 1958/1994; Cassey, 1998; Lefebvre 2004).

Insights of De Certeau and Lefebvre

Michel de Certeau is another philosopher and scholar worth consideration. Taylor and Preston (2006) cite de Certeau's (1984) view on spatial practice, noting how he examines text narratives to negotiate between mapped and stable space that is traversed and individually experienced. They also draw attention to his acknowledgment of the relationship of time, body, and place to the understanding of spatial practice. The work that they refer to is "Spatial Stories"—a chapter in de Certeau's *The Practice of Everyday Life* (1984). This work provides an appropriate and insightful text on spatial practice.

When de Certeau speaks of stories and narratives, he is speaking of experiences and spatial trajectories. He uses the idea of metaphors in a story to define movement in space. He clearly identifies the difference between place and space.

I shall make the distinction between space (espace) and place (lieu) that delimits a field. A place (lieu) is the order (of whatever kind) in accord with which elements are distributed in relationships of coexistence. It thus excludes the possibility of two things being in the same location (place). ... A place is thus an instantaneous configuration of positions. It implies stability. ... A space exists when one takes into consideration vectors of direction, velocities, and time variables. Thus, space is composed of intersections of mobile elements. (de Certeau, cited in Taylor and Preston 2006, 79-80)

His views are important to note in this thesis, as the spatial designer is tasked with creating place through the manipulation of materials. The vectors and velocities of time variables are the materials that exist in space and contribute to space articulating place. New tools to articulate the narrative of place may assist the spatial designer—an experience that needs to be understood. These new tools are the vectors that de Certeau mentions, and are the materials that are, at the time of acquaintance, unknown to the designer.

De Certeau continues by making the connection to the phenomenological perspective of Merleau-Ponty, and his distinction between ‘geometric’ space and ‘anthropological’ space. This analysis of Merleau-Ponty concludes that there is symbiotic relationship between place and space, in which the former is static, whereas space is always alive and is determined in operation. These ideas belong to a larger discussion on place and space, yet it is important to take from de Certeau’s comments the idea of space being alive and establishing the operations through vectors and variables.

Henri Lefebvre was praised for his insights into the nature of space (Hubbard et al. 2004) that derived from his seminal text, *The Production of Space* (2004). Here he shifts the analysis of ‘space’ from that of territorial and social ecology to

“... the manner in which understandings of geographical space, landscape and property are cultural and thereby have a history of change” (Hubbard et al. 2004, 210). Lefebvre’s critiques of everyday life were a reflection of the time and context that he wrote the work—student unrest in Paris—and also of his neo-Marxist stance. His book was also grounded in his views and earlier texts on urbanism.

... Lefebvre,...insist that space is not a pre-existing container for artefacts and practices but is constituted by them in a relationship of reciprocal influence and inflection. Artefacts are made possible by the spatial configurations which give rise to them, but artefacts in turn reconfigure the spaces they inhabit. (West-Pavlov 2009, 24)

This view by West-Pavlov links spatial design, placemaking and material artifacts together. This research will explore this idea to examine if spatial designers relate the notion of artefacts as being a factor in configuring the space and thereby creating place. Yet this exploration of placemaking results only from the engagement with a material to construct that artefact. It is the combination of light, material, and the medium from which we engage with the experience that adds to the creation of place (Smith and Verghese 2013).

Through an analysis of spatial juxtapositions throughout history, Lefebvre identifies that if space is a product, then there would be knowledge to reproduce the space and explain the production (Lefebvre 2004). His claim is that the focus must shift from the focus of things in space to the production of space. He presents a conceptual triad of terms that defines his view of the production of space. Key aspects of the triad are reproduced in Table 2.1.

Table 2.1 Lefebvre’s Spatial Triad (Lefebvre 2004, 33 and 38-39)

SPATIAL PRACTICE	Embraces production and reproduction, and the particular locations and spatial sets characteristics of each social formation. [Daily routines and practices.]
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REPRESENTATIONS OF SPACE	Conceptualisation of space, the space of scientists, planners, urbanists, technocratic subdividers and social engineers, as of a certain type of artist with a scientific bent. [Use of verbal and visual signs such as, maps, models, designs.]
REPRESENTATIONAL SPACES	Space as directly lived through its associated images and symbols, and hence the space of ‘inhabitants’ and ‘users’, but also of artists and perhaps those few writers and philosophers. [Ideas, imagination, theory, and vision.]

It can be seen that this triad of spatial concepts that Lefebvre defines simultaneously apply to the spatial designer who engages with unknown materials. In a recent study, interior designers—a category of spatial designers—spent 27% of their time researching products, meeting with vendors, or sourcing/specifying products, as opposed to 22% of their time working on drawings and designs (Quail 2018). An even higher amount of time was spent doing online searches for materials and products (Gibertini, 2018). This is their lived experience, and as this thesis will describe, their lived experience is very much about material engagement and spatial practice. It is also clear that spatial designers are technically inclined and use their insights and skills to articulate ideas to their clients, so they can easily fit into Lefebvre’s concept of representations of space. Lastly, at the point of engagement with the unknown material, the spatial design enters a process of imagination and discovery. They are trying to find the core aspect of the material, and through this process, they can be described as being in Lefebvre’s conceptual state of representational space.

Lefebvre refers to ideas of material and spatial design as he discusses “...thought and discourse *about* space (i.e. restricted to words, and signs, images, and symbols), and thought that are *adequate to the understanding of space* (i.e. grounded in developed concepts)” (Brackets are from original quote) (Lefebvre

2004, 104). He continues by noting that these distinctions are based on a more fundamental one of *material* and *matériel*. The former term—important in understanding the relationship of materials to space—is concerned with the elements used to construct the outcome, essentially the advanced materials that this thesis refers to. The second term references the associated technologies. Lefebvre refers to these two terms thus:

Materials are indispensable and durable: stone, brick, cement and concrete, for example—or, in the musical sphere, scales, modes, and tones. Matériel, by contrast, is quickly used up; it must be replaced often; it is comprised of tools and directions for their use, and must be invented to meet them. (Lefebvre 2004, 105)

Lefebvre continues by stating that when new circumstances and needs arise, then new matériel needs to be invented to meet the criteria for the changes; he notes that new construction and manufacturing techniques along with new equipment can be classified as matériel. Lefebvre’s distinction between the ideas of the material and the matériel is important, for it acknowledges how technologies both generate and utilise an advanced material, and the symbiotic relationship between technologies and materials. At the time of writing his ideas, Lefebvre was not witnessing the current exponential growth of the material sciences, and the consequent development of new and advanced materials. The context is now vastly different for the spatial designers, who are faced with enormous choice, and technologies that combine material and matériel, unlike the defined divisions of the past (Antonelli 1995; Basalla 1999; Gann 2000; Kieran and Timberlake 2003; Guidot 2006; Arthur 2009; Moskowitz 2009; Drexler 2013). Today, huge advances in material technologies that lead to materials that were unimaginable a few years ago are available to designers (Braddock and O’Mahony 1999, 2005; Mau 2004; Quinn 2011).

Insights into Knowledge Acquisition

Acknowledging the relationship of known and unknown materials provides the framework for philosophic investigation into the process of knowing something new. Cambridge Dictionary states that knowledge is the “...understanding of/or

information about a subject that you get by experience or study, either known by a one person or by people generally; and, the state of knowing about, being familiar with something” (Cambridge Online Dictionary).

As this research is focused on the lived experience of the spatial designer, the process of obtaining knowledge is recognised as being drawn from their experiences. It is phenomenological in its approach. American philosopher John Dewey (1859-1952) discusses how knowledge results from the ability of the individual to read the world around them and synthesise the observations.

On the one hand, the outer world presents the material or content of knowledge through passively received sensations. On the other hand, the mind has certain ready powers, attention, observation, retention, comparison, abstraction, compounding, etc. Knowledge results if the mind discriminates and combines things as they are united and divided in nature itself. (Dewey 1916/2015, Kindle, Locations 1320-1322)

As already noted, phenomenologists see that there is intentionality involved with consciousness and that the seer is not passive in the process of receiving sensations. Knowledge gained through an intersubjective engagement, and like Dewey recognizes, that other powers exist in the comprehension of sensations. This research will examine what these powers may be through the process of material engagement.

Epistemology and the Learning Paradox

Epistemology can best be defined as the philosophical investigation into the origins, methods, and nature of propositional knowledge (Abel 1976; Rohmann 1999; Martin 2010; Chilisa 2012; Sosa, 2017). Comprehension the methods of understanding knowledge is of relevance to this thesis, that examines how designers understand a material through engagement with it. What methods are available for them to understand this engagement with new knowledge? Before I examine the research into what designers know and think, it is necessary to list the various epistemological perspectives. This area of philosophical study is

vast, and well beyond the scope of this thesis to justify a thorough analysis, yet some key ideas are necessary to ground the argument presented in this thesis.

If epistemology is the study of knowledge, it is necessary to know what is studied. Rohmann (1999, 118) notes that “knowledge is true justified belief.” He also notes that what knowledge *is*, is elusive; various philosophers reference their own worldview when defining knowledge. The view based on opinion is opposite to Plato’s view of knowledge. He believed that knowledge was true belief; Marx believed it was the construction of economic relations; and, Wittgenstein saw knowledge as being the practical know-how within a specific social context (Rohmann, 1999). This thesis discusses how the spatial designer refers, consciously and unconsciously, to a worldview of design when they first become acquainted and try to know an unknown material.

There are various theories about the process of how we obtain knowledge, and epistemology—one of the five classical fields of philosophy—helps to clarify this process. Rohmann (1999, 118) states that “...knowledge is true, justified belief.” The various approaches can be defined by four different perspectives outlined in the chart below:

Table 2.2: Categories of How Knowledge is Obtained (After Rohmann, 1999, 118)

Description	Key Philosophers and Groups
<p>1. Knowledge is an inherent part of our existence in the world.</p> <p>Plato: Humans possess an intrinsic yet imperfect understanding of the world of ideal forms. Knowledge is the opposite of opinion.</p> <p>Hegel: The dialectic process of history produces knowledge.</p>	<p>Plato (Ideas/Innate Ideas)</p> <p>Hegel (Dialectical Process of History)</p>
<p>2. Intelligence and reason enable the individual to extract the truths within the world.</p>	<p>Aristotle, Descartes, Russell</p>

<p>Descartes and other rationalists addressed the question of doubt and separated truth from certainty.</p>	
<p>3. Knowledge is what we think we create out of our experiences. This knowledge is not considered objective as it is dependent on psychological, historical or social conditions. Here the object of knowledge and the subject (one who does the knowing) is brought into question. For Marx it is the social context that constructs knowledge.</p>	<p>Nietzsche, Marx, and Phenomenologists</p>
<p>4. Knowledge is the product of the manner in which neurons acquire and store information. Cognitive psychology and information theory are evolving fields in this perspective of knowledge.</p>	<p>Neuroscientists.</p>

Abel (1976) presents a list of ways that knowledge is justified to the individual. His analysis covers three of the four areas of processing knowledge as noted above; the recent developments in neuroscience were not known to him at the time he wrote his text. Abel notes that sense perception, intuition, memory, and self-awareness are all forms of justification. These are clearly dealing with the phenomenological experiences that would lead to justification of knowledge by the individual. Abel also notes that logic, authority, consensus, revelation, and faith are also forms of justification that would lead to the individual validating knowledge in their worldview.

In *Democracy and Education*, Dewey (1916/2015) discussed the factors that gave rise to the epistemological structure that defined his theory of knowledge (Dewey 1916/2015). His description of the separation of disciplines that fractured a holistic understanding of our world is echoed in recent texts (Senge

et al. 2004; Thackara 2005; Martin 2006). Dewey explains that the separation led to the need to establish systems to understand the nature of the differentiated areas of knowledge. Doczi presents a parallel viewpoint that describes this separation as cultural approach that separates the East from the West: “...the West seeks knowledge by taking things apart and looking at each separately, the East takes another approach which is to put things together to look for the holistic nature of design, The East seek wisdom instead of knowledge...” (Doczi 1981, 127).

Western philosophy has addressed the problems around the question of knowledge for the last two thousand years (Van Doren, 1993). Prawat (1999) discusses how Plato first addressed issues of learning, and in particular the *learning paradox*—finding new knowledge from old. Prawat highlights the work of Peirce and Dewey as philosophers who understood and could provide insights into dealing with the paradox. He notes Bereiter’s (1985) observation that the understanding that new knowledge can be derived from existing knowledge is crucial in the case of conceptual thinking. This thought is highly relevant to this thesis, which addresses how spatial designers examine an unknown material that could lead to new insights and practice in spatial design.

Prawat (1999) outlines four different ways of dealing with the learning paradox, which all stem from a constructivist framework in which the learner constructs their own subjective reality from the objective world. The first approach that Prawat identifies is the rationalist approach that deals with deduction. The second approach is that of the realist who deals with induction. Prawat (1999) describes these two as modernist approaches and a duality. The rationalists look away from the world and rely on intellect to reach an understanding and acquisition of knowledge. The realist looks outward towards the world to acquire knowledge. The third approach is a post-modern one, which places the mind of the learner in the world—a world defined by language. Prawat explains it as:

Postmodernists dismiss the quest for certainty that motivates this effort. It makes more sense, the postmodernists believe, to entertain the possibility that there is no objective reality outside or apart from the way members a society talk about that reality. Language, in effect, is reality—or, all we can ever know of it. (Prawat 1999, 50)

The final approach explained by Prawat (1999) deals with ideas, abduction and the importance of metaphors. Drawing on the work of Peirce, he explains that when considering the paradox of learning, abduction—a term introduced by Peirce—has many attributes that are more advantageous than either induction or deduction in generating new ideas in a system. "Deduction proves that something must be," Peirce declares. "Induction shows that something actually is operative; abduction merely suggests that something may be" (Peirce 1934, cited by Prawat 1999, 50).

Prawat (1999) continues by explaining how Dewey provides clarity on the epistemological systems of knowledge; he builds on Peirce's views on addressing new ideas to form the foundation of his epistemological insights. Both of these philosophers addressed the paradox of learning through the view that abductive reasoning is an approach that can reconcile the issues of the known and the unknown.

Abel analysed the many key issues of philosophy in his book: *Man is the Measure—A Cordial Invitation to the Central Problems of Philosophy*, in which he gives a comprehensive examination of knowledge, citing many key thinkers in the history of philosophy. He begins by describing Bertrand Russell's definition of the distinction of knowledge to being "... 'knowledge by acquaintance' and 'knowledge by description'. Acquaintance is direct and immediate ..." (Abel 1976, 18-19). He describes the knowledge by acquaintance as a knowledge that we can have in degrees and likens it to the knowledge that we may have of a certain food, pet, or person. He clarifies the distinction: "But acquaintance is knowledge only in a preliminary or inarticulate sense. Organized scientific and philosophic knowledge, by contrast, is knowing 'that'

such and such is the case: it is descriptive of fact; it is couched in propositions” (Abel 1976, 19). It is useful to make this distinction, as the spatial designer begins a lived experience of an unknown material through initial acquaintance with the material (Karana et al. 2014). Their knowledge of that material is limited, as they have just been exposed to it. They begin a process of uncovering what the material is and what it can be. This recalls the idea of ‘unconcealing’—Heidegger’s term—that is central to this thesis. I will examine if it is necessary or vital for the designer to participate in this stage of ‘unconcealing’ through acquaintance with an unknown material for as long as possible.

We can all recognise that when we meet someone new, we become acquainted with them, and through our own world of experiences we try to understand who that person is. We need to be aware of their presence as a whole at this point and not shift to seeing just the parts. Yet understanding that each part plays a role in understanding the whole, as they are both integrated (Doczi 1981; Senge et al. 2004). In the process of engagement, a shift occurs from the knowledge of acquaintance to trying to *know who or know how*. Knowledge from the past assists the knowledge of acquaintance in understanding a person; or, in the case of the spatial designer, knowledge of an unknown material is a process of trying to understand the ‘how’ of an unknown entity. When faced with an unknown material, the thesis will examine if the designer will try to classify the material through known systems, or if other processes occur.

Polanyi writes about a slightly different view of *know-how*, which is not propositional and descriptive of knowing; he terms this tacit knowledge. Scholars have debated the impact of his views, which have not been empirically tested (Hill and Von Ende 1994; Morgan 2008). The term was first introduced by Polanyi in 1959 in *The Study of Man*. In this text, he differentiates between *explicit knowledge* and *tacit knowledge*. The former is based on text, symbols, numbers, and images that can be easily communicated to others. The latter is knowledge that is transmitted through the generations and is not easy to communicate to someone else. Quite often, it is not even possible to articulate it

to oneself (Polanyi 1959). Taylor (2007, 61) writes, “In general, explicit knowledge is knowledge a person can easily explain or describe, while implicit or tacit knowledge is knowledge that a person may be unaware of having, and that is difficult to articulate”.

Polanyi’s ideas are pertinent to the world of design, as designers quite often develop work that forms from a place that they cannot articulate (Bohm 2004; Lawson 2004, 2010; Dorst 2006). Further research into this area will be invaluable for the design disciplines but is beyond the scope of this research thesis. However, Abel does refer to Polanyi in his analysis of knowledge and differentiates between experience and propositional knowledge. He states:

Experience is a very wide philosophical term: it includes everything we do and everything that happens to us; it encompasses sensations and emotions and pains and aesthetic experiences and mystical transports. None of these should be confounded with propositional knowledge. (Abel 1976, 21)

He notes that the function of knowledge is to describe and explain, but not to reproduce the experience. He explains that experience may be the object of a particular type of knowledge, or that it may give a reason to develop some knowledge but experience alone is not knowledge (Abel 1976).

As this thesis frames the question of how spatial designers engage with unknown materials, Prawat’s insights into the ideas of Peirce and Dewey and how they relate to the paradox of learning were useful in exploring this question.

Ideas, they argue, are instruments of knowledge that connect the old and the new, the known and the unknown, the antecedent and the consequent. ... Dewey believed that the role of intelligence is to help manage the inherent tension between known and unknown. Ideas are the main instrument of this activity. (Prawat 1999, 60-61)

To engage with the unknown means that there are limited guideposts and datum points for making decisions. It indicates a transgression into an area or territory that is foreign, uncertain, and without precedent. It requires a reasonable ability to deal with ambiguity and risk, as the margins of existing knowledge are questioned when working with an unknown material. Designers work alongside this margin and define their relationship to creative risk-taking (Verghese 2007, 2009b).

Part E: Lived Experience

Introduction

This is the final part of the review of each research domain. Previously spatial design and unknown or advanced materials were reviewed, with Part D outlining key theoretical insights that support the review, in particular the insights of phenomenologists. This part of the review will discuss the literature that examines the practice of the designer through the lived experience with materials. It will be divided into three sub-sections: designer's knowledge that includes material memory; design process; and application of design.

The designer begins to learn about materials in the world to produce design outcomes that enhance the user's experience. These outcomes reside in a spatial context in which are the materials and technologies that are utilised to engage with the materials. The seer of a material outcome is intentionally conscious of that phenomena. These ideas were previously discussed in the work of Husserl, Heidegger and Merleau-Ponty.

It is essential to recognize that three areas of enquiry are not distinct and that the whole process is iterative (Hubel and Lussow 1985; Ching 1987; Lawson 1994, 1997; Miller 1995; Mitchell 1996; Leupen et al. 1997; Laseau 2001; Dorst 2006; Lawson 2010; Petrovic & Perkins 2016; Makstutis 2018; Martini 2020). Although the pathway is identified as linear, the actual process is anything but linear as designers circle back to examine a previous step in their process to assess if there needs to be a re-evaluation of decisions. Each time the outcome reaches a new level of clarity. Although many have discussed the process of design this review will look at the engagement with materials as the connection between the sub-sections.

Lived Experience/Designer's Knowledge

This section examines the lived experience of a designer's knowledge, in particular, knowledge of those materials that are initially unknown and would be described as advanced. Within the context of spatial design reside objects

and spatial experiences that alert the designer to pay particular notice to them. As they turn their attention to the material composition their consciousness is exposed to new ideas and knowledge.

The temporal nature of the lived experiences with materials (See Figure 2.5) indicates that the greater the experience in practice that the designer has, the more their knowledge of materials expands. There are some designers that are specialist in a particular material, while others have a greater breadth of experience (Grillo 1975; Zumthor 2005; Dorst 2006; Lawson 2010; Karana et al. 2014). Yet, to understand the spatial designer's lived experience of material knowledge, it has to be recognised that only the present experience can be explicitly examined. Experiences of the past, although potentially very important for the designer, exist in the sensory memory (Gayet et al. 2017) and therefore cannot be examined as a current experience. The relationship of memory to the acquisition of material knowledge will be examined shortly, but it is worth noting Surprenant and Neath's (2009) reflections on Tulving's research into memory:

... "no profound generalizations can be made about memory as a whole," because memory comprises many different systems and each system operates according to different principles. One can make "general statements about particular kinds of memory," but one cannot make statements that would apply to all types of memory. (Tulving 1983, quoted in Surprenant and Neath 2009, 4)

The research will not be able to comment on a generalized theory of any research participants although some analytical observations can be made about the types of memories that they draw upon when engaging in material practice. The potential future engagement with materials, as indicated in Figure 2.5, is not possible to predict accurately, but there will be an expected engagement with materials of some order in their future lived experience. The exact details of that future experience will become apparent at the time when the designer engages with the material, which only can occur as a present moment that occurs sometime in the future. Those designers that have a predilection to

explore new materials in their spatial world will likely follow that same path towards the exploration of material knowledge in the future.

Designers accumulate experiences, as Treadway (2009) has suggested, and the sources are varied and are continually expanding. The process of accumulating these experiences and being apt to venture to the margins of design (Verghese, 2009) to exist in the territory of the unknown is a common practice for designers. Kaufmann and Gregoire (2015, 82) note: “We need new and unusual experiences to think differently.” A grounding for many designers is the search for the new, novel, and different to find their voice (Brook 1980; Dorst 2006; Csikszentmihalyi 2007; Lawson 2010; Kaufman and Gregoire 2015). This search begins early in life with childhood experiences that form part of the intuition of the designer and creative individual (Polanyi 1974; Dorst 2006; Kaufman and Gregoire 2015; Diyanni 2016; and). What we learn from real-world experience is absorbed into our knowledge bank and forms our view of the world. “Experiences are not necessarily vague. They are what we notice and feel, and this is very real, very concrete (in fact, much more concrete than the theories and models of design research)” (Dorst 2006, 78).

It is the present moment when the designer engages with the material that is the prime focus of this research. At that moment, they seek knowledge. Eric Drexler (2013) discusses empirical knowledge and data and how that relates to the selection of materials by designers. He comments on how empirical studies and data dominate the selection process for engineers and designers, with calculations that are reliable to predict behaviour of the material increasing in quality and quantity every year. Yet he claims that his studies indicate that those engineers and designers who are seeking reliable material information will refer to a table or undertake an experiment with the material. “In other words, rather than calculating on the basis of physical law, they ask the physical world directly” (Drexler 2013, 104).

His comments reflect the interaction that spatial designers demonstrate with an unknown material as they physical engage with it. He continues:

Scientists focus on what's not yet discovered and look towards an endless frontier of unknowns, while engineers focus on what has been well established and look towards textbooks, tabulated data, product specifications and established engineering practice. (Drexler 2013, 105)

He points out that limited knowledge leads to conservative design. This way of thinking is expressed by spatial designers who rely on codes and standards to move a project forward. This thesis will demonstrate that those who are willing to take creative risks are less likely to depend solely on codes and calculations, and more likely to establish new pathways for innovation.

As I explore in this review, this thesis addresses the lack of analysis of encounters with previously unknown materials. It does not attempt to predict the future, nor is it about a detailed historical analysis of the past. These are both equally interesting topics, but not aligned with the subject of this research. The focus is on investigating the idea of encounters with materials.

Design Knowledge—Nigel Cross, Bryan Lawson, and Donald Schön

Although components of design are taught to students of various disciplines, and the disciplines can be defined together with their theoretical framework, supporting technologies, taxonomies, and historical lineage, it is a challenge for many scholars to describe exactly what design knowledge is (Bohn 2004; Dorst 2006). However, a few scholars have provided significant insights into the topic of design knowledge: Nigel Cross, Bryan Lawson, and Donald Schön are three who have progressed the conversation of design.

In Cross's article, *Design Research: A Disciplined Conversation* (1999), he discusses the growth of design research towards establishing a design culture, as within any culture there is a particular way of knowing. Years earlier in his (1982) article, he introduced the term *Designerly Way of Knowing*, in which he

describes the dichotomy between the two dominant cultures of science education and arts education. He claims that this needs to be broken, and he raises the concept of a third culture, *the design culture*. He describes aspects of what design culture is; the need to seek new ideas; an appreciation of material culture and the process of planning and inventing; adherence to a core language; and lastly, a distinct '*designerly*' way of knowing. These are captured in a report by the Royal College of Art (1979):

The claim from the Royal College of Art study of 'Design in general education' was that 'there are things to know, ways of knowing them, and ways of finding out about them' that are specific to the design area. The authors believe that there are designerly ways of knowing, distinct from the more usually recognised scientific and scholarly ways of knowing. (Cross 1982, 223)

Lawson builds on his previous work, *How Designers Think* (2010), and *Design in Mind* (1994), with his book *What Designers Know* (2004), in which he begins by referencing Nigel Cross's statement about *designerly* ways of knowing. He also draws attention to the notion of an expert designer, and asks: what knowledge would these experts have that separates them from the novice design? These terms will be seen again later in this thesis in another scholar's views on educational development. Lawson defines five approaches that can assist in uncovering design knowledge. As this thesis is focused on the lived experience of uncovering knowledge about a material that is unknown to allow it to be known, insights into the process of uncovering are useful. The techniques are presented in the chart noted in Appendix C. Lawson (2004) concludes that there is not a perfect method for understanding what designers know, and research will need to address a hybrid combination of these methods.

What Designers Know covers a wide spectrum of issues related to a designer's knowledge. Lawson (2004) address the relationship with clients, site, legislators, design process, problems, and solutions. He spends a considerable amount of time examining communication of the issues related to design, and how the designer uses different modes of expressing an idea to understand it

and inform others about it. Here drawing, model-making, and verbal communication are all considered a means to an end and are vital aids in a reflective thought process about materials. Within his analysis of drawing as a way of knowing, Lawson refers to Donald Schön's seminal work, *Reflective Practitioner* (1983). Lawson identified propositional drawing as the most significant key type of visual communication tool for the process of designing (Lawson 2004). Lawson states that: "A propositional drawing more than any other must be of the kind that Donald Schön (1983) had in mind when he described the designer as 'having a conversation with the drawing'" (Lawson 2004, 46).

Schön's writing on reflective practice in action draws into focus the professions, and accurately identifies the actions of designers as legitimate and rigorous in their investigation (Schön 1983). Schön identifies a knowing-in-practice that is not based on the epistemology of technical rationality; rather, it expresses a tendency to convert convergent ideas to divergent ones. Ambiguity is an aspect of practice that is difficult to address in a positivist framework, which gave rise to technical rationality (Schön 1983). Schön traces the historical roots of this approach to knowledge as a reaction to the reliance on facts alone—a worldview based on positivism. In terms of the spatial designer's investigation of unknown materials, his comments about the practitioner dealing with uncertainty are important: "Indeed, practitioners themselves often reveal a capacity for reflection on their intuitive knowing in the midst of action and sometimes use this capacity to cope with the unique, uncertain, and conflicted situations of practice" (Schön, 1983, Kindle, location 66-69).

The term *intuitive of knowing* is used by Schön to describe a knowledge that is tacit, and deep within the ethos of the individual. Together with reflection-in-action, it forms the basis of his views on creative thinking. Schön discusses various creative practitioners and how they have the ability to be connected to the creative act by "being in the groove"—a phrase that Schön admits is unclear to him, yet he recognises its place in practice. His statements conclude with a

recognition of the sense of surprise in working with the unknown, when intuitive performances lead to pleasing performances that lead to new ideas, and reflection-in-action is activated in the designer; it is like the common saying, 'thinking on one's feet' (Schön 1983).

Material Memory

Material memory is a term I have used in this thesis to identify designers' recollections about their experiences of spatial outcomes influenced by the materials used in the design. Cognitive scientific analysis of the different forms of memory has progressed over the last fifty years (Kropotov 2016). The three terms used to define memory are: iconic or sensory, short-term, and long-term. Referring to the work of Richard Atkinson and Richard Shiffrin, Kropotova (2016) writes that of the three different types of visual modality, iconic memory lasts a few hundreds of a millisecond, whereas short-term memory can last a few seconds, and longer-term memory—as the name suggests—lasts days, months, or years.

Eichenbaum (2010) examines memory systems and asserts that they are derived from earlier philosophical ideas and considerations of recollection and introspection. This form of introspection was aimed at finding a singular approach to articulating how memory works. His work outlines that the current state of research into memory systems is defined by three different areas (Eichenbaum 2010, 481). The first is *procedural memory*, which is reinforced by response habits that involve sensorimotor responses through the cerebellum. The second is *emotional memory*, which is concerned with conditioned preferences and aversions. This involves the amygdala, the part of the brain that deals with external stimuli and the emotional influences they have. The last memory system is *declarative memory*, which involves episodic and semantic recollections. This involves the hippocampus—the part of the brain involved with memory formation, storage, and organisation of memories. Eichenbaum links declarative memory to spatial memory. He discusses how cognitive memory is built up through a network of experiences and recollections that is

employed to address problem-solving. He refers to O’Keefe and Nadel’s research in 1978 that used cognitive mapping systems in the study of the hippocampus:

They referred to the domain of memory supported by the hippocampus as a system that represents spatial relations among objects in the environment, that is driven by curiosity rather than reinforcement of specific behaviors, and that is capable of very rapid learning. (Eichenbaum 2010, 481)

An understanding episodic memory will provide a basis for understanding material memory and how the spatial designer engages with the spatial world. Eichenbaum states that the objective features of the memory’s content are usually examined in an objective manner under four aspects of the phenomenon (Eichenbaum 2010, 482):

1. Episodic memory refers to a recollection of previous experiences that is distinguished from a sense of familiarity, despite the magnitude of the sense of familiarity that could provide a clue about the recency of the experience.
2. The details of the context in which a recollection occurs is a distinguishing feature of episodic memory, particularly when and where the event occurred.
3. A vivid episodic memory involves a clear organisation in terms of the temporal flow of events of the unique experience.
4. Episodic memory is integrated with many episodic memories creating a network of knowledge of substantial common information. This establishes a bridge towards semantic memory.

Designers tend to see the world in patterns and synthesise ideas (Grillo 1975; Alexander 1977; Dorst 2006; Diyanni 2016). Eichenbaum (2010) connects episodic memory to the idea of combinations and networks in his description of semantic memory as a natural product of the network of events and episodes. He acknowledges that his work is not the definitive source on various types of memories, but he wanted to note the importance of the networks of memory.

Eichenbaum's research identifies that there is not a singular model of memory that is useful, but rather a network between the different forms of memory systems.

A general axiom of this characterization is that new memories for unique episodes are integrated with related memories to form networks of knowledge; furthermore, these memory networks support our ability to make inferences from the information contained in those memories, such as navigating novel routes or generalizing to solve new problems. (Eichenbaum 2010, 483)

Eichenbaum's work also refers to Tulving (1983) and the relationship of spatial and temporal dimensions to episodic memory.

Tulving defined episodic recollection as involving memory for the spatial and temporal context of specific experiences, and many studies have shown that the hippocampus is involved in memory for the context of experiences. (Eichenbaum 2010, 482)

Rich in ideas and supported through quantitative research, Eichenbaum's research opens a door for exploring memory in relationship to spatial understanding. His work also connects anatomical systems to memory—a valuable area worth mentioning here as it reinforces this research as designers are tactile and the memory of sensory experiences is triggered by touch (Stewart 1999; Merleau-Ponty 1945/2004). In his philosophical reflection on memory, Eichenbaum established the idea of introspection as important, even essential when making the link between remembering the experience and translating that into material knowledge.

Cultural understandings and practices influence both collective memory and personal memories, and as these are or become engrained within the user, a sense of place or connectedness is developed. As a result, the collective characteristics of situations or settings come to have meaning as a whole. The environmental attributes or the tangible materiality of colour and the materials

(surface or structural) act as cues or signs. (Smith and Verghese 2013, 521)

In terms of memory, Diyanni (2016, 47) is noteworthy when he refers to Twyla Tharp (2003) who comments: “A well-stocked memory can be a solace in time of difficulty, provide entertainment in times of boredom, and lend coherence and meaning to life.” Treadway (2009, 231) moves even closer to the functions that memory serves for the creative individual when she notes: “The way in which the world is experienced and perceived, remembered and imagined, provides inspiration, sometimes unexpected, for the development of visual representations by artists and designers.”

Material Knowledge of Unknown or Advanced Materials

It is essential to understand the complexity of the term ‘unknown materials’, and to see it with open eyes in relationship to the research problem. The domain of unknown or advanced materials is dependent on the knowledge base of the designer, which is built upon their lived experiences. Each spatial designer has a different lived experience, within which sits their knowledge base. Within this material knowledge-base they would either know or not know a particular material when considering it for a project. This knowledge base is developed through observation and encountering materials in the world of spatial design. It could be said that the less material knowledge that a designer has, the greater number of unknown materials exist for them. When a designer does not know about a material, it would be considered unknown to them. This moment, which could be dismissed as the obvious, lies at the core of this thesis.

As material is the medium in which designers express their outcomes, it is common for designers to have a fairly comprehensive understanding of materials and a desire to expand that knowledge (Hubel and Lussow 1985; Weston 2003; Ashby and Johnson 2003; Coles and House 2007; Schittich 2004). So, when they are faced with a material that is unknown to them, it would quite often be called a ‘*new material*’; if it exhibits different properties, particularly if those properties offer a higher degree of performance, it would be termed

'advanced material'. Therefore, materials that are new or advanced are a sub-set of the domain of unknown materials, as materials are either known or unknown, and whether they are advanced or not depends on their properties. Since each designer has their own inventory of material knowledge, developed from formal and informal education and experiences, it is not possible to define the boundary of unknown materials. Despite the fact that even some advanced materials would be known to some designers, the term will be used here as a test case of what an unknown material might be to a designer.

The use of the term advanced material to signify an unknown material is an appropriate substitution. It allows the body of literature surrounding advanced materials to be linked to the central idea of knowing an unknown material. The research is significant in describing the process of unconcealing the material knowledge of what is presented to the spatial designer when they are first acquainted with an unknown material. The search for what is the material knowledge of the unknown material, together with a deeper investigation into the revealing of knowledge or the unconcealing of the concealed, has been discussed earlier in the framework of Heidegger's concept of *unconcealment* (Heidegger 1977, cited in Krell 2002). This research will question whether this understanding can theoretically inform the design process, which raises the questions: how does a designer confront the unknown nature of materiality? How do they work towards unconcealing the core essence of the material? Would the expansion of material knowledge allow for a richer spectrum of design alternatives for a project?

In their study of designing in a multidisciplinary setting, Niinimäki, Tanttu and Kohtala (2017) discuss the issues of design-driven material innovation (DDMI). They reflect on a challenging question raised at the official startup of their research project in 2015 at the EU in Brussels, in which a designer asked: "How can we design anything if the material properties are unknown?" They explain how "... an unknown material innovation process is based on [a] future innovation approach..." (Niinimäki et al. 2017, S4436). Understanding how the

material innovation process works is only possible by looking at how certain designers experience these new or unknown materials. In this thesis, I explore specifically how spatial designers encounter these types of materials through their situated actions and knowledge.

Lived Experience/Design Process

As material memories and material experiences establish multiple trails of informative points of interest, when the need comes to apply this, a conceptual framework is needed. The development of any sort of design involves a concept—an intentional framework to build upon. Rengel (2014, 140) offers a simple definition of a design concept: “The point of design concept statements is to tell the audience, as efficiently as possible, about the designer's approach to solve the design problem.”

This section of the research domain of the lived experience deals with the lived experience of the spatial designer within the design process. The focus is on the relationship of the process of designing with the knowledge of materials that is innate in the designer. How we access knowledge is a key aspect of the process of design. There is a huge array of literature that addresses the design processes and skill acquisition (Mayall 1979; Hubel and Lussow 1985; Miller 1995; Mitchell 1996; Laseau 2001; Dorst 2006; Lawson 2010). When examining the design process, these authors have constantly referred to design going through a sequence of activities, from observation, through to analysis, synthesis, and communication.

The process also involves the constant search for new ideas or new ways of addressing the issues and problems at stake (Dorst 2006; Diyanni 2016). For many designers, it involves exploring the material world to expand their horizons (Ashby and Johnson 2003; Karana et al. 2014). “Exploring materials is one of the biggest challenges for designers. Today's enormous range of materials requires designers to follow a process of creative and analytical research to find the right material for the right product” (Karana, et al 2014, 284). The process of making design decisions about materials requires the

designer to be informed, either through primary research or through secondary research (Ashby and Johnson, 2003).

Synthesising ideas to create something new often requires few guideposts, as knowing the rules are one aspect of creativity, and being able to break them by stepping into the unknown is another aspect (Doorst 2006; Gallagher 2011; Diyanni 2016). When discussing how combining odds and ends of ideas to create something innovative, Diyanni refers to Steven Johnson's (2011) thoughts on synthesising new ideas in *Where Good Ideas Come From: The Natural History of Innovation*. Diyanni states:

... Johnson (2011) claims that all new ideas are combination of former ideas, and that all inventions are based on aspects, elements, and components of things that already exist. Ideas are typically networks of other ideas; we found and combine them into some new form. (Diyanni 2016, 156)

Diyanni and Johnson both address the learning paradox of being able to create new knowledge from old knowledge. This is a cornerstone of the design process, in which a designer unhinges the old to be able to access the new.

Yet, it is not only the sequential and iterative aspects of the design process that need to be understood. The spatial designer produces work that resides in our world—a world of three dimensions and tangible objects and materials. The lived experience of the design process needs to deal with the processes that the designer engages with within the world, in order to inform and be informed by the design process. This review has already discussed knowledge and memory as it relates to the lived experience. When discussing the lived experience of the design process, the active aspect of the relationship of the body to the design is required. This relationship to perception and the body has been examined earlier through the review of the phenomenological work of Merleau-Ponty.

When Diyanni (2016) writes about critical thinking and creative thinking, he draws from many sources that discuss the ideation process. While many

authors have also discussed the design process (Archer 1965, 1980; Jones 1970; Zeisel 1981; Hubel and Luscow 1985; Miller, 1995; Lawson 1997, 2004, 2010; Julier 2001; Laseau, 2001; Brawne, 2003; Dorst, 2006; Maris 2012), Diyanni's reference to Jack Foster is particularly appropriate in regard to idea generation and the notion of *play*. Foster expands his design process to identify ten strategies:

1. Have fun.
 2. Be more like a child.
 3. Become idea-prone.
 4. Visualise success.
 5. Rejoice in failure.
 6. Get more inputs.
 7. Screw up your courage.
 8. Team up with energy.
 9. Rethink your thinking.
 10. Learn how to combine
- (Foster 2007, cited in Diyanni 2016, 141)

Many of these strategies will appear in this study, but a comprehensive examination of all of them is beyond the scope of this research. Yet his comments about being like a child and being idea-prone are important to consider as we explore insights into material engagement much like a child would engage with a new-found object.

The Design Process in Relationship to Materials

The relationship to the design process and materials is as old as the practice of making space. Humans engaged with materials to create shelters well before there was a theory about materials and spatial arrangements. Pile (2000) describes how the first shelters were either caves or spatial arrangements made with simple tools and materials that were at hand. Throughout the history of architecture and spatial design, theorists and architects have written about the process of building with materials and described a design process that connected them together. Vitruvius, William Morris, Le Corbusier, Frank Lloyd

Wright, and others have all examined the nature of materials as an essential aspect of spatial design, and all have seen materials as a means representing the outcome (Malnar and Vodvarka 1992; Kurtich and Eakin 1996; Conrads 1997; Pile 2000; Weston 2003).

Drexler (2013) discusses the differences in the scientific model and the engineering model of enquiry and design. Both approaches can equally be applied to design: the top-down model of engineering design, which moves in an inductive manner from abstract model to a physical outcome; or the scientific model of deduction that moves from the physical reality to an abstract model. The engineering approach is needed in design when referring to and examining the classification of materials based on prior knowledge, or through the structured articulation of the final outcome; both of these engineering approaches will be described later as a form of *telic* activity. The scientific approach of exploring unknowns has a relationship to design in that it is explorative—noted later as a form of *paratelic* activity. The similarities in the approaches that designers and scientist take were also noted by Ralph Caplan in a comment that addresses the open-endedness of the process of examining an unknown material:

Perhaps the most valid model for the designer of situations is the scientist, because of the open-endedness of scientific experiments. The experiment itself is designed, but the working rules require that the designer does not manipulate the process. The scientist sets up a situation on the basis of reasonable prediction, but in fact he does not know what will happen. Neither does the designer. (Caplan 1982, 143)

It can clearly be argued, in contrast to Caplan's comment about the designer not manipulating the process, that the design process can be manipulated with numerous insights that have been documented as iterative (Hubel and Lussow 1985; Lawson 1994, 1997; Miller 1995; Mitchell 1996; Leupen et al. 1997; Laseau 2001; Brawne 2003; Hudson 2008; Curedale 2013). Yet, within the vast amount of literature on the design process, the ideas of Ashby and Johnson

(2003) are most appropriate for describing a typical design process that involves material selection. In a 2003 text on materials and design, they note that the design process has broadly three phases: concept, development, and detailed design. This is generally similar to process models of other spatial design disciplines, who use the terms: analysis, synthesis, and evaluation (Hubel and Lussow 1985; Ching 1987; Lawson 1997). Markus and Maver (1969) cited by Lawson (1997, 37) combine both approaches, as they state that analysis, synthesis, appraisal, and decisions need to occur at the outline proposal stage, the scheme design stage, and the detailed design stage. Their process map aligns with the Royal Institute of British Architects' (RIBA) handbook for design process (Lawson 2010), and is similar to the concept, development and detail phases described by Ashby and Johnson (2003).

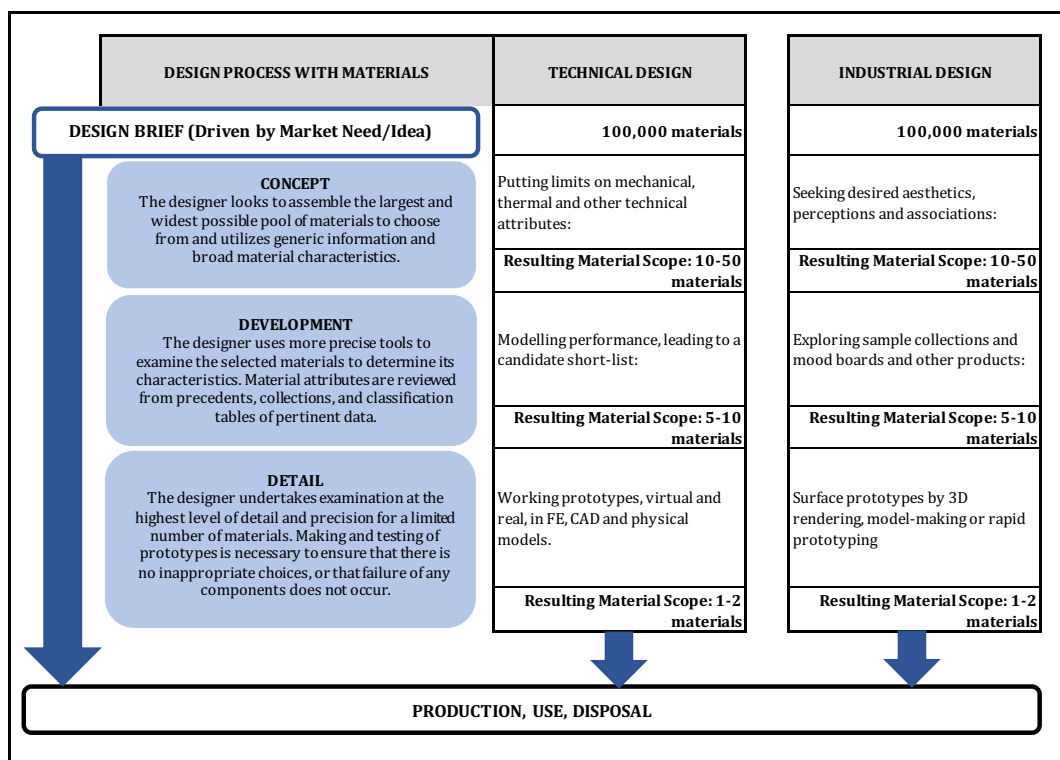


Figure 2.6: Design Process with Materials (After Ashby and Johnson 2003, 32-34)
A flow chart of the three main stages of the design process that involves materials. It aligns with other spatial design process in architecture and interior design and indicates that at each stage the number of applicable materials to meet the project needs diminish.

The design process with materials as it relates to both technical design and to industrial design—a form of spatial design—is described by Ashby and Johnson (2003) and reformatted in Figure 2.6. It describes the stages of the design

process and how these stages relate to the material selection and the scope of the choices available to the designer at each stage.

There are other models of design processes, and Ashby and Johnson (2003) even discuss the non-linear process of bubbles, as presented by Ken Wallace (1991) and published in the first conference on Design Thinking at TU Delft University. His diagram does address the iterative process of design but, like many others, does not address the issues of the lived experience of engaging with materials.

When considering the iterative process of design that projects into the future by understanding the past (Brawne 2003), a sense of the past is necessary as a point of reference. However, within the spatial design discipline, the notion of traditional materials is changing (Farrelly 2009). Technology, cost, and sustainability are key factors that impact whether materials that have been used can continue to be used.

In Search of the Unknown

The design process is the sum of the relationships between designers and technologists and communications people and marketing people and consumers. When I say that design is an exercise in managing knowledge, it's because a designer does not invent atoms or create fundamental concepts; a designer orchestrates material and immaterial things that already exist. He or she gets materials together, uses different media to communicate about a product, and marshals physical and information input so that out of the other end comes products or services. (John Thackara, cited in Mitchell 1996, 113)

The process of design is to seek a resolution to a set of objectives which implies a transformation from one state to another. This explicitly defines a sense of change. As designers, we are constantly seeking new approaches and outcomes, and are in a constant state of becoming something else through our practice (Dorst 2006; Vergheze 2009). Even when using traditional design aesthetics,

there is a search for exactitude in restoration, and a quest for delaying the new and preserving the gap between what was the past and what is the current state of design. The constant advance of time makes more things traditional in the sense that more is now known. Yet this growth of knowledge, in reference to this research—the material knowledge-base—does not quench the desire of designers to continue to explore and extend themselves, therefore prompting them to come into a new state or territory of the unknown.

Despite claims that designers live on the margin (Dorst 2006; Vergheze 2009), it must be also recognised that not all designers have a propensity for the new and uncharted, despite all that is involved with the process of change. As this thesis examines those faced with an option to engage or not to engage with an unknown material, the spatial designers interviewed in this thesis can be considered to be those who would have the potential to take a creative risk.

It needs to be understood that all designers are change agents, as they are tasked with providing an experience that alters the existing state of those whom they are doing the work for, whether a client or themselves. In this state of change, designers constantly deal with uncertainty. Designers feel at home in this space, as it creates a sense of tension that good designers are attracted to in order to elevate their work. Dorst (2006, 111) declares that it “...makes you realize that design is a very risky profession.” Dror Benshetrit reiterates this exploratory spirit of designers when he states: “Often people are sceptics because they do not want to leave their comfortable zone. It is important to follow the most absurd ideas; pushing the envelope is our job as designers.” (Benshetrit cited in Tidy et al. 2008, 193).

As Brook (1980) put it, searching for new horizons as a way to find new ways of being indicates that there is a constant transcendence over a margin towards something new. This research examines the experience of engaging with an unknown material, an act of engagement that takes the designer across a margin of knowledge about an unknown material. A margin, by definition an

edge of another entity, immediately infers the context of the designer. Regardless of the designer's predisposition towards change, facing a margin is an almost indefinable position between what has been and what could be. Designers reflect, react, and participate on this boundary as their very core activity. The margin, or the edge, is a continuous threshold, and like any threshold it opens onto new areas of investigation, so is not necessarily a barrier, but more like a portal. These ideas were also expressed earlier in the review of Deleuze (1994) who discussed difference, flow, and new ideas as crucial elements in his philosophical approach.

This thesis examines the lived experience of spatial designers with unknown materials. In doing so it examines the act that occurs at when the designers are faced with the margin of materiality, as the unknown material prompts them to cross a threshold. Mark Kingwell succinctly describes the function of a threshold as something that "... is not to be wide but to be crossed. Every limit is also its own negation" (Kingwell 2003, 1). It is this transcending or transgression of boundaries that helps define radical innovation and design. O'Shea's (1999) research into innovation and product development and its relationship to Bourdieu's theoretical tools explores breaking the rules. O'Shea states that "[t]ransgression thus means that we must leave behind the profane, rational world to become other by a leap into the void" (O'Shea 1999, 5).

This thesis will examine the designers who are attracted to exploring materiality in their work; the uncertainty of working with an unknown or an advanced material is all part of the natural tension that drives them in their work. For designers—and those interviewed—the margin in which they practice is like a threshold or portal into new ways of investigation, and not a barrier. Gallagher (2011, 34) identifies that scientists refer to this phenomenon as the 'novelty effect', getting excited about something new and then getting used to it.

The idea of novelty is examined in the work of Bayley (1991), who provides a thoughtful investigation into the many facets of taste. His study on art, architecture, design, food, and culture brings clarity to the topic, as he concludes that taste has nothing to do with style. By referencing Laver (1945), Bayley’s work provides insights into what temporal parameters may exist when we consider stepping over a margin and exploring an unknown material. These insights are investigated within this thesis, addressing the question of being novel and innovative, or being traditional in the use of materials.

Table 2.3 Cycles of Fashion (Bayley 1991, xiv, after James Laver *Taste and Fashion*, 1945)

Indecent	<i>10 years before its time</i>
Shameless	<i>5 years before its time</i>
Outré	<i>1 year before its time</i>
Smart	—
Dowdy	<i>1 year after its time</i>
Hideous	<i>10 years after its time</i>
Ridiculous	<i>20 years after its time</i>
Amusing	<i>30 years after its time</i>
Quaint	<i>50 years after its time</i>
Charming	<i>70 years after its time</i>
Romantic	<i>100 years after its time</i>
Beautiful	<i>150 years after its time</i>

In the building industry, Gann (2000, 10) discusses the histories of innovation from the machine age through to the digital age. He argues “... pressures for innovation are strongest when there is demand for radically new types of building structures. This usually occurs during periods of general and widespread technical and economic change” Gann (2000, 10). The challenge of dealing with innovation, novelty, and the unknown goes even further back in history, an area for further research beyond this thesis. However, when

exploring the growth of ideas of the early pioneers of design during the development of the Industrial Revolution of the 1750s, Martin (2006) noted that they were excited about new ideas and the continual growth of new ways of doing things. "... each wave of technology brought with it new ideas for improving things, and the waves picked up speed and followed one another increasingly quickly" (Martin 2006, 18). Complacency and tradition were challenged by ideas that broke the social bonds, and "... transformed attitudes: for the first time, the idea that something was 'new' made it attractive, preferable to something that was traditional, familiar, tried and tested" (Watson 2005, 553). This idea tested the status quo and is something that designers are faced with when looking at new ways of producing outcomes.

Ian and Albert Tidy also note their dissatisfaction with status quo:

Unfortunately, satisfaction is not yet part of our vocabulary. I wish it was but we rather tend to be critical about our work. If you look back to your work and you still like it, it probably means that you haven't moved forward. The favourite work is always the current one. We try to explore a different topic in every work. (Tidy et al. 2008, 9).

These thoughts are echoed by Frank Gehry: "...you can't redo old ideas. The only way to gain is to go forward and not look back. You can learn from the past, but you can't continue to be in the past" (cited in Friedman 2003, 12). Gehry clearly aligns his practice to the future and not having to tie one's approach to past ideas. He says this as a senior practitioner working on cutting-edge projects that redefine spatial precedents. He clearly belongs to a unique group of designers that have become so through exploring materials as a core activity.

The time between when the project starts and when it finishes is the in-between time is the time that the project ideas are incubated. Those who are unfamiliar with the creative process comment on how inefficient creative individuals are, as there does not seem to be any productivity.

Those who study creativity find that the process is by nature contradictory and paradoxical, which is why it can seem so

mysterious. Creative people can be simultaneously hardworking and goof-offs. They can have a laser focus on a task but keep the wide view that lets them see how something fits into the big picture.

(Brown,2009, Kindle Locations 1608-1610)

Bohm (2004, 50) discusses the range of imagination and how it is essential for creativity: “The power to imagine things that have not been actually experienced has ... commonly been regarded as a key aspect of creative and intelligent thought.” He goes on to describe an alternative view, that imagination is a more passive arrangement of images of thoughts arising out of memory. He refers to Barfield’s book *What Coleridge Thought* (1971), which describes a binary relationship between primary imagination and fancy: “Primary imagination is, for Coleridge, an act of creative perception through the mind, in which the images are generally fresh and original rather than derived from memory ...” (Bohm 2004, 50-51). Bohm connects the idea of passive association from memory with ‘fancy’ derived from ‘fantasy’; so the active creation of original images and passive arrangement of images from memory are two facets of intelligent imagination at work in “...composition design, and possibly invention, in the fields such as literature, art, and science (Bohm 2004, 51). Schön (1983, 61) describes the process of generating new ideas.

A practitioner’s reflection can serve as a corrective to over-learning. Through reflection, he can surface and criticize the tacit understandings that have grown up around the repetitive experiences of a specialized practice and can make new sense of the situations of uncertainty or uniqueness which he may allow himself to experience.

Exploring new ideas, or viewing the world through a different lens, is a core trait of a designer; they “... set out to innovate, to cover new ground” (Dorst 2006, 50). In searching for the new, you can look back into your material memory to re-discover, adapt, and re-invent a material experience.

Creative Risk

If we are to venture into new territories and transcend the margins, a degree of risk is inevitable. The handling of risk is essential for designers no matter what discipline they engage in; whether or not the design outcome is focused on avoiding risk, or challenging the norm, risk is integral in any design methodology.

In the opening lines of his book about the invention of creativity, Reckwitz (2017) discusses how it would be incomprehensible and absurd to take the position of not being creative. His detailed study examines the sociological framework that has led to the handling of novelty within society as a driver for the continual existence of creativity.

The revolutionary idea that defines the boundary between modern times and the past is the mastery of risk: the notion that the future is more than the whim of the gods and that men and women are not passive before nature. (Bernstein 1998, 1)

Bernstein traces the story of risk and discusses how its existence today demonstrates the ability to take control of our lives. His thoughts are relevant to this thesis, as the lived experience of spatial designers with an unknown material demonstrates a degree of risk. When they take on an unknown material to be used in their design, they are stepping into uncharted territory. Some designers have a greater propensity towards taking risks than do others. This thesis examines the fine grain of the moment of acquaintance in which the spatial designer is introduced to an unknown material. The issue of creative risk provides a deeper understanding of the design process, particularly as working with a material is central to most spatial design practices.

The majority of designers seek acknowledgment for their identity and recognition for their unique outcomes, which are appreciated and understood by those who use their designs. “Being creative is about making fresh connections so that we see things in new ways and from different perspectives” (Robinson and Aronica 2010, 77). The search for the new is the ethos of the

profession, as it structures its approach to activities by seeking the novel, the new, and the current of ideas that provide the structure for defining itself.

Maton discusses the shaping of *habitus* as described by Bourdieu: “It is our material conditions of existence that generate our innumerable experiences of possibilities and impossibilities, probable and improbable outcomes, that in turn shape our unconscious sense of possible, probable and crucially desirable for us” (Maton 2010, 58). As designers, we are entrusted with the development of experiences through the manipulation of materiality into innumerable experiences.

Education is truly transformative, as it takes us from one condition to another. Education alters our worldview. Designers who are pushing the margins of design in dealing with the unknown are in fact pushing margins that were at one time new frontiers of the unknown. In doing so they are structuring a structure. As Maton (2010, 51): “It is ‘structuring’ in that one’s habitus helps to shape one’s present and future practices.”

The task of a designer is to project the future into the present by articulating a possible outcome to an existing condition. So, at its fundamental level, it is about change and flux, which involves the process of creative risk.

Creative Risk in Practice

Jerrard, Barnes, and Reid (2008) discuss how the designer has to venture into an unknown space beyond the current context to create a culture of creative risk-takers, resulting in design scenarios that are innovative. These designers are often referred to as those who think ‘outside the box’ (Lawson 2004); designers work on the margins, with the periphery as the centre of their activity (Vergheze 2009b). Understanding risk and its relationship to our modern world (Bernstein 1998; Watson 2005) helps to place the designer in context. Risk in explorations in materiality is an essential aspect of this research (Fischmeister 1989; Manning 1999; Ashby and Johnson 2003; Vergheze 2007). Humans are most happy when they take risks (Csikszentmihalyi 2007) but Tuomi (2002, 25)

explains that “... individual creativity often drives change in social practices and also creates tensions in the process.”

Even though there has been research into risk in terms of industry needs (Jerrard, Barnes, and Reid 2008), and pedagogical implications (Lawson 2004), and despite Gallagher’s (2011) study of novelty and change, there is a lack of literature on how a designer experiences an advanced or unknown material in relationship to creative risk-taking. With the continued interest in advanced materials resulting in a growing list of demonstrated design outcomes, and large financial investment into the development of these materials, little research has been undertaken on what happens when a designer fully engages with an advanced material, and then decides to take a risk with the material despite little tacit knowledge of it.

For the professional spatial designer, the issues of liability associated with incorrect specification of a material are highly problematic, and require careful consideration (Veitch, Dixon, and Jackman 1990; Ballast 1992; McGowan, 1996; Guerin and Martin 2001; Coleman 2002; Knackstedt 2008; Piotrowski 2008). Although it is essential to provide protection for the public, the professional direction is often concerned with meeting the legislative codes of practice, and making sure that they make “... safety, health, and welfare the priority in all of their design decisions ...” (Guerin and Martin 2001, 77). However, this demand for professional practice to meet standards is challenged by the demands by clients to have a point of difference in their spaces and a sense of personal identity. To facilitate originality, creative risk is undertaken by professional spatial designers seeking to explore ideas within a project through the use of advanced materials (Verghese 2007). In most cases these designers or firms are individuals or organisations that cannot support material researchers, so they resort to finding their materials through the Internet or, more commonly, through manufacturers' representatives who supply them with samples and product literature (Verghese 2008b). Yet within this innovation network, there has developed a need for more experimental and more innovative materials.

This need is currently met by organisations like Material Connexion®, Transmaterial®, and Materia® (Beylerian and Dent 2005; Brownell 2006, 2008; Zijlstra, 2008). Numerous firms work directly with these organisations, but far fewer work directly with manufacturers to develop brand new materials to facilitate their practice. Firms like OMA (Ferré et al 2004), and Herzog and de Meuron (Ursprung 2002) are forerunners in a new way of practising design as they work collaboratively with advanced material manufacturers.

However, the larger issues of the changing world are often put aside by practitioners, who are engaged with the immediate contextual concerns of dealing with client needs and project brief. It is here that the dynamics of another conflict comes to light: the demands of the profession bearing down on the discipline (Guerin and Martin 2001; Knackstedt 2008; Vergheze 2008a, 2008b). Kemmis (2010) clearly defines practice as a ubiquitous notion and cultural phenomenon and clarifies the relationship of the professional to the client. His work describes how practice is reflexive, and the practitioners are constantly using their work as a means of research to improve their work—ideas that are discussed by Schön (1983) Downton (2003), and Van Schaik (2003), who examine practice-led research, and the reflective practitioner. Kemmis (2010, 3) also draws on numerous theorists that argue that practitioners are “... socially-, discursively-, culturally- and historically-formed.” Through his reading of Bourdieu, Foucault, Habermas, and McIntyre, Kemmis situates practice in material culture: “practice involves action on the material world in the material here-and-now” (Kemmis 2010, 7).

Pierre Bourdieu: Field, Habitus, Cultural Capital, Practice

Bourdieu’s methodology for understanding the interactions of actors in any social space or event involves the terms field, habitus, practice, and cultural capital. Many scholars have pored over his work and discussed the many finer details of his philosophy; the works of Grenfell (2010) and Schirato and Roberts (2018) are two ideal sources for future research. This review only draws on ideas pertinent to the investigation of the spatial designer’s lived experiences and materials.

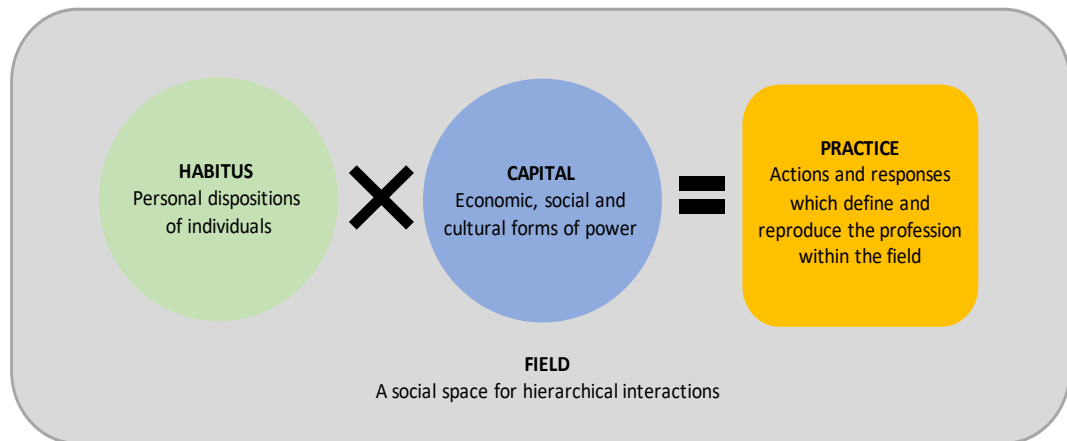


Figure 2.7: Key Concepts of Pierre Bourdieu (Hu et al. 2015, 1127)

The relationship of the key concepts of Bourdieu’s theory of social interaction is illustrated in Figure 2.9. Bourdieu (1984) describes the relationship in terms of an equation: [(habitus)(capital)]+field = practice. Maton provides further clarity: “The equation can be unpacked as stating: practice results from the relations between one’s dispositions (habitus) and one’s position in the field (capital), within the current state of play of the social arena (field)” (Maton 2010, 51).

All the terms are applicable to this thesis in that they provide insights into the lived experience of spatial designers with unknown materials.

a. Field

The social field in which the activities of the spatial designer’s lived experience exist is what Bourdieu calls the field. This social space, in which interactions occur, is a key aspect of Bourdieu’s methodology of understanding the interactions of actors in an event. This device that he uses does not represent anything tangible in the material world, but rather, it is a device used by social researchers to make sense of the world. Thomson describes Bourdieu’s approach to social space as:

... not only locating an object of investigation in its specific historical and local/national/international and relational

context, but also interrogating the ways in which previous knowledge about the object under investigation had been generated.... (Thomson 2010, 67)

This research thesis involves the examination of the practice of spatial designers who viewed materiality as a main driver of their work. Thompson's quote directly relates to the aspects that the designers interviewed in this thesis experienced through their engagement with materials. They interrogated the material and sought to understand it through investigation into previous knowledge and by understanding the context in which they viewed it and its future opportunities.

The world of design can be defined as the field of power, as this is the social space in which interactions occur through a multitude of disciplines and corresponding methodologies that constitute what is considered 'design'. Within this field lie numerous social fields that constitute the entire field of power; education and the profession are but two of these social fields (Bourdieu 1977, 1984, 1990; Fligstein 2001; Webster 2011; Schirato and Roberts, 2018). Bourdieu describes how the social fields can be defined by examining the data of the social agents and mapping it to an economic axis and a cultural axis. The analysis necessary for a full account of the process of mapping the data is beyond the scope of this thesis. However, it is useful to know, as Bourdieu's insights into the dynamic nature of the social fields, and what he calls fields of power—multiple social fields such as educations, the arts, economics—have a direct relationship to this thesis, as design is a dynamic discipline. The paradox of knowledge, which was discussed earlier, indicates the continual pattern of reconstruction, which is similar to the description of social fields, as Thomson describes:

A social field is not fixed, and it is possible to trace the history of its specific shape, operations, and the range of knowledge required to maintain it and adapt it. To do so is to understand how change happens within a field. (Thomson 2010, 70)

This thesis will examine how the spatial designers are actors in the field of design and are engaged in a social field of material knowledge. Material knowledge is not fixed yet has a specific history with the engagement of designers who shape the field and who are being shaped by it. This is what Thomson (2010, 71) referred to as a “...mutual process of influence and ongoing co-construction....”

Schirato and Roberts (2018) discuss the nuances and criteria that define a cultural field. They also discuss the difference in the durability of habitus versus the recalibration of a cultural field to the dynamic nature of social contexts:

A field is a discursive regime or entity and a materiality: the field of cultural production, for instance, is distinguished by forms of dress and address, texts and technologies, and the production, organization and use of space and architecture. However, the material conditions of a field are necessarily an extension of, and take their significance from, the discursive regime of which they are the product: the field is not and never can be reducible to its built environments, institutions or formal organizations, rules and regulations. A field is everywhere but only recognizable in terms of what it brings out—that is, in its capacity to produce significance, identification and ways of seeing and categorizing the world. (Schirato and Roberts 2018, 165-6)

This insight is particularly important in understanding the spatial designer’s lived experience of unknown materials. The field that the designer is part of has many distinguishing elements that help define the designer’s place in the field. As design, being the field of power, has at its core the idea of change and novelty (Mayall 1979; Dorst 2006; Vergheze 2009; Gallagher 2011; Reckwitz 2017), the rules of engagement are an extension of this discursive regime. How the designer relates to an unknown material is an extension of the field—a field that is continually being re-evaluated through the practice of designers.

Although it is valuable to identify the examination of the field, the scope of this paper limits investigation of the three criteria that Bourdieu suggests are necessary. These three areas are: analysis of the positions of the field of power; mapping out the objective structures of relations between social agents in the field; and analysis of the habitus of the social agents (Thomson 2010, 75; Wacquant 1992, quoted in Grenfell 2010, 222). However, this literature review needs to discuss Bourdieu's concept of habitus, which may lie at the heart of our understanding of the lived experience of designers.

b. Habitus

Bourdieu has written extensively about the term habitus, a term that forms a fundamental element of his philosophical insights (Bourdieu 1977, 1984, 1990; Grenfell 2010; Schirato and Roberts 2018). It is a term that is often misunderstood, and even Bourdieu would shift its definition to address feedback that he received (Grenfell 2010). Bourdieu uses the term habitus to describe the articulation of a personal practice in social space. He notes that it is a "a system of durable, transposable dispositions that function as the generative basis of structured, unified practices" (Bourdieu 1984, 170). To unwrap this term completely, as with all of Bourdieu's terminology, would not do it justice in the available space. However, an awareness of this essential device used by Bourdieu in understanding social agents allows for a greater appreciation of the propensity of spatial designers towards materials.

Bourdieu "...defines habitus as 'the durably installed generative principle of regulated improvisations... [that produce] practices'" (Bourdieu 1977, 78 cited in Schirato and Roberts 2018, 144). Habitus is not defined by rules (Grenfell 2010; Schirato and Roberts 2018) but through negotiations and improvisations. This core aspect of habitus allows for the continual growth of the core approach of the designer through re-evaluation, reflection, and through exploration with an unknown material.

Maton (2010, 52) discusses how habitus allows us to draw attention to how we act, feel, think, and participate in our world. It connects to our history and how we engage with it in the present moment, which leads to making choices and acting in a particular manner. He continues:

Our choices will then in turn shape our future possibilities, for any choice involves foregoing alternatives and sets us on a particular path that further shapes our understanding of ourselves in the world. The structure of the habitus are thus not 'set' but evolve—they are durable transposable but not immutable. (Maton 2010, 52-53)

It also refers back to the paradox of learning through the idea of the structured structure—a key idea about habitus (Bourdieu 1977, 1984, 1990; Korp 2008; Grenfell 2010; Crossley 2013). External structures are represented internally within an individual's consciousness; Bourdieu (1984, 170) defines habitus as "A structuring structure, which organises practices and the perception of practices."

When discussing the relationship of habitus and field, Bourdieu describes the notion of the feel for the game, which deals with the anticipation of future events. He states: "... native membership in a field implies a feel for the game in the sense of a capacity for practical anticipation of the 'upcoming' future contained in the present ..." (Bourdieu 1990, 66). He continues with his analysis of this relationship by alluding to the term capital: "The symbolic forms of capital are associated with the well-formed habitus ..." (Moore 2010, 103). The habitus of the spatial designers interviewed, in terms of their approach to materials, will be phenomenologically investigated in this thesis, so an understanding of the term is essential.

In considering the link between habitus and learning, we are led to the notion of becoming. Bourdieu (1990, 67) states "[b]elief is thus an inherent part of belonging to the field." When discussing research training, Lee and Roth state:

Legitimate peripheral participation therefore always also involves transformation of the community, including transformation of its practitioners; it is a constant process of becoming in and belonging to a community that is itself becoming and belonging to the practitioners. (Lee and Roth 2003, 2)

The design profession, which is informed by discipline knowledge, is structured, in that it belongs to a state of being that immediately wants to become something else. This is the state of the profession and the path of a designer as they seek to belong to the profession, which embodies a pre-defined group with attributes worthy of emulating. Becoming can also have ideals that are not defined, and that you aspire to. Bourdieu (1990) would describe this process as a feel for the game, belonging and understanding the rules that govern the field. As a practicing designer and as an academic this challenge is always present in my reflection on my own engagement with projects and also witnessing and educating students who are constantly becoming. This constant state of change is at the core of a designer who exists on the margins (Verghese 2009b).

May (2011, 368) unpacks the links between belonging and social space in such a way that her argument clearly aligns with the practice of design and the process of design exploration: “A sense of belonging is indeed partly achieved on the basis of knowing these unwritten rules and being able to conduct oneself in an ‘acceptable’ manner before others.” Belonging allows us to be at ease in our social field, as we know the rules—the game. Our education and experience guide us to this indescribable point through our quest of being, and in time, developing a full comprehension of this what this being entails in an effort to take the journey of ‘being-towards-becoming something else’. Bourdieu would see this as being in the game and with a durable habitus; negotiation with the external elements of the field allows for a shift in the cultural capital. Being fully aware of one’s habitus in the field of design allows the engagement with cultural capital to impact practice. This in turn has an impact on cultural capital.

c. Habit

Bourdieu's term habitus was used by other philosophers and is often confused with the term 'habit', which John Dewey, Merleau-Ponty, and William James all wrote about (Maton 2010, 55-56; Crossley 2013, 139, 151). Writing about the relationship between the terms, Crossley notes that habit, as Bourdieu suggests:

... denotes mechanical behaviour, a stimulus-response reflex, whereas 'habitus' implies a flexible disposition which, though pre-reflective, remains commensurate with purposive action and in no way precludes intelligence, understanding, strategy or knowledge on the part of the actor. (Crossley 2013, 139)

The research needs to identify this popular topic of habits and how they form, as these spatial designers engage with materials in their lived experience and through that engagement, habits emerge.

Three characteristics have emerged: firstly, we perform habits automatically without much conscious deliberation. Secondly, habitual behaviors provoke little emotional response by themselves. Thirdly, habits are strongly rooted in the situations in which they occur. (Dean 2014, 14)

Habits are considered to involve a sense of meaning and understanding that relates to a practical knowledge (Crossley 2013). This research makes explicit the habits of designers as they engage with an unknown or advanced material. This engagement is an extension of their design process, which seeks to know what the unknown material is and how they can give it meaning in their spatial design outcomes.

d. Capital

Referencing Bourdieu (1984, 240), Schirato and Roberts (2018) identify three forms of capital as: economic (convertible into money); cultural (educational qualifications, and various forms of creative expression); and social (networks,

titles, and the value of a reputation of one's good name). They continue their analysis of Bourdieu's ideas of cultural capital:

Cultural capital can be defined as anything that a field identifies as having value, and that can be exchanged within that field... the production of value—much like the production of meaning—is never an accidental or unmotivated occurrence. (Shirato and Roberts 2018, 178)

This reference to the dynamics within the field of power and the cultural field is one that is constantly being examined by designers. The use of a certain material within the field of power, known as the design discipline, has an immediate impact on the remaining field, and the challenge is either to question or celebrate the application. It is the challenge of whether to maintain continuity or to strive for change (Heskett 1980). Shirato and Roberts also relate Bourdieu's ideas to the notion of this challenge: "...because cultural capital is the primary means through which positions within the field and the orientations of the field itself are modified or challenged, it is subject to fluctuations in exchange rates..." (Shirato and Roberts 2018, 179).

When a designer is considering the application of something new, or even presenting an old idea in a novel manner, the application needs to occur within the game and is driven by the context of that game, in particular, at the time of the introduction to change (Bayley, 1991); see Table 2.2. When dealing with adoption of new materials or material technology transfer, different design disciplines all have different constraints and inherent timelines that need to be considered. See Figure 2.6. Here, the notion of creative risk becomes relevant—a topic covered later in this chapter.

Moore (2010, 102) also offers a critical view of Bourdieu's use of the term cultural capital and through examination of standard social theories, he concludes, "... it can become difficult to differentiate conceptually between Bourdieu's ideas and those traditionally employed in social stratification

theory—cultural capital is to all intents and purposes a synonym for ‘status’ or habitus for ‘socialization’.”

The exploration of materials by designers in spatial practice is supported by the material manufacturing industry, which understands that the noted designers are those most likely to push the manufacturers’ products. This research will examine whether the status of a designer will allow particular designers to have a wider material palate to select from, and if this access may preclude those without the status and cultural capital to address the unknown material in ways that are creative. As the suppliers—in the business to sell more material—would know their materials in the way that they are produced, they require the designers to explore the possibilities of the product, and in a Heideggerian approach, unconceal the material.

Considering that an unknown material is only “unknown” as a consequence of a designer’s material knowledge, as has already been explained, engagement with the material is therefore devoid of status if the material knowledge is available to all those in the field. This leaves the practice—the outcome of the habitus and capital—highly aligned with the designer’s habitus.

e. Practice

There has been plenty of literature on the practice of design from the lens of the final act or outcome of the design process (Blau 1988; Veitch et al. 1990; Gutmann 1997; Borden 2014; Piotrowski 2014), and there has been plenty of literature about the design process (Mayall 1979; Hubel and Lussow 1985; Miller 1995; Mitchell 1996; Laseau 2001, 2004; Dorst 2006; Lawson 2010). However, the view of practice presented in this literature review is about the lived experience and the theoretical lens through which to examine it.

The approach taken toward theory, in this review, is to provide tools to demystify the phenomenon of the lived experience of the spatial designer’s relationship to an unknown material. The insights provide the thinking tools

necessary to practice spatial design that engages unknown or advanced materials. The choice of Bourdieu as a source of theoretical insights provides a framework to act incisively with material engagement. It should be noted that Bourdieu felt that his views were practical in nature, as Webb et al. (2002) discuss when describing Bourdieu's approach to theory. They note that he sees that his work is really a set of thinking tools, and that he does not "...fetishise theory for theory's sake ..." (Webb, Schirato and Danaher 2002, 47).

An important distinction is being made here between theory as a kind of language game almost exclusively involved in and for itself, and theory as something (a 'tool') that enables you to understand and deal with problems and difficulties. Bourdieu's theories are produced by, and always oriented towards, a task.... (Webb, Schirato and Danaher 2002, 47)

For Bourdieu, creative practice involves more than just the artist or designer. Bourdieu rejects the romantic idea of the creative individual who is given a special gift. Instead, Bourdieu sees the output of the artist as a practice that resides in the social field, one in which other agents, such as suppliers, manufacturers, and even clients, are part of due predisposition towards the game (Schirato and Danaher 2002; Grenfell 2010; Webb and Webster 2011; Schirato and Roberts 2018).

"... [B]oth the ability to be creative and the practice of being creative are effects of the combination of individual artists' habitus, and their social and historical contexts" (Webb, Schirato and Danaher 2002, 172). This idea is also reflected in the understanding that innovation is not the outcome of the creative innovator, but that it is based on the network of innovation (Toumi 2002) in which innovative ideas result from the synergy of many component parts. When spatial designers engage with an unknown material, it is only unknown to them, as the industry that manufactured it and the vast array of individuals working to bring the material to the notice of the designers, specifiers, and distributors make up a system that knows the material.

Schirato and Roberts (2018) discuss how Bourdieu's tools deal with a temporal sense. They note that the practical nature allows the habitus to recalibrate and adjust to new conditions. "Bourdieu makes the point that the feel for the game involves, first and foremost, a sense of anticipation, and more specifically an understanding of chronology (past, present, and future), and objectivities" (Schirato and Roberts 2018, 221).

Bourdieu claims that the tools inform and anticipate the future, and it is this relationship of habitus and cultural field that defines the logic of practice (Schirato and Roberts, 2018). This relationship is played out in a continual process of reflexivity, in which Bourdieu describes habitus as:

...structured structures, that is, as principles of generation and structuring of practices and representations which can be objectively 'regulated' and 'regular' without anyway being the product of obedience of rules... the habitus, as the strategy-generating principle enabling agents to cope with unforeseen and ever-changing situations are only apparently determined by the future. (Bourdieu 1977 72)

Bourdieu's philosophical tools allow for a clear understanding of practice that anticipates the future, and through reflexivity, constantly re-aligns itself to what is presented as an unknown. This sense of practice and the habitus that is demonstrated by the designers in this research all contribute to advancing the cultural field of design.

Lived Experience /Application of Design

This last area of investigation of the lived experience is focused on the application of the material knowledge into the world. It is part of the iterative process of design, in which work is progressed and put into the world of spatial design. Engagement with that outcome results with others who would recall that work and place it their material memories. If the final act exists in the completed work that resides in the world of spatial design outcomes, and the

process of engaging with materials—unknown, known, or those considered advanced—lies in the lived experience, this area of investigation is the action of putting the material into the world.

The section will begin with a brief examination of material application in the world of spatial design by designers that use advanced material in their practice. Since this research is focused on what is at the core of the spatial designer's approach to an unknown material, the act of applying the material recognizes the concept of change as a core attribute as the designer stretches to find new material expressions (Mayall 1979; Dorst 2006; Verghese 2009).

Spatial Designer's Practice with Advanced Materials

Interior design is a profession involved with the development of spatial outcomes that are enclosures, whether complete or partial, formed from the manipulation of material matter. As an interior spatial outcome establishes a sense of place within a material enclosure, it is the experiencing of the materials that facilitates this place-making—theoretically examined in Part D.

Spatial design, and in particular architecture and interior design, offer experiences for a variety of users to engage with the interior and exterior of design outcomes (Rasmussen 1964; Lydon and Moore 1994; Pallasmaa 2005; Zumthor 2005). The term 'experiencescapes' was used to describe corporeally immersive experiences (Svabo et al 2013), which supports the notion of the 'experience economy' (the economy impacted by designed experience) as discussed in recent literature (Sundbo and Sørensen 2013). Svabo et al. (2013), refer to the works of O'Dell (2010) and Riewoldt (2002), and express an interest in 'branding-experiences'. The practice of design in the twenty-first century is heavily influenced by the world of visual stimuli (Goldschmidt and Smolkov 2006) as the corporate message is often expressed in the choice of materials and form in the various forms of corporate spatial design. Ideas are either filtered into the community by an individual, or generated by the community (Schultz, 1967). The designer intrinsically engages with these ideas to form a conceptual framework for a given project. Rengel (2014, 140) comments on the

context and stimuli: “... we can say that all projects have salient aspects that become important design drivers. These may be external, such as contextual forces, or internal, driven by function, desired image, or brand characteristics...”

The visual stimuli in spatial experience—which occasionally involves brand identity—is constructed through materials, and it is this aspect of the lived experience that is investigated in this thesis. Design is heavily influenced by visual stimuli—a key component of ‘branded’ environments. Olins (1989) discusses the communication, behavioural, and design audit of an organisation. The latter encompassing all elements from factories, interior offices, showrooms, visual material, signage, and all forms of graphics. The selection of materials assists to communicate these brand elements to their customers through the experience-making properties of materials.

Zumthor elaborates on his approach to the possibilities of materials:

Material is endless. Take a stone: you can saw it, grind it, drill into it, split it, or polish it — it will become a different thing each time. Then take tiny amounts of the same stone, or huge amounts, and it will turn into something else again. Then hold it to the light — different again. There are a thousand different possibilities for one material alone. (Zumthor 2006 ,25)

The subtlety of the quality of a material is captured by Zumthor’s comment and indicates the need to understand the potentiality of a material regardless if it is a traditional material or one that has advanced properties. Engaging in a material that is unknown would also require an ability to sense the possibilities of that material when applied to a spatial design. Potter’s advice to beginners is important to recall, “Don’t be conned into thinking that only new materials or processes are worth investigating. Every material available is strictly contemporary” (Potter 1980, 193)

The application of a materials is informed by the technologies with which we construct these spaces; however, many materials, either traditional or new,

achieve the sense of space/place through advanced technological developments and digital interfaces. The digital databases of materials that include smart materials, nanotechnology, interactive materials, and advanced material fabrication technologies, all thoroughly support the role of spatial designers who use materials towards innovative outcomes. The practice of spatial design is a practice of material manipulation towards an objective. Spatial outcomes have been documented in countless research documents over time, a venture that will not be duplicated here. Instead, a few cogent examples of work will help to highlight how a spatial designer has practiced through a sense of engagement with materials.

The spatial designer addresses the *unconcealing* of the material's being to attain the atmospheric impact that eventually creates a sense of place within a spatial project—an idea derived from the work of Heidegger that has been explained in Part D of this review. Through this process of *unconcealing*, the designers work with matter to address a sense of time and place. Peter Zumthor has been identified as an architect that creates a sense of place through the delicate manipulation of materials (Zumthor 1998, 2005, 2006; Weston, 2003).

When Zumthor was discussing the work of artist Joseph Beuys and some of the members of the Arte Povera group—an Italian anti-elitist art group c.1967—he mentions how he was impressed by their use of materials. He describes their work as being: "... anchored in an ancient, elemental knowledge about man's use of materials, and at the same time to expose the very essence of these materials which is beyond all culturally conveyed meaning" (Zumthor 1998, 8). He continues his comments on materials by aligning himself to this act of revealing, and how the materials are made to be poetic through the manipulation of their properties. He states: "Sense emerges when I succeed in bringing out the specific meaning of certain materials in my buildings, meanings which can only be perceived in just this way in this one building" (Zumthor, 1998, 8).



Figure 2.8: *Kunsthhaus Bregenz, Switzerland by Peter Zumthor, 1997 (photo by Helene Binet)*
(Image source: <https://www.e-architect.co.uk/architects/peter-zumthor>)
Zumthor's buildings demonstrate the poetic use of materials and the *Kunsthhaus Bregenz* portrays the delicate use of translucent glass that highlights the values of the client.

Zumthor is not alone in the profession in connecting with this thought of revealing and unconcealing the essence of the material. Kengo Kuma, the award-winning Japanese architect (Weston 2003; Bognar 2009), clearly captured the idea of revealing in *Anti-Object*.

Materials are all basically the product of action and movement. In most cases, however, materials do not have the capacity to acknowledge that fact, nor do we have the capacity to understand it. Materials have incredibly rich histories, but we don't know how to read them, so materials and buildings remain silent. (Kuma 2007, 67)

His statement indicates that there is a material being that spatial designers do not have the capacity to understand. Kuma briefly refers to the re-examination of Leibniz by Deleuze in *The Fold: Leibniz and the Baroque*, in which he states that: “[t]ime is built and folded into matter, and so cannot be separated from it” (cited in Kuma 2007, 67). Kuma’s connection of time and matter is important to the research proposal to gain insight into a spatial designer’s engagement with a material. This raises a fundamental question: how are time and matter (material) linked in spatial design practice?

Architect Stephen Holl is highly regarded for his delicate work with light and material (Holl 2000; Weston 2003), while he is simultaneously noted as influential in developing a comprehensive understanding of spatial design and its atmospheric properties. He makes the direct connection to philosophical ideas in his book, *Parallelx*: “Phenomenology is a discipline that puts essence into experience. The complete perception of architecture depends on the material and detail of the haptic realm...” (Holl 2000, 68).



Figure 2.9 Bloch Building, Nelson-Atkins Museum, Kansas City by Stephen Holl, 2007.
(Image source: <http://pamdora.com/blog/2007/09/18/stephen-holls-bloch-building/>
Holl has noted that the use of nanogel panels was a key element in his design process.

Spatial design is expressed through materials that define the design. It achieves this through the degree of enclosure of the space that is defined through the use or absence of materials. The type, scale, mass, detail, juxtaposition, relationship to the user, context, and fenestration are all elements of the material that are taken into consideration when designing spatial enclosures (Ching 1987; Abercrombie 1990; Malnar and Vodvarka 1992; Lydon and Moore 1994; Kurtich and Eakin 1996; Weston 2003; Brooker and Stone 2004). It is understood by designers in various disciplines that the knowledge of the characteristics of a material enables them to express their work in a clearly articulated manner, expand the boundaries of their disciplines, and—if a tangible constructed form is involved—would allow the form to perform as predicted in the design. This goes beyond the modernist call for “form to follow function”; rather, it is about the outcome being a consequence of the intent.

Throughout history, architects and makers have established a language of design that reflects their intentions (Smith 1987; Sparke 1987; Malnar and Vodvarka 1992; Pile 2000; Weston 2003). Students studying spatial design discover the wonders of the built environment from Rudofsky’s (1965) *Architecture without Architects*, in which the wonders of material adaption were documented from primitive and indigenous architecture. Students also learn of the classical understanding of materials through the work of Vitruvius and Alberti, which are comprehensively discussed in the studies of architectural history by Sir Banister Fletcher (1975). Tracing a path from the industrial revolution to the present day, Sparke (1987) outlines that design is influenced by the social context of the time and highlights how many design disciplines evolved through their manipulation of materials, through influences from society, and from advances in technology. So not only is the study of spatial design dependent on the understanding of material properties (Yglesias 2014) it is also grounded in the body of knowledge of the discipline that is based on the manipulation of material (Smith 1987; Sparke 1998; Pile 2000; Weston 2003; Beylerian 2007).

Technological developments occur throughout history; thinking evolves and affects performance; inventors alter inherent properties once considered immutable. Ultimately, the innovative use of materials in design comes from designers asking new questions of significance today, particularly about using materials sustainably. For designers, understanding materials opens possibilities of working in innovative ways that take advantage of these materials' innate capabilities. ... Sometimes the more innovative approach is to reclaim sound practices that have been supplanted by technological systems. Using "old" materials to address "new" questions requires understanding the technical capacities and theoretical capabilities of materials. (Yglesias 2014, 1)

Asking new questions is what seems to lie at the core of what motivates designers to explore new boundaries. It is not just about adoption of the new technologies for the sake of just having something new, although the term "early adopters" designates those willing to use new technologies as soon as they become available. The mass production of spatial designs results in the need to be thoroughly conversant with materials (Hubel and Lussow 1985; Ashby and Johnson 2003).

Material research, along with new fabrication technologies, has enabled architects to envision uses for a new palette of building materials. In the hands of young architects these new applications have very often been used to change the nature of interior space. (Rieselbach 2003, 13)

The designer's core seems to be more about curiosity and assessing how that technology will sit within their worldview and approach to design. This research explores this process of engagement with materials to examine whether it is at the core of the designer's lived experience.

Materials have inspired new ideas throughout history and, in doing so, have allowed creative individuals to exploit the properties of material. Despite visual properties of the material being a prime factor in how the designer relates to

the material (Brooker and Stone 2004; Zumthor 2005, 2006), others are equally important in knowing how a designer relates to a material.

Inspiration—the ability to stimulate creative thinking—has many sources. One of these is the stimulus inherent in materials. It is one that, since the beginning of time, has driven humans to take materials and make something out of them, using their creativity to choose function and form in ways that best exploit their attributes. The most obvious of these attributes are the engineering properties—density, strength, resilience, thermal conductivity and such; it is these that enable the safe and economical design of products. (Ashby and Johnson 2003, 169)

Extrinsic factors play a central role in how materials perform in spatial design outcomes (Ashby and Johnson 2003; Weston 2003; Farrelly 2009), and the performance of a material is heavily dependent on its properties. Issues of the context in which the outcome will exist is also a factor that this could include the client and the project brief, site conditions, and external regulations. Presentation to the client of new ideas and materials occurs at various points in the design process (Veitch and Jackman 1987; LeClair 1992, McGowan 1996; Bell and Rand 2006; Knackstedt 2008; Holzman 2008).

Zumthor captures the relationship of client, site and budget to material usage:

I take a certain amount of oak, and a different amount of tufa, and then add something else: three grams of sliver, a key—anything else you'd like? To do it I would need someone to be the owner, so that we could get together and arrange things — first in our heads, and then in the real world. And we would look and see how these things reacted together. And we all know there would a reaction. Materials react to one another and have their own radiance, so the material composition gives rise to something unique. (Zumthor 2006, 23-24)

Reflecting on the design process of engaging with an unknown material, spatial designers always consider the project brief as a catalyst in their approach to materials. “Although we cannot help but see the designer at the centre of the

design process, we must take care not to neglect the importance of the roles played by others, most notably the client” (Lawson 2010, 282).

In a comprehensive report on architecture and spatial design, the Dutch Government published an Action Agenda addressing the need to shift perspectives in how spatial design and architecture was undertaken. “A different way of working is required to allow us to respond effectively to new (market) conditions. There is a need for different methods of cooperation between designers, clients, users and other stakeholders.” (Ministry of the Interior and Kingdom Relations, the Ministry of Economic Affairs, Agriculture and Innovation and the Ministry of Defence 2012, 13). They were not the first to comment on the relationship between client and designer (Lawson 2010, Martin and Guerin 2010), but their statement is important in that the issue is taken up in a government initiative.

Gann (2000) comments on the regulatory and procurement policies that impact on spatial design outcomes and how they shape technological change. Health and safety are core issues for practising designers (Gutman 1988; Ballast 1992; Gann 2000; Martin and Guerin 2001, 2010; Knackstedt 2008). Knowledge of the codes and regulations for safe practice is essential for designers to assure the safety of occupants and those in close proximity.

This part of the literature review has examined the application of the material knowledge into the world. The spatial designers who practice have all had to manipulate materials to achieve their goals. With new and advanced materials comes the possibility of different ways of creating space. This expansion of the material options available to designers has required them to be continuously educated about the new and advanced materials available. Yet it is not the material itself that creates the spatial outcome, whether advanced or traditional; it is the manipulation of the material that creates the space. The core to understanding the manipulation of a material is not necessarily just knowing the properties of the material, it is knowing the inherent intent of the designer,

or their disposition to take such an action. This thesis addresses this issue experienced by spatial designers.

Sparke (1987) discusses material engagement when she writes about how William Morris used the vernacular of materials to demonstrate the honesty of craft and create spaces that were of their time. His dismay at the existing products available for him to use in his Red House led him to extend his arts and craft ideals into manufacturing everything for the home. He rediscovered materials that were local to the area, such as pewter and oak, and incorporated them in his new designs (Sparke, 1987). Yet in the history of design, he is not alone in this questioning of materials and technologies. The gothic builders built their cathedrals that utilised new methods of spanning arches to create more open voids filled with stained glass to create the atmosphere for worship that used the known material of stone in new ways. The modernist pushed the boundaries of space with steel, glass, metal, and concrete, to create new ideals of spatial configuration. From Nelson's use of new materials in furniture (Bosoni 2002) to Novembre's use of gunshots into laminated glass (Novembre 1997), the examination of materials is the constant thread in spatial design history. There are many examples in all fields of design and architecture in which the experience of space was created through material composition—a central factor of spatial design.

Part F: Evaluation of the Gap in the Literature and Summary

Introduction

This literature review examined the three key research domains identified as spatial design, unknown or advanced materials, and lived experience. With a research problem focused on the lived experience of a spatial designer with an unknown or advanced material the theoretical framework that resulted was one of phenomenology.

This review demonstrated that the three research domains are closely linked. It also indicated that the evolution of design over time is tightly connected to the development of material technology (Weston 2003; Guidot 2006; Beylerian and Dent 2007; Moskowitz 2009). The rich and elaborate history of material application rests in a context in which the designer produces work, noted as the world of spatial design. When reviewing spatial design practice throughout history, the work of Sparke (1987), Smith (1987), Pile (2000), Bosoni (2002), Weston (2003), and Guidot (2006) all clearly establish the relationship of materiality to the development of the discipline. This review has also discussed spatial design outcomes and its relationship between place-making—a vital aspect of spatial design—and the impact of material application within those spaces. Spatial design is the first research domain reviewed. Within this domain sits the outcomes that involve the use of advanced materials.

This review has defined a problem that involves the lived experience of an unknown material. It has determined that the definition of what an unknown material is, is particular to that designer, as all designers will have a different material knowledge and material memory. The term ‘advanced’ has similar constraints, based on the knowledge of the designer, yet it could be considered unknown when first experienced. The second research domain is defined as that of unknown or advance material. There has been plenty of research into materials from a scientific perspective, a user’s perspective, and from one that looks at the final outcome and how the application of a material—advanced or known—adds to the body of the discipline.

The third research domain was that of lived experience of the spatial designer engaging with a material that is unknown and may demonstrate properties of advanced characteristics. This domain consisted of three areas: the designer's knowledge; the design process; and, the application of materials. These address the question of how the lived experience occurs. In order to enrich an understanding into how the experience occurs a grounding in the theoretical insights of key phenomenologists were discussed. The theoretical underpinning of phenomenology was useful to provide a foundation to the lived experience of the access of knowledge, the design process, and the application of materials.

The two philosophers that shed light into the research problem were Heidegger and Merleau-Ponty. In reviewing the design process, Bourdieu provided theoretical tools to aid a deeper understanding of the habitus of the designer, and how that exists in practice. All of these insights clearly relate to the act of engagement with unknown material, but there seems to be very limited explicit literature on spatial designer's lived experience with a material that is unknown to them, despite literature on technological change and social change (Gann 2000; White 2002; Kieran and Timberlake 2004; Senge et al 2004; Wright 2004, Arthur 2009; Gessinger 2009; Gallagher 2011).

This final section of the literature review will reflect on the core ideas coming out of the investigation in light of establishing the existence of any gap in the existing knowledge. It will also conclude by indicating the need for this research and how it can benefit the designer.

Key Insights

Spatial Design Provides the Context

The review provided insights into the ideas that define spatial design. It is an evolving term that is practiced in the fields of architecture, interior design, and landscape design. Yet the review discussed how space is seen as a relationship between other entities that creates a sensory and cognitive impact on a user of the space. The correlation of the solid and the void is determined by the presence or absence of material. Our sense of place is largely determined by

engagement with the spatial conditions that we experience. An alternate view of space being one that flows relates to the work of Deleuze and how he discusses the ideas of difference and repetition. Material that defines that space exists in a temporal mode and we experience space temporally as the material state will change in time.

The practice of spatial design is constantly in conflict with the two opposing demands of continuity and of change (Heskett 1980). Although designers have a propensity to move to a more dynamic and less traditional state of design (Bayley 1991; Verghese 2008b, 2009a, 2009b), socio-cultural and economic demands quite often dampen their enthusiasm for change. Yet despite these pressures, designers constantly seek new ways of expressing themselves in their final outcomes, which help them address complexity in a changing world (Lawson 1997; Vaske 2002; Adjaye 2007; Gallagher 2011). Many designers and theorists have written about change and discussed the range of transformations occurring in our world (Mau 2004; Thackara 2005; Martin 2006; Stefan 2006).

Notable designers who have changed our understanding of products, spaces, and architecture, are all individuals who have explored materiality at the margins by constantly trying new approaches to techniques, materials, and technologies, often with improved utility, use, market appeal, or cost benefits. Wedgwood, Boulton, and Pritchard were key pioneers and early material change agents in design, who looked at new glazes and ceramics together with new metals like ormolu and cast iron (Sparke 1998). Early modernists and art nouveau architects such as Horta and Guimard, through to the work of Wright, Breuer, and Neilson, all demonstrated an understanding of spatial design that evolved through their explorations with advanced materials (Pulos 1990; Sparke 1998; McCarter 2005). Currently the list of practicing designers is far longer, with Newson, Herzog and de Meuron, Diller and Scofidio, Tokujin Design, Gehry, Kuma, Yabu Pushelberg, and OMA, to note a few who search the margins of materiality in their work (Rawsthorn 1999; Jodidio 2001; Matsuura 2002; Ursprung 2002; Friedman, Gehry, and Sorkin 2003; Ferré et al. 2004;

Schittich 2004; Kuma 2007; Bogner 2009; Norwich 2009). Their practice and final outcomes aid this research in identifying the context of field in which the designer occupies.

Unknown Materials Expands the Material Vocabulary

New material technology has been identified to have an impact on our built environment (Mau 2004; Thackara 2005; Martin 2006; Stefan 2006). Mau (2004, 140) is the most provocative when he states: “We will build intelligence into materials and liberate form from matter.” Spatial designers can be described as change agents, as they are tasked with the role of creating environments for the use by, and habitation of, living beings. In doing so, they search for new discriminations to describe reality or extend it. These new outcomes address the constantly shifting socio-cultural perspectives.

Every designer has experienced the moment of being introduced to an unknown material, and with the growth of advanced materials available to designers, this common moment of engagement will not cease, but will likely increase in regularity. Gessinger (2009, 2) states, “Materials are mostly part of very complex systems...”, which he follows by noting that a material may be used for a small part of another material system. In much the same way this idea of spatial outcomes within other spatial outcomes aligns with Deleuze’s ideas of difference and flow. This research will examine the idea of questioning whether the choices that the designer may make with a material has other impacts. The review indicated the iterative relationship it has throughout the lived experience from the material memories, and design process into the final application of the material.

The material that is presented to the designer who may not be aware of its existence prior to the encounter, is a material that generally has not been manufactured for a particular discipline—a polycarbonate fibre may end up as a structural element; part of a piece of furniture; or as a fashion accessory. The material is not discipline specific. Yet it can be said that there many materials

that tend to be used only in one discipline which is only by habit of use and generally not by the manufacturer's intent.

The selected spatial outcomes that have been described in this review indicate a particular use of a material, or a material methodology prescribed by the designer. The designer works with materials that contribute to the experiencing of the spatial outcome. The materials selected may demonstrate advanced properties. Professor Toshiko Mori—a leading researcher in new materials at the Harvard Design School—commented on phenomena and how innovative materials play a role in developing sensory beauty: “We predict that the development of innovative materials must take place in parallel with new approaches to engaging human senses” (Mori 2002, 63).

Knowing and Living with Materials

At the heart of this thesis is the lived experience of the designer. The literature review discussed insights that provided a depth of understanding of the engagement that occurs. If the lived experience begins by the act of knowing, then the knowledge of a material is essential. Heidegger's view of *unconcealing* provides phenomenological insights into knowledge. Finding the truth was the core of his exploration, and this is much like the journey of a designer when faced with something unknown. This research will need to explore this premise of seeking to discover and in doing so what factors play a part in that discovery process. Heidegger's approach to discover the lifeworld of an individual that is revealed in the everyday experience links clearly with the discovery of the knowledge of a material. Heidegger view on technology is also crucial as he explains that the idea of search and the process of search is central to the question of the unknown. Yet there is always a pre-understanding inherent in a search. Again, this insight is useful to examine in this research of designers. How do they search and what pre-understanding is there for them, and how is that built upon in their lived experience? These questions could provide knowledge of the process that they undertake.

Merleau-Ponty provided an additional phenomenological lens to examine this engagement. He explored perception and the embodiment of the seeker with that which is perceived. This allows for an experience beyond just the sensation as he explains that there is an understanding that is achieved through composite experience between the senses. Merleau-Ponty expresses the ideas that the tactile experiences allow the seer to know the thing rather than just the object. Knowledge emerges from embodied engagement with the material world is a view that Merleau-Ponty expresses and is one that is worthy of questioning with this research to see whether or not the designers feel a connection with the material interobjectively or intersubjectively.

The review also provided insights into the connection of placemaking with material allocation through the writings of de Certeau and Lefebvre that support the understanding of the relationship between the two. Yet this investigation rests on the outcome achieved and the lived experience of the outcome rather than the lived experience of the unknown material.

Equally Bourdieu's ideas of the actions of an individual in the social field who participates with cultural capital through their own personal dispositions, or habitus, that results in actions in the professional field of practice is valuable to understand the grand narrative of how the elements relate. However, the understanding of how that experience occurs is with a material is not documented from a designer's perspective.

Seeking knowledge about an unknown material is embedded in the experience of it. The literature is rich on the topic of knowledge, and the acquisition of knowledge as seen throughout history from different philosophical perspectives. There is also a wealth of understanding of the learning paradox in which new knowledge comes from old, which is also the domain of the design process. Despite knowing of material classifications, and the application of the design process with available technologies there is limited understanding of the actual lived experience of a designer with a material that is unknown. Exactly

what is the process that they would go through to engage with this learning paradox around materials is worthy of investigation which this research will address.

Finding the Gap in the Knowledge

An unknown material comes into existence through a manufacturing process, and the designer engages with it to create a spatial design. The material scientist, engineers, and manufacturers have produced manuals and data that clearly define the material. The designer goes through the design process from a client brief to a completed outcome in which the engagement with this material may occur. The unknown properties of the material may or may not be advanced but upon first engagement it is different than others that are known but through use it enters the material lexicon of use. It is clear that all materials were at one moment in time considered to be unknown to the person that first used them; the material may be seen by a novice designer, or even by an experienced designer who is unaware of that particular material. The unknown qualities of the material will give the material a sense of being novel and new.

The outcomes of the work of spatial designers using materials are well documented throughout history and sit in the world to be experienced by all that encounter it. Although this history of design and of the lives of designers are known, and copious amounts of literature and databases exist on materials driven the speed of progress that accelerates the need for new technologies and materials, there is scarcely any literature on the human engagement process with materials from a designer's perspective.

The gap that clearly exists is not in how materials have been used by designers, nor is it about the materials themselves, it is about the experience of the engagement. Literature on phenomenology (Moran 2000; Merleau-Ponty 2004; Van Manen 2014) all discuss the how examining through a phenomenological gaze in which the ordinary becomes quite extraordinary. The literature reveals that our focus has been on the external outcomes of the spatial designer with materials, but all material engagement starts with the first exposure. At that

moment they are attempting to uncover something that is presented to them—an idea that resonates with phenomenological research as explained by Turner:

This property of 'hiddenness' is the target of phenomenological inquiry, the goal of which captures and describes new information for others. It becomes a hermeneutic exercise as the researcher strives to also interpret this meaning in relation to the world.
(Turner 2009, Kindle Locations 95-97)

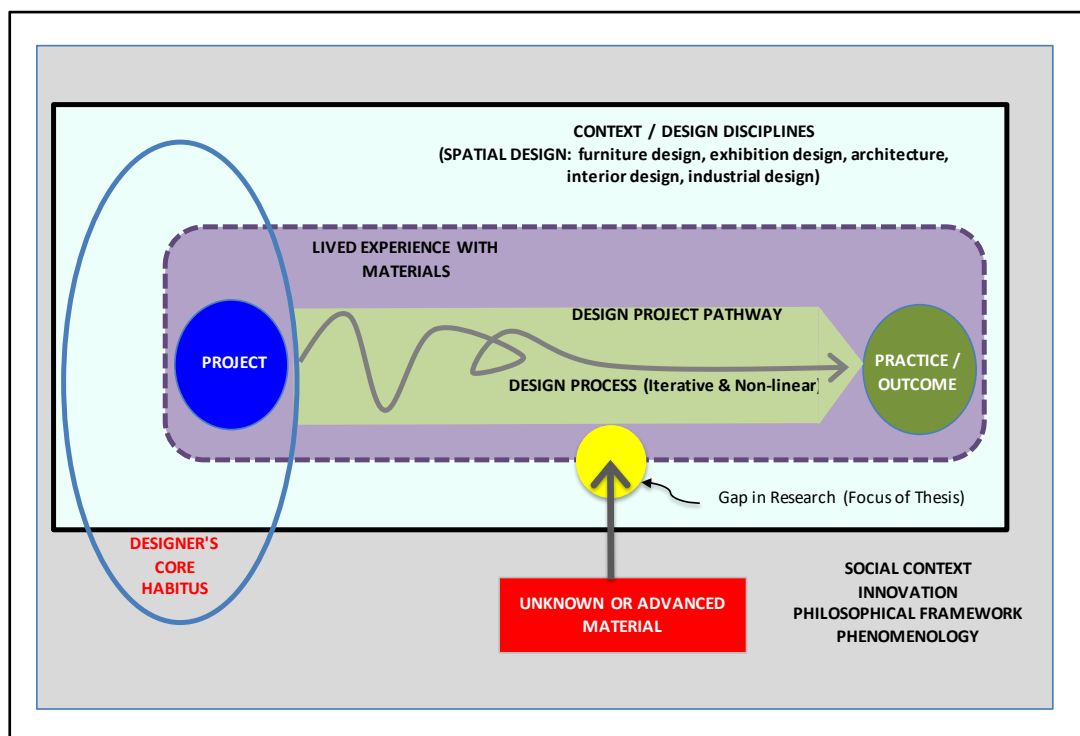


Figure 2.10 Key Aspects of Literature Review

The iterative experience of a designer moving from a project brief to an outcome along a project path is interrupted with the engagement with an unknown or advanced material. This point represents a gap in current research and is the focus of this research.

The use of advanced and novel materials within spatial design is an approach that has existed in the past to varying degrees, and as Basalla (1999, 64) notes, the diversity of material objects is “...proof that novelty is to be found wherever there are human beings.” Yet whether or not the material is novel or not is not at the heart of this research. The literature has indicated, through the work of Bourdieu and Heidegger, that what may lie at the core of the designer, or his habitus, is a constant restructuring. It is proposed that the becoming of the designer is connected to their engagement with their understanding of

materials, which aids them in their practice. The literature indicates a gap in truly understanding this moment of engagement with a material by a spatial designer. This gap in the literature will be addressed in this research.

Architects and other design theorists have written about the relationship of time, meaning, and memory to the practice of spatial design (Weston 2003; Zumthor 2005, 2006). Furthermore, the relationship of time to materials has been discussed by others over time. Hamilakis and Labanyi cite Bergson: “Henri Bergson has taught us that a fundamental property of material is its duration, its ability to defy linear, modernist conceptions of time, seen as irreversible movement and progression” (Hamilakis and Labanyi 2008, 5). This notion of movement is reinforced by Deleuze (1993, 1994) in his consideration of space and the flow of materials seen in a temporal manner. Yet within the vast literature on design theory informing practice (Nesbitt 1996; Flusser 1999; Taylor and Preston 2006; Brooker and Weinthal 2013), there is a gap in the literature around the process of acknowledging and knowing a material that is unknown and will be used in a spatial outcome to provide function and meaning to a space.

This literature review explores the principle that materials make up our world, and that it is essential to have a thorough understanding of the engagement with them. A counter view by Flusser is based on what he cites as the misreading of the Greek word for material by the Romans (Flusser 1999). He recounts that the Roman word “*materia*” is a translation of the Greek word “*hyle*”. Flusser discusses how the Greeks used that term to be the opposite of form, which they referred to as “*morphe*”. Flusser explains that this *hyle/morphe* or *materia/form* relationship is currently very important. Somehow, it seems that the original concept of matter as a temporary filling of eternal forms is returning. One example he gives is table; he sees wood in the form of a table; however, as hard as it is, the state is transitory, since it can be burnt and decompose into ash. Thus, the form of the table is real, and the content of the table (the wood) is only apparent (Flusser 1999)—an idea not

dissimilar to that of Deleuze (1994). This contradictory view that material is not the dominant factor in spatial design, and that it is secondary to form, is a valid point to pursue, if the thesis is about the relationship of material to form or about the Deleuzian view of spatial design, but it is firmly on the lived experience with a material that results in a form that is a spatial outcome.

Summary

The literature review has looked at: the three domains of the act or the spatial outcome in the world of design; the medium in which the designer constructs spatial outcomes, the material; and lastly, the lived experiences in engaging with this act in terms of gaining knowledge from it and making new spatial outcomes through a process. The focus of this research is the engagement with unknown or advanced material.

The review has led to an understanding that the designer may have a state of being that could be termed their habitus. This is a disposition towards utilising materials to issue a change through their practice that adds to the cultural field. The manipulation of materials to design a spatial outcome first starts with the engagement with the material, as Bogner discusses the work of Kengo Kuma (2009, 40) he states that “Kuma approaches each project first by thinking about materials.” Alberto Meda—a designer noted for his use of materials in highly creative ways—states, “During the design process I try to formalize the idea, holding on to a physicality of a material or a process” (Meda cited in Karana et al 2014, 267). This investigation into material engagement has not been thoroughly referenced in any literature until now.

If knowledge is about a process of *unconcealing* to achieve an understanding of what is at the core of that being observed, then the process of *unconcealing* needs to be understood as it applies to spatial designers *unconcealing* what the being of the unknown or advanced material might be. This gap in the literature (See Table 2.4) is depicted in Figure 2.10 that shows the moment of engagement with an unknown material. Current literature on the design process comes

closest to understanding the territory, but it is never explicit about the process of engagement with a material. There are also countless journals, reference books, websites, and organisations, that specialise in information about materials. Design education also emphasises the practical classification and sciences behind material selection. These are all extremely useful, yet the gap in the literature is the explicit understanding of how to engage with materials that are unknown or advanced. This knowledge of a process will assist with the overall design process and will be highly significant in understanding the potential of a material.

Table 2.4: Key Authors and Gap in Existing Literature

RESEARCH DOMAINS		EXISTING LITERATURE	KEY AUTHORS
World of Spatial Design	PROJECT	Literature exists that discusses the opportunities for advanced materials that effect professional project briefs. There are also numerous authors that have written about project typologies, and professional practice.	Ashby & Johnson (2003), Coleman (2002), Gann (2000), Guerin & Martin (2001), Kemmis (2010), Kieran & Timerlake (2003), Knackstedt (2008), Knox & Ozolins (2001), Lastres (1994), McGowan (1996), Mori (2002), Moskowitz (2002), Piotrowski (2014), Ritter (2007), Schropfer et al (2010), Travi (2001), Veitch et al (1990), Zumthor (1998, 2005, 2006).
World of Spatial Design	CONTEXT	Literature exists that deals with the external demands on spatial design practice and the impact of the advanced material revolution. Government legislation, innovation, socio-cultural ideas, and sustainable issues are discussed by various authors.	Arthur (2009), Exner & Pressel (2017), Gallagher (2011), Gann (2000), Kieran & Timerlake (2003), Knackstedt (2008), Lastres (1994), Martin (2006), Mau (2004), Malnar and Vodvarka (1992), Schropfer et al (2010), Sparke (1987, 1998), Stefan (2006), Thackara (2005), Toumi (2002), Watson (2005), Weston (2003).
Lived Experience /	DESIGNER'S BACKGROUND	Design journals and research documents on the history of design	Abel (1976), Ashby & Johnson (2003), Bayley (1991), Bognar (2009), Bosoni (2002), Conran &

<p>Designer's Knowledge</p>		<p>clearly describe the lives and projects of many designers. What knowledge is used and how knowledge is attained is also examined from secondary sources.</p>	<p>Fraser (2004), Cross (1992, 1999), Dolan (2005), Csikszentmihalyi (2007), Dorst (2006), Eichenbaum (2010), Friedman et al (2003), Gessinger (2009), Guidot (2006), Heidegger (1962), Hubel & Lussow (1985), Kuma (2007), Laseau (2001), Lawson (1997, 2004, 2010), Norwich (2009), Polyani (1974), Prawat (1999), Pulos (1990), Rawstorn (1999), Rohmann (1999), Smith (1987), Sparke (1987, 1998), Schittich, Tidy et al (2008), Van Bezooyen (2004), Weston (2003).</p>
<p>Lived Experience / Designer's Knowledge/ Material Memory</p>	<p>LIVED EXPERIENCE WITH ADVANCED MATERIALS</p>	<p>Limited literature exists on how designers think in relationship to their experience of advanced materials. Very limited literature exists that discusses the lived experience of a designer that is introduced to an unknown or advanced material for the first time and the associated risk, this is only through text on affordances.</p>	<p>Bonaccorsi (2006), Gibson (1986), Karana et al (2014), Kropotova, Lawson (1997, 2004, 2010), Tidy et al (2008), Vaske (2002), Verghese (2007, 2008, 2009), Yglesias (2014).</p>
<p>Lived Experience / Designer's Knowledge/ Material Memory</p>	<p>LIVED EXPERIENCE WITH BEING INTRODUCED TO AN UNKNOWN OR ADVANCED MATERIALS</p>	<p>Scant literature exists that discusses the lived experience of a designer that is introduced to an unknown or advanced material for the first time and how they would engage with the material in a process.</p>	<p>GAP IN LITERATURE</p>

<p>Lived Experience / Design Process</p>	<p>DESIGN PROCESS</p>	<p>The design process is clearly defined in numerous texts. The relationship to material selection as part of the process is also discussed in terms of material properties, aesthetics, and functionality.</p>	<p>Ashby & Johnson (2003), Diyanni (2006), Dorst (2006), Gallagher (2011), Hubel & Lussow (1985), Lawson (1997, 2004, 2010), Mitchell (1996), Pile (1995) Schittich(2004), Schön(1983), Thackara (2005), Tidy et al.(2008)</p>
<p>Lived Experience / Application of Design</p>	<p>OUTCOME</p>	<p>Design journals and history texts are the main source of literature that document the final outcomes of design briefs that explore advanced materials.</p>	<p>Adjaye (2007), Bogner (2009), Ferré et al (2002), Friedman et al (2003), Jodidio (2001), Kuma (2007), Kurtich & Eakin (1996), Malnar and Vodvarka (1992), McCarter (2005), Matsuura (2002), Pile (2000), Rawsthorn (1999), Schittich (2004), Sparke (1987, 1998), Sueyoshi (2004), Thompson (2007), Ursprung (2002), Weston (2003).</p>
<p>Lived Experience / Application of Design</p>	<p>PRACTICE</p>	<p>Literature on the theoretical stance on what drives a designer to practice. Research papers, and texts are the main source of literature.</p>	<p>Bourdieu (1977), Grenfell (2010), Lefebvre (2004), Schirato & Roberts (2018), Wrathall (2011).</p>
<p>Unknown or Advanced Materials</p>	<p>ADVANCED MATERIALS</p>	<p>Literature that discusses the science, economy, and practical application of advanced material innovation. In the last two decades resources have appeared that document the properties of advanced materials that are available to spatial designers.</p>	<p>Antonelli (1995), Ashby & Johnson (2003), Ball (1999), Berlerian & Dent (2005, 2007), Braddock & O'Mahony (1999, 2005), Brownell (2006, 2008, 2010, 2011, 2012), Drexler (2013), Leydecker (2008), McQuaid & Beesley (2005), Manzini (1989), Mau (2004), Moskowitz (2009), Quinn (2011), Ritter (2007), Seymour (2008), Van Berkel (1999), Zijlstra (2008).</p>

The gap in the existing knowledge, as seen in the research domains of this thesis, is identified as an explicit knowledge of how to engage with an unknown material, and to allow that process of engagement to remain central to the design process.

This literature review has covered the pertinent topics of three research domains that allow for a thorough understanding of what has been said about the problem of understanding the lived experience of spatial designers with an unknown material.

Ashby and Johnson (2003) provide a thorough study of materials and techniques for the spatial designer to utilise—particularly the industrial designer, but equally applicable across design. They begin their study by noting how humans have the ability to design and create things out of materials, and—an extremely important insight in relation to this thesis: “...the ability to see more in a material object than merely its external form” (Ashby and Johnson 2003, 1). This key insight—never elaborated by the authors—is the central aspect of this research. The lived experience of a spatial designer with the technology concealed in an unknown material represents a gap in our knowledge in the field of spatial design.

We can ask ourselves if the practical knowledge of a material will suffice to provide all the understanding necessary, or is it also the actual handling of the material? Other questions arise from this review, in terms of the willingness to act and step outside comfort zones to take creative risks. Yet the moment of first contact with the material—although being essential in material knowledge acquisition—has not been addressed in literature; the actual handling of the unknown material is a key aspect that needs investigation. It is clear that the gap in our understanding of this moment of engagement with an unknown material is worth further investigation. In the following chapter, I explore how I frame this empirical study.

Chapter 3:

RESEARCH METHODOLOGY

Introduction

This chapter articulates the research investigation undertaken in this thesis. The components of the study are focused on the engagement with a material that is unknown to the spatial designer. This lived experience is examined in a qualitative manner to understand the phenomenon. From the findings of the literature review of research into core components the use of phenomenology as the appropriate choice of a research methodology emerged. Giorgi states: “Another quick definition of phenomenology is its identity as a method for investigating the structures of consciousness and the types of objects that present themselves to the consciousness” (Giorgi 2009, 87). This view supports the decision to use phenomenology as a methodological lens to examine the data presented in the interviews about a designer’s everyday experience.

At the most elemental level, we are constantly caught up, unselfconsciously, in the everyday flow of experience. As soon as we become aware of what is happening, we have the beginnings of what can be described as ‘an experience’ as opposed to just experience.
(Smith et al. 2009, 2)

This thesis used Interpretative Phenomenological Analysis (IPA) as a methodology that interpreted the descriptions of the participant. It is selected because it allows for exploration, description, and interpretation of the sense that participants make of their experiences. In Tuffour’s (2017) critical overview of IPA as a research methodology, he examines the nuances of the lived experience and sees that the “taken-for-granted experience” ideally locates this research methodology. IPA is not a methodology about testing hypotheses but about understanding the personal experiences in the world (Howitt 2010).

This chapter begins with a brief discussion of the phenomenological research methodology that informed the approach to the data. This is followed by the four key areas forming the main content of this chapter, documenting: the development of the research problem; selection of the methodology; the research design; and the details of the co-researchers/participants involved in

the research. A discussion of the ethical considerations, trustworthiness, limitations, and delimitations of the research concludes the chapter.

Structure of Research Methodology

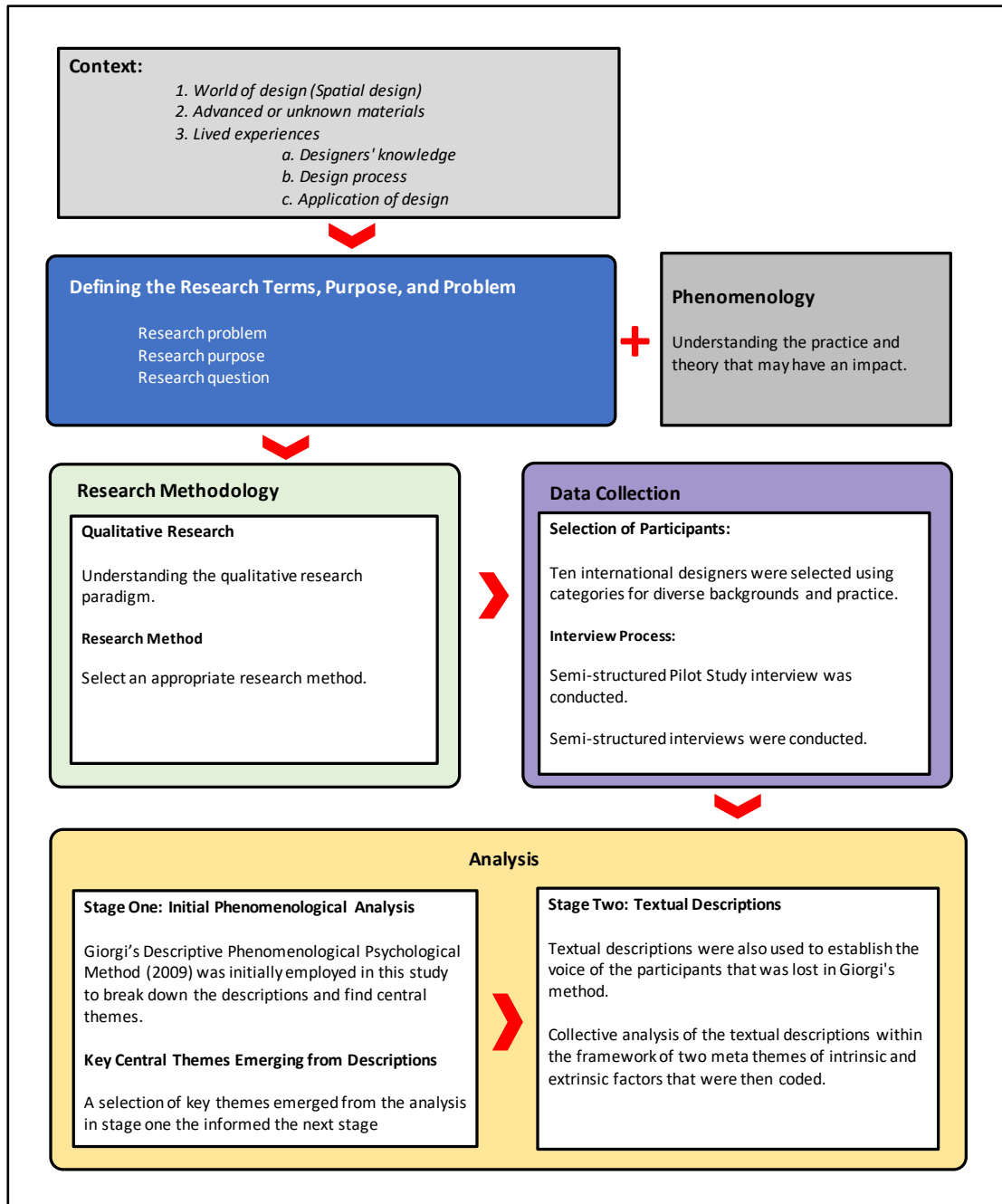


Figure 3.1 Research Methodology Flowchart (See Appendix D for a Detailed Version)
 The context of the problem informed the various steps of the research methodology.

A methodology refers to a way of gathering, sorting, and analysing data (Polit and Hungler 2004). It is a means of obtaining and organising information

collected by following a process and a strategy for investigation (Mouton 1996; Polit and Hungler 2004). It involves the design, context, sampling, data collection, methodological limitations, and analysis techniques (Burns and Grove, 2003). Chilisa describes methodology as the “place where assumptions about the nature of reality, knowledge, values, and theory and practice on a given topic converge” (Chilisa 2012, 162). This view is especially suited to the research purpose of this thesis, in which the nature of the reality of spatial designers’ lived experience is examined.

The research methodology followed a structure that built upon the context of the problem and a phenomenological base that gathered, sorted, and analysed data (See Figure 3.1).

Phenomenological Research Methodology

...phenomenology is not a singular concept, idea, or methodology. And even though phenomenology(ies) stem from a set of similar philosophical commitments and underpinnings, phenomenological methodologies understand, interpret, and apply the philosophy differently. (Vagle 2014, 51-52)

Understanding that phenomenology aims to address the essence of the lived experience, the next decision was to choose the appropriate phenomenological approach. A meta-view of phenomenological research indicates that two approaches are taken: the descriptive (eidetic) approach as established by Husserl; and the interpretive (hermeneutic) as described by Heidegger (Cohen and Omery 1994). As research indicates (Dahlberg 2006; Finlay 2008, 2009; Giorgi 2009; Vagle 2014), there are many ways of examining lived experience with phenomenological research methodology. Vagle (2014, 51) references the work of Finlay (2008) and highlights the different approaches of phenomenological research as:

- Descriptive empirical phenomenologist:

The focus is the written descriptions by the participants in an attempt to

understand these protocols and attempt to determine the essential and general underlying structures to the phenomenon.

- Heuristic researcher:
The focus here is not the question being asked. The research outcome could be a composition of descriptions and creative synthesis of the data.
- Lifeworld researcher:
The focus of a lifeworld researcher is on the participants' self-identity and embodied relations when experiencing the phenomenon being researched.
- IPA (interpretive phenomenological analysis) researcher:
The individual experiences of the participant are the focus, in which the researcher compares the experiences between each of participants.
- Critical narrative approach researcher:
The focus on this approach is on the stories that the participant may tell in the process of being interviewed, and how they could be co-created in the research context. This could occur with just one participant.
- Relational researcher:
Similar to the critical narrative approach in which one participant could be interviewed and self-identity and creative adjustment may be developed. Additionally, the researcher and participant may create a dialogical research encounter through the relationship and reflective nature of the research.

All of these methods have a varying degree of descriptive or interpretive emphasis. They go beyond the common breakdown of descriptive and interpretive phenomenology, as indicated by Matua and Van Der Wal (2015). Variability in approach is a core attribute of phenomenology. As described earlier, phenomenology is about a new way of seeing the world and is not fixed on principles or standards; combinations and variability are applicable, as is the essential need to maintain rigor.

Research Problem and Purpose

The research problem is exploratory in nature, so in keeping with the phenomenological approach, it is not a problem to be solved, but a purpose to achieve a greater understanding of the context. The problem is to explore the factors that may provide insights to aid understanding of the lived experience and context to address the purpose of this research.

As huge advances have occurred in material technology, designers who are tasked with the role of engaging with materials to incorporate them into their design outcomes have not been examined to understand their relationship to materials that are unknown and advanced in their attributes. The purpose is to understand an aspect of the social world of spatial designers through descriptions of their lived experiences from their perspective. The research will examine if there is a relationship between the act of taking creative risks with materials and the design process of material engagement.

The literature review has indicated the huge developments in material science with the corresponding market growth and availability of advanced materials. It is argued that at the core of the definition of an advanced material lies the notion of novelty. The material is new, novel, and unknown to the designer when they are first exposed to it, and their interest is triggered by the novelty prior to knowing whether the material has advanced properties. Once the designer is aware of the material, and they become accustomed to using it over time, the material then ceases to be new, novel, or advanced. However, an unknown material is always unknown until it becomes known to the designer. This moment of engagement lies at the core of this research question.

Research Question

This research began with my keen interest and experience in exploring new ideas, demonstrated in teaching, design practice, and research investigations into advanced materials. Working in the discipline of interior design, architecture, and product design, my natural inclination was to research within those boundaries.

The process of investigation continued with the literature review, and through reflection on the issues that surrounded the problem. The challenges surrounding the nomenclature of the terms advanced material and unknown material have already been discussed, leading to the overarching concept of unknown material that is used in this thesis. This process led to the research question:

What is the lived experience of spatial designers when they engage with unknown materials, with particular reference to the phenomenon of willingness to take creative risks in their work?

Purpose, Aims and Objectives

The literature review raised questions regarding the perception of the material and the act of unconcealing the knowledge of it, as well as creative risk-taking as it relates to the lived experience of the spatial designers. The purpose of this research is to gain an understanding of the process of attaining material knowledge and how creative individuals engage with materials that are, at the moment of introduction, unknown to them, and whether the challenges of taking a creative risk and being innovative play a factor in their design process.

The aim of the thesis is to present rigorous research into the lived experience of these spatial designers who work in innovative ways and often become exposed to unfamiliar and advanced materials that may be unknown to them. As the literature review has identified, there is currently a gap in the literature surrounding the understanding of this experience.

In order to achieve this purpose and aim, the objective was to examine a group of spatial designers that demonstrate innovative approaches to materials. The particular sub-group of creative individuals selected are spatial designers who are currently practising in a contemporary manner. The objective was purely to observe the designer's relationship to the concept of new and uncharted opportunities with materials, and whether or not they were interested in the

global world of materials, regardless of whether the material had advanced properties.

In order to remain open to the lived experience being observed, yet also to examine the phenomenon in terms of the research question, the literature review identified three research domains that provided insight into exposing the gap in the body of knowledge. The research domains are: the world of spatial design; lived experience; and unknown or advanced materials.

Understanding these domains informed the research design and selection of a method to accomplish the objective of the qualitative study. This led to a research method utilising semi-structured interviews that provided the data for this phenomenological study of spatial designers.

Research Methodology

To expatiate on the observations of the everyday experience of materials that are unknown to designers, it was decided to use qualitative research as the appropriate approach suited to the phenomenon being examined. Qualitative research methods are better suited to addressing complex issues in which an understanding is sought (Creswell 2013), as they are used to uncover what is unknown about, and what is behind, a phenomenon (Strauss and Corbin 1990). “The goal is to comprehend human experience as it is actually lived in the daily life and not in an artificial environment” (De Castro 2003, 49).

Qualitative Research

Qualitative researchers acknowledge that the participants are key members of the research procedure (Higgs et al. 2009) and can be engaged as co-researchers. The qualitative research should also be located within a research paradigm that demonstrates alignment with a philosophical and methodological framework. This approach recognises that research is a journey of learning that describes and interprets human engagement, an aspect that is particularly pertinent to this thesis. Higgs et al. cite Dormholdt (1993) who discusses the search for a deeper understanding of the particular as evident in qualitative research; this study of the lived experience of spatial designers seeks the deeper

issues of a particular engagement and describes and interprets them. With a focus on the everyday moments of people's lives, the very moment of engagement with a material is an ideal social construct to examine. Qualitative research uses 'thick descriptions' which are analysed and interpreted in order to make sense of the lived experience (Geertz 1973; Holloway and Wheeler 2010). While the research material is a systematic collection of subjective data, it is organised in an intuitive fashion to identify the significance of human experience (Holloway 2005). This research project used a combination of these techniques to understand the designer's lived experience, perceptions, meanings and interpretations. The term that anthropologists use to describe this approach is emic perspective (Harris 1976): "It [emic perspective] means that researchers attempt to examine the experiences, feelings and perceptions of the people they study, rather than imposing a framework of their own that might distort the ideas of the participants" (Holloway and Wheeler 2002, 12).

Through the emic stance, the researcher addresses the qualitative aspects of the perspectives shared by the participants. The perspectives of spatial designers are provided in the form of descriptions of experiences. These are gained thorough the research method, which allows the researcher to release prior preconceptions and learn from the participants, who become co-researchers in the process. This allows the work to have rigor and accountability.

The Paradox of Bracketing

This research approached the lived experience of the spatial designer through a phenomenological attitude. Unlike a natural attitude, which is unreflective and just lives life as it comes, a reflective attitude undertakes research in a bridled manner (Dahlberg 2006; Giorgi 2009; Vagle 2014). This requires an attitude not biased by presuppositions (Van Manen 1990). I undertook the research openly, without assuming pre-determined outcomes, and with an eagerness to seek the meaning of the experience being researched.

Husserl's pure phenomenological approach led to his method of bracketing previous views or developing a phenomenological epoché, which, together with the process of reduction, forms the phenomenological attitude (Giorgi 2007). Husserl believed that in order to have a clear view of consciousness, all past experiences and actions need to be bracketed, excluded, eliminated, or deleted. This is a transcendental phenomenological perspective, seeing things from a pure, essential consciousness (Giorgi 2007).

This thesis uses “thick descriptions and close analysis of experience to understand how meaning is created through embodied perception” (Stark and Trinidad 2007, 1373). In this kind of research, the bracketing of the researcher's voice is an essential aspect of phenomenological methods. This allows the co-researcher/participant to speak to their own stories and not be hindered by the researcher's perspective—a key aspect of Husserlian Phenomenology. When Moran (2000, 126) describes Husserl's discovery of reduction, he notes that “nothing must be taken for granted or assumed external to the lived experiences themselves as they are lived.” Placing the phenomenon in epoché (brackets) allows for an uninfluenced search for the essence, as the researcher needs to set aside any prior thoughts, past knowledge or presuppositions about the phenomenon.

Giorgi notes that Husserl describes the need for the bracketing of past knowledge. This is also known as epoché (Moustakas 1994; Giorgi 2009; Husserl 1913/2012). My epoché for this research stems from my relationship to change that was established early in life. This journey has been discussed earlier in this thesis—its relationship to seeking new ideas and being a global nomad or third-culture kid (TCK). This is not to say that all children who move when they are young are likely to embrace change. It is connected to my background and needs to be bracketed.

My formal educational experiences were deeply connected to the exploration of materials in both architecture and industrial design. Practice, teaching and

research reinforced this as explored pathways to extend this knowledge through experimentation, discovery, and formal research. With each experience, I began to assemble an approach to design that was always about exploration of new ideas and how the use of materials can impact the form and function of the outcomes I designed. An explicit process was always central to my awareness.

My experience was a driver in wanting to examine this area of advanced materials and its relationship to the design process. It informed the selection of the participants as my understanding of their work indicated that there was potentially a deeper understanding of material engagement than what I had, and that understanding would be beneficial to study. My voice in the research methodology is framed on the conception of the interview questions aimed to elicit a deeper response about materials by being both probing and accessible.

This chapter will later explain the use of Giorgi's Descriptive Phenomenological Method in stage one of the analysis, with the use of bracketing allowing the researcher to be open to the full experience of the designer. This was then followed by the stage two investigations incorporating Interpretative Phenomenological Analysis (IDP) that enabled the analysis to use the researchers' views and interpretations of the data.

The work of Heidegger and Merleau-Ponty greatly informed the insights. The approach adopted by these philosophers on departing from the Husserlian pure phenomenology would be towards an interpretive heuristic direction. In discussing Heidegger's view that there is always a pre-supposition by the researcher about what is interpreted, I note that a "listener brings their fore-conception (prior experiences, assumptions, preconceptions) to the encounter, and cannot help but look at any new stimulus in the light of their own prior experience" (Smith et al. 2009, 25).

...the manner in which Heidegger unpacks the relationship between interpretative work and the fore-structure of our understanding should cause us to re-evaluate the role of bracketing in the

interpretative of qualitative data. Indeed, a consideration of Heidegger's complex and dynamic notion of fore-understanding helps us see a more enlivened form of bracketing as both a cyclical process and as something which can only be partially achieved. (Smith et al. 2009, 25)

This raises the issue of a paradox with the use of bracketing. When discussing Husserl's pure phenomenology and the resulting phenomenological attitude leading to bracketing of past knowledge, he notes that they are a departure from "...the ideas from hermeneutic or interpretative approach which is based on the principles that reduction is impossible and thus, rejects the idea of suspending personal opinions in favour of interpretation of experiences" (Tuffour 2017, 2). This paradox is resolved through the separation of the stages during the analysis.

Separation of Stages for Research Methodology

This thesis is focused on understanding the meanings made that reveal themselves in the complexity of the lived experiences of the designers who experience a particular event through an embodied engagement with materials. Therefore, there is a need for interpretation of the data. "In IPA research, our attempts to understand other people's relationship to the world are necessarily interpretative and will focus upon their attempts to make meanings out of their activities and to the things happening to them" (Smith et al. 2009, 21).

The research methodology occurred in two stages. The first used Giorgi's Descriptive Phenomenological Method which provided a foundation of ideas. This was then followed by Textual Descriptions that belonged to an Interpretative Phenomenological Analysis methodology.

The result of a Giorgi study is most likely to take the form of a third person narrative, a synthesized summary statement outlining the general structure for the phenomenon under question. The result of an IPA analysis usually takes the form of a more idiographic

interpretative commentary, interwoven with extracts from the participants' accounts. (Smith et al. 2009, 200-201)

An idiographic inquiry is focused on the particular and is an essential element of IPA. It is also ideal for the study of a particular experience of spatial designers. Small sample sizes are also a perfect match for such a study, as in the case with this thesis.

The decision to use IPA as a methodology that utilises textual descriptions of the life experiences of designers in an interpretive manner, and to do so by a systematic analysis of their transcripts, resulted in a rigorous method (Flood, 2010). It was selected because it is a methodology that deals with the comparison of experiences of participants who have had to deal with a major experience. I argue that as materials play a major role in the practice of spatial design, the engagement with them and the discovery of a new material, previously unknown, represents a major experience. This moment of discovery and interpretation is between the co-researchers/participants and the researcher, who both search for an understanding. Smith et al. (2009, 3) state that "It can be said that the IPA researcher is engaged in a double hermeneutic because the researcher is trying to make sense of the participant trying to make sense of what is happening to them." It is useful to note that the term co-researcher is a phenomenological term that is often used to pay respect to the impact that the participant has in the research process (Given 2008).

Research Method Selection

With the research question established, based on a legitimate assumption that the lived experience of spatial designers will provide insights into how they engage with materials that have unknown or advanced characteristics, there was then a need to select an appropriate research method.

The perspective and activity that governs the context of the problem is the phenomenon of the lifeworld of the participants (Whiteley 2002). The phenomenon lies at the heart of the question, and is described by Booth,

Colomb, and Williams (2008, 59) as what drives the research problem; they state that the problem is “incomplete knowledge or flawed understanding. You solve it not by changing the world but by understanding it better.” The problem’s context of research is the lived experience, so qualitative research that examines meaning was determined to be the most appropriate approach for this project.

The research method that was selected to best acquire the data for the qualitative research was the process of semi-structured interviews with a select group of spatial designers who acted as co-researchers. Semi-structured interviews led to a large amount of data collected from the nine interviews, each lasting between sixty to ninety minutes. Once transcribed, the process of analysis began. Initially the analysis began with the use of Giorgi’s (2009) descriptive phenomenological psychological method. After the first round of analysis, a modified phenomenological method was used, based on a descriptive approach noted by Moustakas (1994). This shift allowed for thicker and more descriptive textual descriptions to emerge, which were then used to inform a composite description. Various themes emerged from the textual descriptions, which allowed for the work to be organised and presented in a case study that examines the phenomenon.

The decision to adopt a research method utilising textual descriptions to analyse and communicate the data derives from the purpose of gaining a meaningful understanding of the participants’ engagement with materials. It also recognises that research design is iterative (Iacono, Brown and Holtham 2009), particularly with a non-linear process of qualitative research. The iterative process of this research thesis used the data that led to finding the most appropriate combination of methods to uncover the richness of the experiences.

Data Collection

Prior to selecting the candidates for this study, a local spatial designer who had a propensity to use materials was asked to undertake a pilot study. The

response from this pilot study yielded minor modifications to the questions that would be asked to the final group of spatial designers (See Appendix G for Final List of Questions).

This research project used criterion sampling in the selection of participants. It was not necessary for all the criteria to be met, although most co-researchers met many. The process described below was aimed to attain a wide sampling of descriptions from a diverse group.

Co-Researcher/Participant Selection—Purposeful Sampling Research that provides insight into, and understanding of, the phenomenon being investigated results from having information-rich sampling from co-researchers/participants (Bloomberg and Volpe 2016). A process of purposeful sampling was used in this thesis (Patton 1990). This resulted from the practicalities that emanated from: the extent of my research background and developing interests; the availability of researcher and co-researchers/participants; together with any other restrictions suggested by the co-researchers/participants that played a part in their original selection. As Coyne et al. (1997) suggest, there are numerous constraints on the selection of participants. From the many potential designers that could be involved, a compact sample was selected that provided adequate depth and breadth of insights.

Participant Selection Process

As phenomenological research into the lived experience is about understanding the experience of those particular participants, a large sample size is not a prerequisite to this type of research. The focus is on the quality of the research, not on the quantity (Englander 2012).

Using my knowledge of the Canadian and American design community, and in an effort to efficiently see as many of the selected designers, I short-listed participants that were known for innovative work with materials whilst also being available for the study. I used information from the International Federation of Interior Architects/Designers who represent 270,000 designers,

educators and industry stakeholders in the international design community in 110 countries and Service Canada statistics (2011) noting 46,685 individuals employed in spatial design professions (architecture and interior design)—a sizeable applicant pool. Designers from the international design databases (Association of Registered Interior Designers of Ontario, International Interior Design Association, and the International Federation of Architects and Interior Designers) were viewed for their compatibility with the criteria outlined below. From an extensive list of over 500 designers, and my industry contacts in 2010, the participants were selected. I also selected two participants from outside of North America based on other criteria. The participant's geographical location was only considered in case it became a factor but the focus of the research centres on understanding their engagement with an unknown material.

The research domains discussed in the literature review informed the selection criteria. It was considered essential to interview designers that were practising, as they have current insights and experience in all aspects of material engagement. It was important that the selection captured the diversity of practice, cultural background, and gender. The selection assisted in providing a broad insight in the world of design and also provided opportunities to examine varied lived experiences. The criteria defined categories listed below:

- Their practice is within the domain of spatial design. This could mean that they are interior designers, architects, exhibition designers, furniture makers, or researchers in these disciplines.
- Their work needed to indicate a willingness to explore aspects of materiality, particularly with materials that are uncommon, unknown, new, or advanced. Those averse to exploring new materials were not selected.
- Their work is within the public sphere, through a built interior, architectural space, exhibition, or product. The work could also be published. Work that is only experimental and theoretical without a tangible outcome did not meet this criterion.

- They must all be directly involved with materials in their current role. Those that have drifted to more administrative, sales, or business aspects of dealing with materials did not meet this criterion.
- Willingness to share ideas and take part in research.
- Additional criteria were also used: role; activity focus; project focus; location/reputation; and potential risk-taking.

Role:

This criterion defined the role that describes the co-researcher/participant. This was sub-divided into three areas. A co-researcher/participant may have more than one role.

- Designer:
The first area was a designer whose main occupation was professional design. These designers would engage with the materials at the onset of a project, and they would need to instruct others on the construction and manufacture of a design using the material.
- Maker/manufacturer:
The second subdivision identified the designer's main role as being a maker/manufacturer. These individuals were directly engaged with materials.
- Educator:
The last subdivision under the criterion of role was that of educator. These individuals would explore materiality through their research agenda, and through material experiments that were not commercially driven nor directed by a client.

Activity Focus:

This criterion defined the activity that the co-researcher/participant is engaged with on a regular basis. This was sub-divided into four areas. More than one criterion may be identified for each co-researcher/participant.

- Works directly with materials:
This subdivision identifies activities in which the co-

researcher/participant directly engages with the materials towards a design outcome. It is here that actual testing and prototyping occurs with the materials in a workshop environment, or directly on the project site.

- Works indirectly with materials:

This subdivision identifies actions taken by the co-researcher/participant towards instructing and directing others in the use of materials. These instructions are delivered through various means of communication, either by words at a job site or in a craftsman workshop, or through drawings and written instruction to other contractors charged with building or manufacturing the design.

- Works for client's project briefs:

This subdivision describes the co-researcher's/participant's activities that are mainly determined by the client's project briefs. Those that ran professional spatial design practices tended to meet this criterion.

- Works on self-directed project briefs:

The last subdivision dealt with the co-researchers/participants who were intent on exploring materiality through experimentation and exhibition. Here the spatial designer crosses the boundaries of craft, art, and practice-led research through a discovery process.

Project Focus:

This criterion defined the focus of the projects that the co-researcher/participant would normally work on. This was sub-divided into four areas. There may be numerous projects that the co-researcher/participant will engage with, and their focus may shift between different projects.

- Work is traditionally focused:

This criterion defined the co-researcher's/participant's projects as those that followed more traditional paths in the profession. Yet within the traditional projects and clients, they would find opportunities to engage with materials that are new, unknown or advanced.

- Work is experimentally focused:
This criterion identifies the projects that are focused on experimental aspects of material investigation by co-researcher/participant.
- Work is theoretically focused:
The subdivision refers to work that is based on a theoretical framework, and from there the co-researcher/participant explores material applications. The end results may or may not be in the public domain, as the research and exploration is aimed at discovering aspects of the material.
- Work is market focused:
The focus of this subdivision is commerce and the sale of a product or spatial design outcome. This is linked to the client and market forces that shape the client's business, and how materials will make an impact.

Location/Reputation:

This criterion deals with the context that the co-researcher/participant works within. This concerns the geographical location of their main practice, and the significance of their reputation in terms of local, national or international impact.

Potential Creative Risk-taking:

The final criterion has a focus on creative risk-taking, and whether the co-researcher/participant is one who takes low to medium creative risks, or whether they engage with medium to high creative risks in their practice. This assessment was gauged from secondary research into their work.

A qualitative researcher has reasons (purposes) for selecting specific participants, events, and processes. The purposeful selection of research participants thus represents a key decision in qualitative research. (Bloomberg and Volpe 2016, Kindle Locations 3016-3018).

The original ten co-researchers/participants that were selected on the basis of how they have engaged with materials in their contemporary design practice. Their awareness and inclination towards the use of advanced materials in their work were factors in the selection. The intent was to focus on new and innovative materials as a subset of materials. Research into their published work and previous experience of their practice influenced their selection.

Whilst all were designers, two were also makers/manufacturers, and three were also educators. Under the second category of activity focus, the sub-categories were: works directly with material; works indirectly with material, works for client's project briefs; and, works on self-directed project briefs. This was evenly spread, with all of the participants having two matched sub-categories, and with not one sub-category being totally filled. The next category was sub-divided into four sub-categories; each dealt with the project focus. These sub-categories were: traditionally focused; experimentally focused; theoretically focused; and market/client focused. Here, only one was traditionally focused, and six were experimentally focused, with three of these also being theoretically focused. There was an equal balance of theory and market focused projects. The next category dealt with location/reputation; here the sub-categories were: location; local reputation; national reputation; and, international reputation. Seven of the participants had a connection to Canada, with the rest located in the USA, Thailand, and Japan. All had local reputation, six had a national reputation, and four had an international reputation. The last category was sub-divided into low-medium creative risk takers and medium-high creative risk takers. Three participants were judged to be in the former sub-category, and the remaining seven were in the latter. Therefore, it can be safely said that there was a broad and well-distributed sample set that would provide opportunities to examine the phenomenon in a deep and meaningful manner.

Table 3.1 Matrix of Participants

Participant #	Pseudonym	ROLE			ACTIVITY FOCUS				PROJECT FOCUS				LOCATION/REPUTATION				POTENTIAL RISK-TAKING	
		Designer	Maker/Manufacturer	Educator	Works Directly with Materials	Works Indirectly with Materials	Works for Client's Project Briefs	Works on Self-directed Project Briefs	Work is traditionally-focused	Work is experimentally-focused	Work is theoretically-focused	Work is market-focused	Location	Local Reputation	National Reputation	International Reputation	Low-Medium Creative Risk-takers	Medium-High Creative Risk-takers
1	Jillian	•			•			•		•	•		USA	•				•
2	Sandra	•	•		•			•		•			CANADA	•	•	•		•
3	Greg	•				•	•			•		•	CANADA / USA	•	•	•		•
4	Lina	•				•	•						CANADA	•	•	•	•	
5	Preya	•	•		•				•			•	THAILAND	•	•	•	•	
6	Yoshio	•		•		•		•		•	•		JAPAN	•	•			•
7	Michael	•		•		•	•						CANADA	•			•	
8	Juan	•		•		•	•			•		•	CANADA	•	•			•
9	Blair	•				•	•						CANADA	•				•
10	Fiona	•		•	•			•		•	•		CANADA	•				•

In order to maintain anonymity, pseudonyms were used for each participant. Their characteristics that relate to the criteria, stated earlier, are charted in the matrix in Table 3.1 (above). The profiles for the participants are noted in Appendix E.

Through the process of ethics applications and correspondence with the designers, a final list of ten designers was selected. The ten designers who met the criteria were all interviewed. All of the participants were contacted by email, and all agreed to participate. Information sheets and consent forms were provided before the interviews (see Appendix F). With originally ten co-researchers/participants selected, one need to be eliminated later as the data was compromised with her partner being too involved with the interview.

Interview Process

The interviews were scheduled to occur at the designer's studio. The interviews all ranged between 60 and 90 minutes, long enough for the designer to feel comfortable in opening up about the issues being discussed. All ten interviews

were spread over a period of a few months. A standard set of questions were asked, and opportunities to ask additional questions were offered, through a standard semi-structured interview process. As the descriptions provided by participants in interviews are proposed by Giorgi (2009) as the chosen method for obtaining qualitative data, this thesis used semi-structured interview as a tool to extract qualitative data from participants.

The texts for all the interviews were later transcribed into a document that was used for analysis. Their answers ranged in detail, with some responses moving towards other experiences and insights that provided depth to the investigation. As in any phenomenological research interview, it is important to keep the participant in a present state of mind, while understanding that reflection on the past through recollection of events does help to enrich the understanding of the lived experience (Giorgi 2009; Englander 2012).

The most important moment in all interviews came at the end of the formal questions. At this point, the designer was handed a material that they were not likely to have seen before. The actual material was not important, as three different materials were used; it was the reaction to a material that was unknown to them that was the focus of observation. Exploration of this social phenomenon aligned with the core question as the lived experience was witnessed and commented upon. They became co-researchers at this point. A few participants were photographed at this moment of engagement.

Interview Questions

My experience helped to frame the questions, but the central focus was how they saw themselves engaging with an unknown material in their work. Prior to establishing the final list of questions, a pilot was run to test the questions. A single designer was asked the set of questions that helped gauge the focus of the final questions for the research. The pilot study led to a slight refinement of the framing of the questions to be asked of the designers. (See Appendix G for Final List of Questions).

By interviewing the designers, a true sense of their material memory and process of engagement was gathered. Questions that helped to understand whether they try to uncover the true core sense of the material in order to enhance their design outcomes were used.

Participants were initially invited to describe their particular approach to materials in general terms. This simple question was aimed to ease the participant into an open dialogue about their material experiences. This led to an inquiry about their material world and how they were located within it. In particular, whether they selected materials from a traditional viewpoint, strategic position, theoretical frame, or for practicality. Further questions focused on finding out about this relationship with materials. The information could be couched in drawings and other descriptive devices that the designer used to communicate—yet most focused on the interview.

They were then asked to describe the relationship of their lived experience with material experiences in their past. An appreciation and description were sought at a deeper level about their relationship with materials. This led to questions about who and what influenced them in their material choices. Questions about the continuity of these sources of influence and knowledge followed, to provide depth to their reflections.

Questions were then asked about the challenges that they faced in terms of materiality when designing, particularly when using new and advanced materials. This led directly to questions about the use of innovative materials and when they felt that they could use them, and on the likelihood of taking a risk with a new material.

Finally, they were asked to describe their relationship to a particular advanced material and its potential applications. This led to the final enquiry, which was intended to observe the designer in action—witnessing the lived experience when faced with an unknown material. When presented with a material that

they had never seen, their reactions were documented. As noted earlier, this observation became a crucial element of the research.

Analysis

The analysis phase of methodology consisted of two parts. The first began with the use of methods defined by Giorgi (2009). This provided a solid structure through a separation of the text, which was analysed three times to determine a central theme. It is a highly rigorous method that removed any bias towards descriptions that provided more data yet gave fewer insights into the actual lived experience. It was a useful step in finding central themes. For stage one, it was essential that I assumed a phenomenological epoché and attitude with all preconceptions checked so that the story of their experience could be clearly captured. The second stage (See Appendix D) undertook textual analysis of transcripts allowing for hermeneutical reading of the data, as the reading of the parts allows for understanding the whole (Bloomberg & Volpe 2016).

Each level of analysis assists in understanding the lived experience of the spatial designer and the terms "category", "theme" and "code" facilitates understanding the patterns of the experience (Saldaña 2013). Categories assisted in the selection of the participants; the themes emerged from stage one of the analysis; and lastly, from the textual descriptions emerged codes.

Stage One: Analysis using Giorgi's Descriptive Phenomenological Method

This thesis used a combination of two approaches that began by investigating the descriptive text of the participants using Giorgi's descriptive phenomenological method. This method allowed for the dense text to be broken down into meaning units that could be sorted and analysed. He notes that his method responds to "...a synthesis of philosophical phenomenology, human science perspective, and psychology" (Giorgi 2009, 94). Giorgi's method involved three stages (Giorgi 2009), which were:

1. Read for a sense of whole. A process not to clarify or make explicit but to understand the phenomenon holistically.

2. Determination of meaning units. Establish units of meaning from the text to break down the scale of the transcript and to provide a synthesis of the text into units for analysis.
3. Transformation of participant's natural attitude expressions into phenomenologically, psychologically sensitive expressions. This final stage requires an additional analysis of the text that is rendered with a psychological dimension and provides a heightened understanding of the phenomenon.

A matrix for this research was utilised (Whiting 2002; Giorgi 2009) to extract insights from the raw data using the headings below:

1. Natural unit (the actual text from the transcript).
2. Key issues (objective translation into the key elements of the statement).
3. Analysed theme (key issues distilled down to an analysed theme revealing similar issues).
4. Central theme (key issues expressed as a central theme, revealing a core structure (what it tells me about the meaning of the lived experience with advanced or unknown materials)).

The data collection phase of Giorgi's method occurs first and requires a phenomenological attitude to be in place. Descriptions are provided at the interviews, and Giorgi asserts that everything needs to be used from the interview. He states: "Description is the use of language to articulate the intentional objects of experience" (Giorgi 2009, 89).

The second stage of Giorgi's methodology is the analysis phase, when participants' descriptions are analysed. At this stage, it is essential to look only at what the spatial designers have said, and to exclude external factors that may try to address ambiguities. The results were useful in breaking down the text from the interview into the natural units and systematically analysing each unit towards a theme that then led to a central theme. This led to understanding the

relationship of the themes. Appendix H demonstrates how this stage was analysed for this thesis.

The final stage of Giorgi's phenomenological methodology deals with reading and re-reading the description in parts and as a whole to be able to determine meaning units. Although the approach of reading the complete description is a feature of other forms of qualitative research, Giorgi stresses that the researcher has to approach it from a stance of reduction, in order to sensitively discriminate any past experiences. It is here that stating my epoché and bracketing my past experiences becomes essential. The goal of the second half of this final stage is to establish meaning units from the descriptions. The text of the description is broken into parts, which are determined from a phenomenological psychological perspective (Giorgi 2009). After the meaning units are established, the entire text was re-read, with consideration of the natural attitude of the participant at the points of the meaning units. This stage of the thesis was a long process, requiring careful analysis of the participants descriptions to develop meaning units (see Appendix H).

Central Themes

Upon analysis of the transcripts using Giorgi's method, a number of central themes emerged as common aspects across many participants. Not all were identical to each other, but the themes were consistent in common ideas that unified the different participants. The following key central themes emerged from the descriptions:

- Colour: the importance of colour in the engagement process, providing the appropriate aesthetics to the designed outcome.
- Memory: the ability to recall memories of material engagement was a consistent theme that supported the material knowledge of the participant.
- Relationship to industry and material supply: the theme of how decisions to engage with materials were related to the material supply chain and relationship to industry.

- Relationship to client and risk: as professionals, the designer's relationship to the client was noted as essential, and associated with the embedded propensity of the designer, client, and/or other consultant to take creative risks.
- Design process: the variation of the design process was evident as a central theme, which the designers expressed in terms of how they engaged with materials.
- Materials and innovative thinking: related to the design process, but more particularly, to how the designer looked at material innovation as an essential factor for them.
- Placemaking: as spatial designers, the need to develop a sense of place is essential, and this is facilitated by the designer's understanding of materials. This theme is a concern shared by the participants.
- Technology and tradition: technological advances in materials are a central theme in the comments from participants, who also reflected on traditional material applications that can offer creative options.
- Relationship to other consultants: engagement with materials often requires negotiation with other consultants on the project. This challenging and sometimes inspirational engagement is a common theme expressed by the participants.
- Understanding the nature of materials: all the participants have a tacit understanding of the nature of materials, and this is at the core of this research investigation.
- Site and context/cost, availability and economics: the designers identified these pragmatic factors of working on spatial projects that would issue demands on their engagement with materials.
- Psychological aspects of working with and experiencing materials: these essential themes were noted by the participants as important factors to consider when experiencing materials.
- Lighting/material performance: the designers noted that in order to create a sense of place, a thorough understanding of the performance of

a material is necessary, especially in how the material relates to different lighting conditions.

- Professional reputation and work: as professionals, the quality of their work is very important to them, so when they engage with materials, they consider how that will impact their body of work and reputation.
- Reflections on profession: the state of the profession and the traces of past practice in relationship to material engagement are a common theme noted by participants.
- Material relationship to society: a clear ethical understanding of the relationship of materials to society and the environment was echoed by many of the participants.
- Personal relationship to engaging with materials: each spatial designer had their own ethos of material engagement that was often supported by formal and informal education.

Despite the voice of the participant being broken down into units their sense of engagement with materials and depth of discussion was not captured. This led to the second stage of the analysis using a hermeneutical reading of textual descriptions—providing greater depth.

Turner (2009) discusses the property of “hiddenness” as being the target of phenomenological inquiry, with the intent of describing new information that will lead to opportunities to interpret meaning in the world. She discusses the importance of the articulated description, which should take into account everything about the phenomenon in terms of what happened, when it happened, how it presented itself, and any emotional connections to the phenomena in terms of feelings created or associated with it. Both stages of the analysis sought to discover this hiddenness within the descriptions.

Stage Two: Textual Descriptions and Interpretive Phenomenological Analysis

With the aim of finding clarity in the issues that describe the phenomenon, it was clear that Giorgi’s method was useful in determining the central themes that emerged from all the interviews. However, the sheer volume of the natural

units that were analysed into central themes hindered the opportunity to demystify the phenomenon being examined. A modified approach led to examining the central units through textual descriptions. These helped to establish the “voice” of the participant that was lost in Giorgi’s method.

According to Moustakas (1994), textual descriptions can be defined as either individual or composite. Whereas the individual approach examines the themes of each participant, the composite approach integrates all the individual textual descriptions into a universal description. The individual approach was first taken, to establish the voice of the participants and core themes expressed in the texts. This then led to composite descriptions, which are used as the basis of this thesis.

Individual textual descriptions helped to return to a path to find the voice of the individual. These helped to identify key elements that had a commonality between designers. Bringing together four or five pages that captured the voice of the designer signalled the necessary shift towards an Interpretative Phenomenological Analysis approach. The thematic analysis evolved through the interpretation of both the co-researcher/participant and the researcher.

Data collection is usually (but not necessarily) in the form of semi-structured interviews where an interview schedule is used flexibly, and the participant has an important stake in what is covered.

Transcripts of interviews are analysed case by case through a systematic, qualitative analysis. This is then turned into a narrative account where the researcher’s analytic interpretation is presented in detail and is supported with verbatim extracts from participants.

(Smith et al. 2009, 4)

IPA is best described as a set of processes that goes from the particular to the general and from the descriptive to the interpretive. It also involves the principles of meaning-making of particular contexts (Smith et al 2009; Howitt 2010). The process has been described (Smith et al 2009) as iterative and

consists of the following strategies that are related to the work completed in this thesis:

- Line-by-line analysis of participant statements

This was accomplished as noted in both stage one and two of the analysis that examined the natural units (individual sentences) numerous times.

- Identification of the emergent patterns (i.e. themes)

The matrix analysis using the textual descriptions resulted in the researcher identifying intrinsic and extrinsic factors that were themes that emerged from the analysis. These factors were the result of interpretation of the designer's narratives.

- Development of a 'dialogue' between the researchers and the data

Throughout the interview process the dialogue with the designer led to a deeper unconcealing of the issues that lay at the heart of their engagement with materials. Setting the scene for an open dialogue was essential in the semi-structured format of the process.

- Development of a thematic relationship structure of the themes

The relationship structure was developed throughout the process of engagement with the research and is illustrated in Figure 3.2, which illustrates the binary relationship of intrinsic and extrinsic factors. It clearly connects the sub-groups of the investigation, which were interpreted from the statements of the designers together with the research domains of the spatial designer and the unknown material.

- A traceable format from data to the final structure of themes

The structure of the methodology provided the framework for a traceable account of the research with the logic of the decisions noted in throughout the thesis.

- Testing the plausibility of the interpretation via supervision

A rigorous process of supervision from a team provided insights and commentary on the interpretations presented. Their insights into the methodology and logic of the ideas, together with suggested readings, helped to provide the depth for the research.

- Development of a full narrative and a detailed commentary on text
The following two chapters provide a thematic breakdown of the two factors and the sub-sections that fall within them. The extracts from the narratives with interpretive reflections weave together to support the findings of the analysis.
- Reflection on one's own perceptions, conceptions and processes
Interpretation of the narrative was included throughout the research with reflection of one's own understanding of the material allowed to impact as required. A further reflection on the findings occurs in the discussion chapter and conclusion.

Analysis of Textual Descriptions

Textual descriptions were used as the research method for telling the story that connected the participants. The understanding gained through the use of textual descriptions not only connected the different participants to a larger narrative it also provided explicit moments of experience that amplifies our knowledge of the phenomenon. These textual descriptive studies can be used to build theory, much like traditional case study techniques, which can use a range of approaches from inductive and interpretive to more indicative and comparative studies (Hoon 2013; Yin 2014). This thesis uses a comparative approach, which utilises textual descriptions to understand the phenomenon.

An examination of the central themes determined that the meta-themes that emerged were dealing with factors affecting the designer's engagement with unknown materials. These two meta-themes were intrinsic factors and extrinsic factors. Clarity in the analysis of this research was achieved with this strategy of examining the connection between all participants, as they engaged with both intrinsic and extrinsic relationships with materials. Sub-sections of this group analysis highlighted the various factors that influenced the act of engaging with unknown materials. Multiple sources of literature were also used to reinforce and enrich the articulation of the phenomenon being observed.

The two meta-themes, or key factors, used in this research method are intrinsic and extrinsic. The relationship to each other and their breakdown will be discussed later in this chapter. The themes are described below:

a. Intrinsic

Defined as being part of the natural character of something or someone, essential to that entity (*Oxford Dictionary 2017; Longman Dictionary of Contemporary English 2017*). Intrinsic in this research means factors that are essential and natural to the spatial designer and emanate from them through actions, reflections, memories, conceptual thoughts, and experiences. These are intangible factors that the spatial designer has control of or has experienced in the past.

b. Extrinsic

Defined as not part of the natural character or essential nature of an entity. Not directly related to someone or something, as if emanating from, and operating from, the outside (As noted in the following online dictionaries: *Oxford 2017; Longman Dictionary of Contemporary English 2017*). In terms of this research into the lived experience of spatial designer's engagement with unknown materials, extrinsic factors are viewed as those that the spatial designer has no control over, and which emanate from an external source. They take the form of comments from others, site, project brief, and in particular, the properties of materials.

Relationship of Intrinsic and Extrinsic Factors

The purpose of this research is to examine the lived experience of spatial designers' engagement with unknown materials. The two subjects in this equation are the spatial designer, and the unknown material. Each sit within various spheres of influence that can be categorised as either intrinsic or extrinsic factors. Together, the spheres of influence, both intrinsic and extrinsic, sit within the domain of cultural ideas and global influences. This diagram of the engagement has been established to analyse the statements made by the spatial designers in their semi-structured interviews.

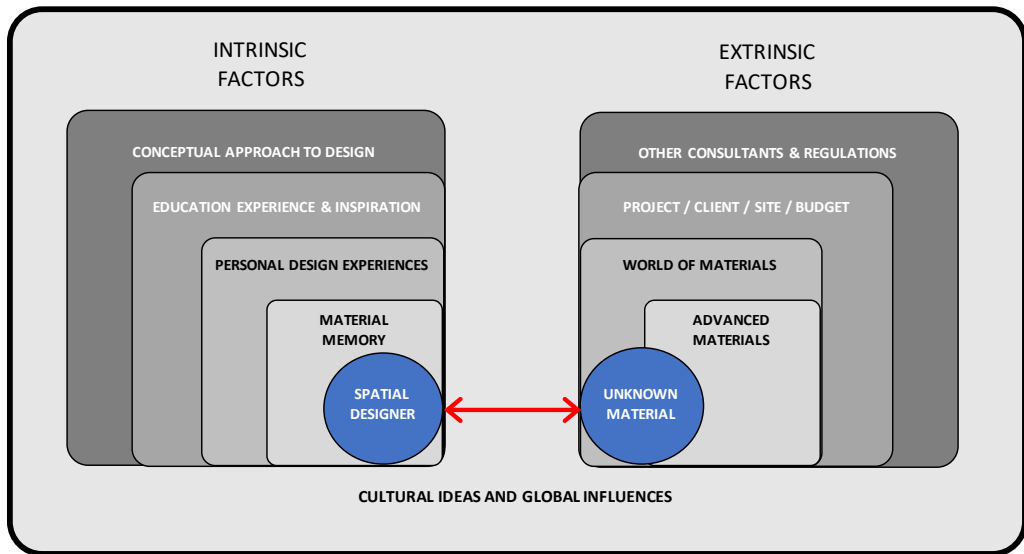


Figure 3.2 Relationship of Intrinsic and Extrinsic Factors

The relationship of the two key elements of the research question is situated in respect to the intrinsic and extrinsic factors derived from the analysis.

The aim of the research is to understand how spatial designers engage with an unknown material, and their willingness to take creative risks through that engagement. To understand this aim, their framework within the process needed to be understood. As there are multiple ways of examining any phenomenon, I approached it from the stance of exploring what influences a designer in the act of engagement with unfamiliar materials.

Within the personal domain of the designer reside material memories. These memories are only a sub-set of all the other personal design experiences that are experienced through the intrinsic filter of the designer. The personal design experiences reside within the larger educational and inspirational experiences that the designer may have had through travel and formal and informal education. Educational and inspirational factors are in relationship to a conceptual approach to design. It can be argued that neither is within the other, but there are some concepts that have not been experienced in formal or informal education settings. The last criterion used to code the transcripts was that of theoretical ideas. This criterion deals with ideas larger than design concepts and influences both intrinsic and extrinsic factors.

The other side of the engagement equation of the spatial designer is the unknown material. This is a tangible element that is not automatically connected to the spatial designer and exists independently. This unknown material sits in the world of materials, and it may or may not be a material that has advanced properties, so may or may not be called an advanced material. Within the sphere of design practice, the world of materials resides in the sphere of a design project that is governed by a project brief, clients, site conditions, and budgets. These constraints are within an even larger sphere of influence in the form of comments from other consultants and regulations.

Methodology and Codes Applied to Transcriptions

Textual descriptions, as a research design strategy, is an ideal form of flexible research design. Empirical investigations of a lived experience provide a rich and rigorous analysis of the phenomenon that is supported by multiple sources of verification (Yin 1994; Robson 2002).

The analysis will indicate that this clear articulation of spheres of influence does not always coincide with comments from the participants/co-researcher. Occasionally, a code used may easily be substituted for another; however, the quantity of text assessed allowed for this degree of variance. With almost nine-hundred minutes of interviews there was a high saturation of data that was analysed twice. Slight variations allowed for the richness of viewpoints.

As a researcher, I kept my distance from assigning my own viewpoint to the comments, in order to allow the text to define which code to be used, allowing the flow of the interview to be directed by the participant guided only by the questions. This maintained the trustworthiness of the analysis.

The codes suggested within the proposed structure permitted the phenomenon of engagement to be understood at a deeper level. These codes were tested through the process of analysis, as Bloomberg and Volpe suggest:

Key codes are determined either on an a priori basis (i.e., derived from theory or research questions) or from an initial read of the data. These codes serve as a template or “bins,” remaining flexible as the data analysis process proceeds. This approach makes use of matrices, networks, flowcharts, and diagrams that supplement descriptive summaries of the text. (Bloomberg and Volpe 2012, para. 5)

This research deals with the act of engagement with an unknown material. What constitutes that engagement will come out of the findings of this thesis. Yet it is necessary to understand the initial stance and structure of the framework in which the study was viewed.

Definition of Codes Used in Analysis: Intrinsic Factors

A1 Reference to material memory

This is an intrinsic factor that influences the spatial designer when they reflect on personal past experiences of material usage. These memories assist in relation to the engagement with unknown materials in design, but also address the general sense of remembering personal experiences of engaging with materials.

A2 Reference to personal design experience

This is an intrinsic factor that influences the spatial designer when they reflect on their past designed outcomes and experiences; it relates to the engagement with unknown materials in design, or to a more general notion of design.

A3 Reference to educational experience and inspiration

This intrinsic factor refers to the influences on the spatial designer of past formal or informal educational experiences. These can be triggered by a past design experience or by remembering a material experience, but it is usually in a more structured setting. Travel experiences that provide informal learning outcomes are valid despite being unstructured. Inspiration from books, films, and engagement with

others who inspire the spatial designer through their words and actions is also considered under this category.

A4 Reference to conceptual design factors

With this intrinsic factor, the spatial designer is influenced in their decisions to engage with an unknown material by the concepts inherent in the design that they are working on. These concepts are internal to the designer, who reflects upon their engagement with an unknown material based on their relationship with a design concept for a project.

A5 Reference to theoretical ideas

Although classified as an intrinsic factor that influences the spatial designer's engagement with unknown materials, theoretical ideas influence many more in society, and do not solely impact the designer on a personal level. However, it is placed in the group of factors under the heading of intrinsic, as it is seen that the selected statement from the participant has personal impact larger than that of a concept.

Definition of Codes Used in Analysis: Extrinsic Factors

B1 Reference to the properties of an unknown material

This is the extrinsic factor that influences the spatial designer when they objectively consider the physical properties of unknown materials in design. The information allows the spatial designer to make informed decisions based on specifications, test results, performance reviews, and the physical handling of the material. It allows the spatial designer to classify the material based on past performance. They are personally removed from the act of engaging with the material, and decisions are directed from extrinsic sources.

B2 Reference to site conditions

The project site for most spatial designers is a vital factor in how they are able to produce their work. This extrinsic factor influences the

spatial designer when they objectively consider the site conditions and related issues that will impact the use of an unknown material. The data of the physical attributes of the space are external to the spatial designer, and provide an extrinsic factor affecting their design decisions.

B3 Reference to client comments

When considering whether or not to engage with an unknown material, the decision is quite often out of the spatial designer's control, as the client who is paying for the professional service will make the decision. The spatial designer can do their best to influence the decision if necessary, but the extrinsic factor of the client's comments, through feedback or even the original brief, is a major factor in the final outcome.

B4 Reference to budget issues

Economic and financial decisions to engage with an unknown material are ones that the client will ultimately make. It is an extrinsic factor that the spatial designer can try to mitigate and direct, but ultimately the multitude of budgetary factors are external to the spatial designer.

B5 Reference to building regulations and codes

A spatial designer is charged with professionally looking after the client's best interests in conceiving and executing designs for the spatial enclosure. The act of engaging with an unknown material will also need to be assured as safe to use in the community and on the project. External regulations provide guidance for safe and sustainable use of materials. These extrinsic legal and regulatory issues influence the spatial designer when they consider engaging with unknown materials in design.

B6 Reference to the ability of other consultants

The spatial designer is one of many consultants on a project, and although at times they may be the prime consultant, they will still need to consider the opinions of others. They may also need to consider the abilities of others to work with the unknown material, which can impact on the final result. These are all external factors that are extrinsic to the spatial designer yet may impact on the opportunity to engage with an unknown material.

The following is an extract from the Methodology Matrix examining the textual descriptions for Sandra (see Appendix H for other matrices)

Table 3.2 Extract from Methodology Matrix Used for Analysis for Sandra (P2)

PARTICIPANT	PARTICIPANT'S COMMENT	INTRINSIC FACTORS					EXTRINSIC FACTORS					
		Reference to Material Memory	Reference to Design Experiences	Reference to Educational Experiences	Reference to Conceptual Design Factors	Reference to Theoretical Ideas	Reference to the Properties of the Unknown Material	Reference to Site Conditions	Reference to Client Comments	Reference to Budget Issues	Reference to Building Regulations and Codes	Reference to the Availability of Materials
	CODE	(A1)	(A2)	(A3)	(A4)	(A5)	(B1)	(B2)	(B3)	(B4)	(B5)	(B6)
P2	We didn't have a mandate from a client or anyone else telling us, "We need a chair and we need to launch it in spring." Just play. No brief at all and being able. I think that epitomizes the way we definitely liked that freedom to maybe even how we might even start in one direction but the freedom to learn from what we're doing and improvise and maybe take it somewhere that we had no idea we wanted to go. That's the real gift of working with the physical world rather than the digital world.								(B3)			
P2	I shouldn't speak to the digital world as much, but it's definitely something I understand and I appreciate the physical world by actually playing with something rather than preconceiving what you're going to do in your brain, inside your head, inside a notebook. That it's evolving in front of you.				(A4)							
P2	Yeah. Engineers and a lot of engineers have figured out that the structural beauty of a honeycomb structure but usually the approach, because you're looking for a lot of rigidity and solidity is to make it solid. So dip it in resin or laminate it between two skins and make a three-dimensional fixed matrix. We'd never come across anyone that had actually played with potential of the flex- the beauty and the flexibility. This is a real diversion going in a direction.		(A2)									
P2	INTERVIEWER: What was that moment that, not turned you, a turning point, a tipping point, but was significant in your material thinking? P2: The project in Alaska is definitely one where we were building with primarily snow and a little bit of ice. No other materials at all. That one, I think because we put ourselves in a position where we would end up having no choice but to improvise and try to understand the material on its own terms and how it was going to be that day and under that temperature and how does it bond and how does it work? Realizing that snow can be many different materials in a way, depending on the temperature conditions that it was formed under and whether it's been tossed around. The crystals have their little times broken off.						(B1)					
P2	Paper is very ephemeral.						(B1)					
P2	Well, it's definitely conscious that we, at one point, decided that the teapot is a good example of deciding how do you make something out of one material? Glass, or borosilicate glass is a fantastic material to use in that way because you can weld it to itself. There's so many different ways to manipulate it. It has negligible coefficient of expansion so it's exceptionally forgiving in terms of how you work with it. You can heat up one spot till it melts and the other one could be sticking in ice and it's not going to fracture from a different skin thermal expansion.						(B1)					
P2	Oh, yeah. Absolutely. I mean from the way I talked about the joy of an open-ended experiment and not being obliged to come up with any particular end purpose is in its early stages. The research we're doing out at UBC with the [helping 00:14:39] paper and material lab. In that case, it's everyone else and then Todd and I, they're material scientists. They're mechanical engineers that study fluid mechanics as well as chemistry and all those things.											(B6)
P2	But being exceptionally interested in any- Like I'll hang on their every word if they're talking about how something actually works or goes together. It's really interesting to me. There isn't freedom in being exposed to it for the first time. Those are important moments because we're not, we're going to see things with fresh eyes and different eyes than they would. We have that opportunity in the collaboration. Then there's that opportunity where we get to really learn what's going on at a molecular level and watch their process. None of us know where it's going to lead to so it's fabulous.			(A3)								
P2	INTERVIEWER: You like that mystery, that journey? P2: Yeah. That freedom that it will get to unfold into something, but we don't know what.					(A5)						
P2	One thing I should say just while I'm thinking about it is because it's definitely not just the intrigue of mystery, but there's a deep belief that by truly learning about a material we'll be able to make something better than we would have been able to make otherwise.						(B1)					
P2	That it will be possible to really understand the material and craft it in a way where there's a level of elegance that it gets because you're paying attention to the nature of the material itself and able to respond to it.						(B1)					
P2	Well, when I look at a piece of joinery that with wood just using that as an example because we're talking about it and understands that wood expands, contracts. Join those pieces in a way that that material can actually live and breathe and work because the person who made it knows that wood expands and contracts and that it does it a negligible amount in one direction and a lot in another direction and a minimal amount in the third direction.						(B1)					
P2	A love of tactility would definitely be childhood. You'd be like playing in the mud in the Bay of Fundy. There's a big clay beach that I used to make rabbits from.	(A1)										
P2	Absolutely encouraged. Yes. I think that's the really important thing and people who have parents who are artists are more likely to look at a child's drawing and see something in it to encourage them.			(A3)								
P2	INTERVIEWER: Are the influences still there? P2: There's definitely probably something that's always there and re-occurring. I remember having a flashback making the Softwalls of when I was really little living in the barn and I cut out paper apple trees and attached them the sides of the kitchen we weren't using because my dad had built two for no particular good reason, but it made this narrow space. I made the apple trees join and stuff, and I made this room out of paper apple trees and I just completely had a flashback to it when I was definitely the early Paper Softwalls I realized this is what I've wanted to do my whole life. I'm compelled to do this. There's something about it that I feel 100% myself right now for some reason.	(A1)										

Table 3.2 Extract from Methodology Matrix Used for Analysis for Sandra (P2)

PARTICIPANT	PARTICIPANT'S COMMENT	INTRINSIC FACTORS					EXTRINSIC FACTORS					
		Reference to Material Memory	Reference to Design Experiences	Reference to Educational Experiences	Reference to Conceptual Design Factors	Reference to Theoretical Ideas	Reference to the Properties of the Unknown Material	Reference to Site Conditions	Reference to Client Comments	Reference to Budget Issues	Reference to Building Regulations and Codes	Reference to the Ability of Other Consultants
	CODE	(A1)	(A2)	(A3)	(A4)	(A5)	(B1)	(B2)	(B3)	(B4)	(B5)	(B6)
P2	Very little. Only sketching. No hard line drawings and ...			(A3)								
P2	Sometimes something new, and it's not necessarily a new material, it's sometimes something new comes of the study because you're cross fertilizing two different thoughts and putting them together. In that case of the wedding bell, the speaker cone, and interest in, we were at the time thinking about urban living and trying to live in a tiny apartment and doing a lot in it, which happened to be our situation in life at the time, but we were also realizing it's an urban condition.							(B2)				
P2	INTERVIEWER: You are exploring ideas that you generate yourself. P2: Yeah. INTERVIEWER: Do you look for materials which are new? P2: We do. I can't say with success, but it's an obsession because we find the potential in nano technology has got to yield something, right? Then it feels like this is the time we're on the cusp of probably a lot of new materials coming about through nano technology. We're interested in watching, looking, and waiting.			(A3)								
P2	Yeah, those are things that apply to kids too. Have their learning conditions growing up but like the not being afraid to fail is a really important thing.				(A4)							
P2	INTERVIEWER: The fact that you just said you wouldn't have the time to process it, the approach that you take with materials does it require process time that not just it requires a wavelength to actually process it or that you actually absorbing that information. Is that what you're trying to say? P2: Yeah and that time to play a little bit and let something morph. If you're in a big hurry to get paid to be, you're not even going to see what happens in between, or just too busy, too distracted. That's what happens in between either.					(A5)						
P2	Yeah but it's also the constraints of the time and the budget for the project. Yeah, the example of the museum in Japan this is it's a museum it's got builds. It's of a scale.									(B4)		
P2	Like a counter example would be building out of snow in Alaska. There's no building codes, no railings, it's made out of snow. Nobody cared but it's a public room. If you made a public room out of anything but snow, somebody in a North American city - somebody would be after you to make sure the railings were there if the kids were running around and platforms ten feet in the air.										(B5)	
P2	Risk is important from a couple of different standpoints to ask personally like the whole thing we're talking about is actually really we value the lessons of not being afraid to fail and just accepting it sometimes, yeah, you will but it's worth it just to try things. Sometimes the things that fail actually lead to something way better than what you were trying to do anyway and all that stuff. Risk is valuable.					(A5)						
P2	Yeah. You do have to take measured risks. Like I don't know, it's prudent to be responsible as well.					(A5)						
P2	Well, that's the thing. There's such a long tradition, particularly in glass in Europe. This is something that men who are craftsmen do. They make the glass. They don't design what's made with it, almost never, but it's a highly skilled profession. It's done by men and the design is done by somebody else. There's a lot of boundaries around it that have been there for hundreds of years since Moreno when no one was allowed off the island ...											(B6)
P2	INTERVIEWER: Is there a moment when you said hey, I will stumble here? P2: I've always been like that. As a kid I was never afraid to do the assignment that wasn't asked for. I always made things in my basement. I always ... I probably felt a lot more like myself in university because in an architecture school it's a lot like being in kindergarten in a way. Maybe, I don't know. Maybe first year architecture school if there was a moment where I realized as an adult.					(A5)						
P2	P2 recited part of a studio exercise in remembering a childhood space: Then where a wall had tipped over it what I imagined was a bed and all these things that were some natural and some remnants of the building that all made up of something. I realized how powerful it all was and shaping my imagination or just my ability to think of what a material could be. That the second floor revealed it could be grass or a meadow and it would still be a house, or things like that. I would say that.	(A1)										
P2	INTERVIEWER: Now if this were new material that you'd never seen before and someone gave that to you, how do you approach a new material? I can see what you do now. You're squeezing it, you're rolling it, you're touching it. P2: Yeah. Which is to learn physically from it. How does just what qualities does it have? There's nothing in particular look at you just start feeling it and then what it is it is. INTERVIEWER: Do you compare it or anything? P2: Probably naturally. It's a little unfair because it says the word Gecko right on it, which immediately biases you to grass. I read that and I started thinking about the natural grippiness of a thing. If I were to play with this like my set of things like it's akin to having a scientific method or something where you would apply a set of things to any particular material or object. One of the things we would do is how do you attach it to itself if you have no other materials but you need to attach those to itself, how is that accomplished? I'd look at this and I'd start to think well, you can probably fuse it to itself. You can probably use heat. Then so you just try that and see if that works. Chemicals probably work too but obviously heat is easier to work with. Then can it hold a fold? Are there different ways to create it and make it fold? Because folds give structure. Those two things like how do you attach it and how does it fold are like something you might take to any material whether it's glass or paper.						(B1)					

Analysis of Factors Towards Material Engagement by Designers

The nine participants were all interviewed, and their comments were individually compiled into separate transcripts. Using the codes noted above, the transcripts were analysed to examine both the intrinsic and extrinsic factors that influenced the designers when engaging with advanced materials. As noted

above, the investigation and data gathered from the semi-structured interviews clearly indicated that the term ‘unknown’ would better represent materials yet to be used or known by them. The comments of the participants all indicated that they shared a holistic view towards materials.

The analysis assessed trends or issues faced by a spatial designer that have not been thoroughly investigated elsewhere, and as Mills et al. (2010) propose, form the hypothesis of an in-depth analysis. The implications resulting from this research will impact the practice of design. The use of multiple participants in one study allows for a richer investigation of the phenomenon, and as Bleijenbergh et al. note, “There is general agreement that a multiple-case study design offers the best abilities for testing theories or hypotheses because it allows researchers to systematically compare variation between the cases” (Bleijenbergh, Peters and Poutsma 2010, 65).

Grouping of Analysis Codes

When examining the coded summaries, there was a clear relationship between parts. Although only one code was used per statement, there could have been multiple codes per statement. This will be elaborated in the text below. The overriding terms of intrinsic and extrinsic were clearly defined earlier, and they indicate the main lens that is used per statement. Within each of the subsets, statements were then grouped into more generic terms. The following is the breakdown used:

Intrinsic:

Related to the internal engagement with materials, experiences, and ideas.

Engaged or acted upon by the individual.

- a. Material memory
- b. Material experience (personal design experience, and educational and inspirational experience)
- c. Material ideas (conceptual and theoretical).

Extrinsic:

Related to the external factors that impact the engagement with materials, experiences, and ideas. Engaged or acted upon by the individual.

- a. Material properties (reference to properties of an unknown material)
- b. Material project concerns (client, site, and budget concerns)
- c. Material community consultation (a larger context of consultation with the community through regulations, and consultant's comments).

Trustworthiness of the Research

As previously discussed, bracketing allowed for a level of detachment from the participant's comments; the two methods of analysis to delve deeper into the issues, and large amount of textual data collected in the interview process addressed how this research could be trusted. Trustworthiness, established by criteria defined by Guba (1981), as credibility, transferability, dependability, and confirmability was utilised.

Credibility was achieved through the utilization of two established research methods, triangulation of data through a diverse range of participants, and iterative questioning to allow for checking the clarity of earlier responses. My own research credibility is also important as a decade of research publications in this area has established my credibility. These strategies provide validity to the research. Credibility leads to defining if the research makes sense to the research context (Gray & Malins 2004). The research is clearly transferable and allows for generalisability (Shenton 2004), as other designers and other disciplines could be involved with further studies that examine their engagement with materials that are unknown.

In terms of dependability of the research and to whether the same results will occur if the same methods and participants were used is a strategy of trustworthiness that was aimed for, yet as designers are constantly evolving within their world of material applications, repetition of the same outcomes is unlikely but there would be similarities as their material memory that would

not alter. However, the detailed research design and flowchart would allow for replication of the same study.

Lastly, the research demonstrates confirmability through the textual descriptions that uses the statements of the participants with my own bracketing of experience clearly articulated. There was no investigator bias only reflection through a process of coding the data in which the immersion approach to extract analysis through interpretation “emphasizing researcher insight, intuition and creativity” (Robson 2002, 458).

Limitations and Delimitations of the Research

This research, like all research projects, has its limitations and delimitations— aspects out of your control and those that can be controlled. It is important to note these to give the research a context.

The limitations were the fractured sequencing of time due to personal circumstances and multiple international relocations, which impacted the flow of the writing. The delimitations of the thesis that can be identified are: research design; the consequence of the selected methodology; and selection of participants.

The core delimitation comes out of the research design, which led to a very broad response from the participants to the selected interview questions. The choice of undertaking a semi-structured interview was the correct choice, and the questions were all appropriate to identify the issues of the lived experience. However, the aim of the research design was to fully investigate the lived experience of these designers, without preconceptions, through a qualitative research methodology. The use of a phenomenological lens to examine the work was ideal, as it dealt with the lived experience, yet the core aspect coming out of the work could only be determined after the interviews were completed. It was only through rigorous analysis and interpretation using textual descriptions that a perspective on the core issues arose. This iterative process is essential to

unpack the core aspects of any research without imposing personal preconceptions. The choice of phenomenological research methodology, first guided by Giorgi, and then through textual descriptions, reveals an important and necessary shift in the research process. Giorgi's approach addressed each statement and examined it multiple times to achieve a phenomenological reduction, which was necessary. Yet the data gathered, although extremely rich, grew too large to capture the core aspects of the phenomenon. This could have been the consequence of too many participants, each with dense and long interviews. Hence the decision to do a textual analysis, on account of the quantity of data collected, to address the quality of the text.

The choice of participants was appropriate in terms of their approach to spatial design and materials. Their range of expertise and diversity of backgrounds and locations was also appropriate. Due to the spread of participants geographically, each with extremely busy schedules, it was not possible to re-interview them with a more focused examination of what occurs when a new material is introduced to them.

Future research can extend this examination on the unconcealing nature of the engagement with materials. It can focus on a smaller sample size and delve deeper into their thought process at the moment of engagement. Research that can come out of this work can also test and extend the Model of Material Engagement that has been proposed.

Summary

This chapter outlines the research methodology and research design undertaken to address the phenomenon being examined in this thesis. The purpose of this research is to examine the lived experience of spatial designers within a subset of those who work with advanced materials that are first presented to them as an unknown material.

The research aims to describe, understand, and gain an appreciation of this experience by this subgroup of designers—those willing to take creative risks

with new and unknown materials. To this end, the objective was to undertake qualitative research. The previous chapter described the gap in the literature that this research aims to address, and it is this gap that has led to a research question about the lived experience.

The context of the research problem consists of the world of spatial design, within which the spatial designer has a lived experience dealing with their material memory and the subsequent design processes undertaken to complete a project. The external element of concern in the context is the actual unknown material that may or may not exhibit properties of advanced performance. This leads to a clear definition of the problem, purpose, and research question. A qualitative research methodology is employed, using semi-structured interviews with a select group of participants. This is then analysed through a phenomenological lens using textual descriptions.

This chapter begins with a brief description of the research problem that frames the research question. The purpose of the research, its aims and objectives, are articulated, and leads to the selection of co-researchers/participants for this study. A full description of the participants explains the relevance to the research (See Appendix F). The relevance of their selection is noted, but their identity is concealed for ethical reasons.

The theoretical framework and practice are identified in terms of the appropriate research method to be employed. The choice of qualitative research and its relationship to this study are briefly described, as well as why this methodology relates to the research question. Moran (2000, 127) states that “Phenomenology must return to what is directly given in exactly the manner in which it is given.” The relationship to the lived experience informs the decision to use phenomenological methods for this research, as it leads to a deeper understanding and exposure of taken-for granted assumptions about ways of knowing the process of engagement.

Heidegger felt that Husserl had conceived of a new way of seeing the world rather than a group of philosophical principles and standards. As the spatial designers that are interviewed demonstrate, each has a unique way of seeing the world, yet each designer expressed a universal interest in the unknown material, and through their handling of it, indicated a material intuition or sense of wanting to unconceal some aspect of the material.

The chapter then describes what phenomenological method was used to examine the qualitative data. Stark and Trinidad (2007) analysed various approaches to qualitative research and highlighted that the lived experience was the core goal of phenomenological methods. Giorgi's descriptive phenomenological psychological method (2009) formed the initial approach that was employed in this study, and this chapter outlines the detailed procedure that was followed. Additional methods that were used to delve deeper into the descriptions are also articulated. The accumulated data revealed the phenomenon of experiencing unknown materials. These descriptions were placed in discrete clusters that described the essence of the lived experience.

The next two chapters present a narrative developed through the use of textual descriptions and IPA. The chapters are separated into intrinsic and extrinsic factors that impact the engagement with unknown materials.

Chapter 4:

INTRINSIC FACTORS INFLUENCING THE ENGAGEMENT WITH
UNKNOWN MATERIALS BY A SPATIAL DESIGNER

Introduction to the Findings of the Interviews

The examination of the findings is divided into two chapters. The first deals with the intrinsic factors that impact the spatial designer when they engage with an unknown material. The following chapter will examine the extrinsic factors that have an impact on the spatial designer. Refer to Figure 3.2 for the structure and categories under the headings of intrinsic and extrinsic factors. The previous chapter outlined that the use of Giorgi's methodology followed by an IPA examination allows for interpretation of the text to determine common factors and sub-groups.

Appendix I will collate the key comments from the participants under the sub-headings noted, thereby providing further depth of the primary research. Samplings from this appendix are included in the text for each chapter to elucidate the topic being discussed.

Introduction to Intrinsic Factors

This chapter examines the nature of the spatial designers' experience in terms of the internal and intrinsic factors that impact engagement with materials. Their comments discuss the internal considerations that have a bearing on how they engage with materials. Common traits amongst the spatial designers were identified from coded responses recorded in the transcripts. The research methodology chapter has discussed the terminology and coding procedure used in this thesis.

This chapter is divided into three areas that group similar coded descriptions under a related heading. These headings—derived from coded transcripts—all relate to the designer's memory of material engagement, experiences, and ideas that address intrinsic factors. The headings are grouped as follows:

- a. Material memory
- b. Material experience (personal design experience, and educational and inspirational experience)
- c. Material ideas (conceptual and theoretical)

Part A—Material Memory

I think ... probably I'm one of the more seasoned persons here that you're interviewing compared to the others, but I found that I had been relying a lot on memory and lost memory. (Greg's Transcript)

Greg is a spatial designer with a huge portfolio of work and a track record of innovation, and clearly connects to a core element of lived experience with this statement. Greg is not alone in connecting to memories of material experiences that form the foundation of the designer's creative work. Quite often, the material memories were innocent recollections from childhood. All the designers who were interviewed had clear recollections of influential moments that had made an impression on them. A sample of two of those recollections are:

I used to watch him and help him. I still have that sense, smells and strong senses, sensory load on memory. I still remember planning away or pulling. You pull the Japanese saw and even the shavings on his plane were just like needle flakes. He did them so perfectly. I used to collect them. Curls of it. They're just perfect. I was just fascinated by it. I used to just go down and watch and smell. (Greg's Transcript)

I loved finding out how things are put together and loved that my grandfather had the first auto body shop and auto wrecker shop in Canada, in [name of city]. I used to go when I was little, and I loved to see how cars were put together. I was always fascinated with how the metal met plastic. (Lina's Transcript)

Remembering moments of childhood is not particularly remarkable, as most adults have recollections of the past that have influenced their character. Yet memories establish the base from which a personal and collective culture is constructed and understood. The characteristics derived from collective and personal memories help to establish a meaning to their practice as a whole. Yet it is not just the memories of past individuals and places that link these spatial designers' memories, it is the tactile memory of materials. This thesis examines how these memories can play a part for them to project potential designed

outcomes into the future. These participants do not view materials in a nostalgic manner; rather, they are quite aware of their place in time and their evolving relationship to materials.

When faced with the conceptual phase for a museum being built in Japan, Sandra discussed how both partners faced the problem when considering the inspiration coming from paper lanterns:

We were looking around for what could inspire us culturally there because we were making a cultural building in a new country, so it both felt appropriate and an opportunity for us to look and learn. We needed it sitting on the ocean and it's going to have to stand up to a lot too, so it's got to be something very durable or it's not going to work. That kind of thinking is so counterpoint to the ephemerality of these paper lanterns that the building's made for. (Sandra's Transcript)

Here, they were both searching for inspiration from the landscape and looking for the connection with the material composition of the exhibit space and the exhibits. However, it is Greg that really connects the relationship of the past glories of material manipulation with potential future uses in restaurants. This is approached in a manner that is not nostalgic, but mindful of the inventiveness of the past and the way materials are handled with the aim to use similar techniques.

Sometimes you get inspired by going to a quarry in Italy. I think, "Oh, my God. That would be so cool." That ... a century ago they actually used slab, a stone, as room partitions. They probably did in some places or in a washroom or just around the bathtub. Probably the walls are like stones, so I thought, why don't we do bathroom partitions in a restaurant that are just thick slabs as rooms, or the toilet rooms, and depending on our budget of course. (Greg's Transcript)

Lina looks back at a treatment of a material in one context and imagines it being manipulated in another manner, and even using the effect of the material being

used and abused to create a textural effect. Although it is decorative, its purpose is to create place through the connectedness of imagery and materiality.

It's taking this image, and it looks like when you're just sitting on old leather chair and you scratch your name into it, or you scratch your nails until it has that warmth to it. I said, "We're doing a whole wall in that." (Lina's Transcript)

Greg and Lina both use their imagination to drive towards projecting the use of the material in a space in each of their respective practices. They are both conscious of this technique of drawing from a collected material memory to utilise the imagery in a new way, but they do not attempt to make it a cliché. Yet the image is tempered by Greg's mindfulness of the client's budget, which indicates that the playfulness of the imagination often has to be balanced by professional concerns. He observes:

I don't know if that's a modernist approach, but it's—God, it's like the days where there was quality. Nothing was artifice veneer. It was the real deal. Solid stone. There's a lot of my memories based in this. I can't get to that. If I can't obtain that because of budget constraints or whatever, just let it go. Yeah, don't even try to fake it. ... I long for the past, that sense of holiday in old craftsmanship. I don't... I'm not always able to do it, because of primarily price, and get somebody to do it. (Greg's Transcript)

The spatial designers who were interviewed were served by memory in many ways beyond the application of imagery. It provides a core foundation of their sense of materiality and, for some, a relationship to their future practice. When reflecting on memories of her youth, Sandra, the designer of an expandable paper spatial system, noted:

I remember having a flashback making the [product name] of when I was really little living in the barn and I cut out paper apple trees and attached them to the sides of the kitchen we weren't using because my dad had built two for no particular good reason, but it made this narrow space. I made the apple trees join and stuff, and I made this

room out of paper apple trees and I just completely had a flashback to it when I was definitely the early paper [product name], I realized this is what I've wanted to do my whole life. I'm compelled to do this. There's something about it that I feel is one hundred percent myself right now for some reason. (Sandra's Transcript)

Not all the material childhood memories were positive, yet they proved to be a catalyst for a career in design. When asked to comment on an earlier memory of childhood with a seamstress mother, Greg noted:

I hated going there. I hated being dragged to the ... because I had disdain for just thinking about that, going into a fabric department and that, all that. I guess all the textiles in bolts seemed to suck all the moisture out of the air. I don't know, when I was a kid and I used to go in there, and I used to almost wince and I was going to die. Ten seconds I'm going to die, because of this dryness and I couldn't breathe. ... The only thing is colour. I was attracted to colour, yeah. ...The world, especially in that time in [name of city] before mass immigration, it is a very dreary place. It's all browns, and some greys and black that people wore. Work blue collar uniforms, navy. (Greg's Transcript)

This disdain for the actual material inadvertently shifted the focus to colour, which proved to be one of the hallmarks of Greg's practice, which also incorporates innovative materials and details. Greg previously noted this as part of a strong impression he had as a child of his father's profession, which is reinforced with another comment:

...I didn't realise, but I think my father was a boat builder, a builder of wood, fishing vessels for the Japanese fishing industry on the West Coast decades ago. I remember his Japanese tools and he made these perfect wood parts. Wood components for the boat, there are such beautiful objects. All done by hand. I think that made a huge impression on me. Probably more than I realised. (Greg's Transcript)

For Yoshio, an awareness of materials was a 'tipping point' in his career path that was realised through reflecting on past material experiences. The

experience was defined as a formal, or informal education, with the dominant factor of note being the material memory.

I had many opportunities to go to the factories. A wooden factory, and a urethane factory, chair factory Then, I, how can I say, faced many different materials in the manufacturing processes. And that's the kind of first part I guess when I think of material very seriously. (Yoshio's Transcript)

All the participants take material memory as being a foundation in their design process. They consciously consider the act of reflecting on the immediate material experiences and also making links to previous experiences.

It's conscious, like it was definitely conscious. I love taking something that people are familiar with but using it in a new way. They touch it and they're like, "Oh, my God! I wouldn't have thought that this was this product. What is this?" I just think it's really interesting. (Lina's Transcript)

... and it's taking a tin ceiling that is so old world and applying it to the wall. All of a sudden, you're applying it in a different way that people aren't used to, but they're used to that material. (Lina's Transcript)

Exploring new ideas, or viewing the world through a different lens, is a core trait of a designer—an idea discussed in the literature review. In searching for the new, you can look back into your material memory to re-discover, adapt, and re-invent a material experience.

We're researching material right now. I'm trying to find an old mason jar so that we can make it into something else... (Lina's Transcript)

A more detailed exploration of this idea was expressed by Fiona when discussing the design of an external spatial installation. Here, her exploration was to find a material to simultaneously contain four to five images that can be viewed sequentially, dependent on the viewing angle. These tight constraints led Fiona to reflect back on a material memory from her childhood:

So, you know, when we were kids, there were things we, gold paper cards ... you know, those little game cards or whatever. You just wiggle to see different images. So, they're called lenticular images. And so sometimes what I do is, because the material is supposed to change with the element and it's very hard to capture that in regular photography media, so, I just do four to five images and print it as lenticular films. So, when you move around the photography, you can see that it's changing. So, like again lenticular prints have been around for 30-40—whatever, 50 years. So, it's just, within the context of my work. It makes perfect sense, that medium. (Fiona's Transcript)

When faced with another exterior spatial installation, Fiona examined the parameters of the site and the project needs and found that the solution lay in a material seen in the past but used in a completely different context. A reflective material was needed that would only be seen from a certain viewing angle. The material that was selected was 3M reflective fabric used in making safety garments for exterior use.

... I used that material to create the effect on a building. So, quite often, there may be some existing materials that I kind of change and the person I dealt with at 3M said, "Oh, that was never used in that manner before." (Fiona's Transcript)

Yet it is all not about innovative materials. Fiona echoes the sentiment expressed by other participants when commenting on their memory of materials that existed or currently exist. Understanding materials that exist can be a springboard for innovative ideas.

I mean, I'm learning constantly from traditional materials but, yeah. Changing it towards innovative.... But, as I said, like I can't start with a new material, right, that you'll always start tinkering with existing or traditional materials. (Fiona's Transcript)

The memory of a material is an essential aspect of the reflections of these participants. Their reflections are conscious, deliberate at times, and take them deeper into their own understanding of their past and their own process. They

also highlight the nuances of spatial design, regardless of the scale from product to architecture, and these subtleties in relation to our senses are described:

Now we understand the micro to the macro concepts and the micro detail to the macro concepts. Then we take all that in and almost forget about it for a second and then walk through the space or listen to the way that the footsteps sound in that hallway or the way that people are sitting down interacting or not interacting or looking at the openings through structures or walls or façades or glazings. (Juan's Transcript)

In the process of describing the relationship of the sense to material memory, Juan was asked if there was a temporal shift when designing, and whether there was an imagining of the future while thinking of the past.

Future past, yeah. This is where materials become the fabric of what we know, of where materials ... I mean they become the connection and it's reflexive this way. We see material, we project ourselves onto it and then we're left with this imprint, not of our material onto the material but the imprint of the material onto us and how it affected our experience. Our experiences are what makes us who we are, through the collective idea of what that feeling of that space or that environment in that time was like. (Juan's Transcript)

Juan elaborates further by recalling a recent memory:

Even smells. I was just actually commenting this morning, I remember walking in that hospital hall this morning actually with my wife and I said, "That smell. I remember that from some workplace somewhere," because it was like a cleaner and some solution. There's something that immediately threw me back to this time and place. Yeah, I mean if, say 20 years down the road, I encounter this material again there could be that anamnesis that occurs or recurrence of that memory or maybe that smell or something like that, but it becomes us. Materials are our memory, and it has an imprint. (Juan's Transcript)

This idea of materials imprinting our memory is echoed by numerous architects when discussing materials and their work, with Juan and the other participants expressing similar thoughts.

To close this section on material memory, Preya captures a view that demonstrates a crossing of a boundary between memory and personal design experience.

As I told you that, the ... We learn how to appreciate the beauty of the sculpture, of texture, of colours. I think this is the way that we appreciate things in our lives. When you see things, and you see materials, and you see that's how you can create beauty out of some certain material. How to make them more beautiful for you to use it. Make the best out of one. Whether that material is worth for you to explore or not, you can decide that you like it or not. You want to explore, you don't want to, or you have a future in that or not. Asking whether you take this or not. You have to try. (Preya's Transcript)

Material Memory Summary

Reflecting on the comments of the participants, it is clear that the memory of material interaction is dominant in the minds of spatial designers. From accidental encounters as a child with materials, to early investigation, say, of material shavings on the floor, through to other experiences as a student of design and as a mature designer exploring the potential of materials—all show an affinity to materials and their impact on the senses. There is also a clear indication that the ability to draw on these memories for future applications is crucial to achieving creative results that also use materials to provide a connected sense of place. However, an explicit system or model of engaging with material memories is not evident, despite the tendency of all the participants to frequently access their memory of material encounters. Such a model would allow for a greater understanding of the process that the designer undertakes whilst providing a practical tool for engagement.

Part B—Material Experience

(Personal Design Experience/Educational and Inspirational Experience)

Through the process of analysis, it is clear that there is a fine line between the spatial designer being influenced by personal design experience and by their educational framework, which has inspired them towards engaging with unknown materials. It is captured through the term *material experience*. The participants recalled moments in which they experienced a deeper understanding of their world of materials through practice, education or inspiration from travel or from a variety of creative work.

The term *experience* will cover the domains: informal forms of education; formal education; education through practice; and life-long educational aspirations. It covers the broadest notion of education and platforms for attaining knowledge. It also acknowledges inspiration from family, academics, and other creative and thoughtful sources. The following chapter will discuss the ideas that ground this quest that designers have for novelty; being conscious of experiences plays a large part in the process.

An experience can be a profound game-changer, as noted below, when Lina was asked: Was there a moment in your study that influenced you towards taking risks in material?

*I would say, we went to the World Fair in 2000 in Frankfurt. No, in Hanover, sorry. The whole premise of this Expo was the innovation of architecture. I've never been blown away like I was there. It was just like the Japanese Pavilion was made of cardboard tubing that was...
(Lina's Transcript)*

When faced with the same question, Greg gave a similar enthusiastic response:

Expo 67 in Montreal, it was super pivotal, pivotal, pivotal. In that I knew I wanted to become an architect, designer or sculptor. As a designer, I was un-moulded. I was un-moulded. That was amazing, and I was blown away. I can remember every detail. So many details of the interiors of those pavilions that are long gone. Travelling on the little

monorail to the Buckminster Fuller dome. I also went through the Ontario Pavilion with these huge, big, big rocks that were evoking the Canadian shield. Cut these square blocks of granite, stack them, and that was the edge, onto the lagoon, and they just put this canopy. This fiberglass canopy over it, or Frei Otto's tent—the precursor of the Olympics stadium, and I was mesmerised by these curves and the ... The structure of the steel net, steel net. Yeah. I was, "This is what the future's going to be." I thought. (Greg's Transcript)

Yet inspiration can come much earlier in life, and from other creative sources and media. Yoshio was clear in his recollection of being inspired about technology, materials and the future:

And the stuff of the special effects of the 2001 (Space Odyssey), and Gerry Anderson's UFO stuff are always the same. And I was a primary school student at the time. About eight years old. Something like that. And I was pretty inspired by those future designs. (Yoshio's Transcript)

Before designing the future, all designers assemble conscious and unconscious experiences that are more than just the memory of a material, but connect with other individuals who have inspired them, taught them, or guided them in practice. Some of the earliest impressions come from experiences and lessons learnt from members of the family. In terms of this research, this is particularly evident in participants who discussed creativity that was experienced at an early age.

Absolutely encouraged. Yes. I think that's the really important thing, and people who have parents who are artists are more likely to look at a child's drawing and see something in it to encourage them. (Sandra's Transcript)

My mother was a seamstress tailor, highly trained. A tailor. She was a perfectionist. I remember her thinking, her brain moving. You can almost smell the smoke as you try to resolve this coat detail or how do you get rid of the buckling. How do you make this drape smoother?

Drape better. Just figuring out different details and that is probably thanks to my mother too. (Greg's Transcript)

Sandra elaborates on the impact that the act of making things had on her in childhood, and how it provided the core of her future practice, with the implication of a relationship with materials.

Well, growing up with a Dad and Mom that are artists and always making things. We lived in a barn that was in constant renovation for quite a few years. Absolutely probably affected me in a really good way, I think, but just always having a sense that things are made, not bought in a shop, whereas a lot of people don't grow up that way. Things come from stores, not necessarily being made. Then just always being encouraged that way. (Sandra's Transcript)

Juan notes that the influences may also come from extended family members, and, in terms of this research, those who had an impact on the participant's view of materials:

Yeah. I think in terms of the framework of design I've inherited or in other words has been passed onto me. I think there's a bit more tradition, more than I can give recognition toward through my family, because my father's father was a blacksmith who also created his own tools. I remember my father showing me some of his tools that he had created. (Juan's Transcript)

The participants also recognised it was not just experiencing materials, craft, art and making that was instilled within them during childhood; a clear sense of design values was provided, which would later be translated into different creative disciplines. Greg comments on the:

Strong sense of quality that they [parents] instil too and helping to put together. (Greg's Transcript)

Juan highlights that although design that was engaged with materiality was not

practised in his house, there was a profound sense of detail and precision provided by a father who was a professional graphic designer.

He would certainly influence my thinking, maybe not specifically about materials in the sense that it's not like he would you say, "Oh, check out this particular type of glass or this edge of glass," or something, but he certainly opened my eyes to what detail consists of. If you took the care to think about perhaps the spaces in between or the subtle contrast of tone on tone or the same tone on tone, in his work that's what he focused on. Right down to, in his days as a graphic typesetter he would space out things to one sixty-fourth of an inch. With that attention to detail, I think, it was almost impossible to escape from when thinking about when I looked at objects in the world itself. Perhaps it's a little OCD. (Juan's Transcript)

Memories of early education also established themselves in the recollection of the participants. They may have seemed innocuous at the time but have remained part of the thread of materiality that exist in these participants. Greg recalls an early experience:

Even when I was sitting on the desks that were old. I went to [X] Collegiate. I went to [X] Collegiate in high school, and at the time they were just still transitioning over from the old desks that were all ganged, cast iron at the tops with the ink well. Then in front—the front panel of your desk, modesty panel, was actually the back of a person in front of you. I'm not allowed. I'm bored out of this thing too, history or whatever, and then trying to sink the ink well, and ergonomics. Playing with it. (Greg's Transcript)

Such a strong impression that was left for nearly half-a-century signifies the power of the experience when it was recalled. While other participants may not have gone back as far in their past, they all were able to recount educational experiences at various stages of their career. With particular reference to material experiences, Fiona recounts an interest course taken simultaneously with her formal postgraduate master's course.

I remember during my masters, I took at this Jewish community centre, they had a good course where they were teaching how to make sculpture or using, um, like there's a cement that you can brush on. So, you know, like stuff like that. I, early on, I mean less so now, because once you're in academia, you make less stuff. I hire students to make stuff, but I don't make them anymore. But early on, I was always interested in making stuff myself. (Fiona's Transcript)

Michael did not recount early memories but did have solid recollection of being at design school and engaging with materials. In his reflection, there is a process of critical analysis that has allowed him to move in a different direction than what was experienced.

Michael clearly makes new sense of the situation and allows himself to shift towards a new path.

I found even in education, although of course, you're taught materials but at that point in time it was taught as an isolated thing. You need a floor material, you need a wall material, you need ceiling materials. It wasn't, I guess, instilled, perhaps, that the integral aspect of the design is the material. The way I approach it now. (Michael's Transcript)

The bridge between education and practice has been crossed by all the participants and represents a moment when there is a realisation of types of exploration and material experiences that are uncovered in both of these domains.

Yeah. I think, as you say, there are two waves of changes in my life. The first one is my furniture company days in the development section, and after that, [name of college]. That's kind of one first wave over facing the material and thinking of a new way of using materials. And the second wave is IDEO. And when it was IDEO, I had a good opportunity to see new materials, innovative materials. And Material Connexion® created lots of interesting software books. Those inspire me a lot. (Yoshio's Transcript)

Attaining insight and knowledge is not confined to educational institutes, as experience provides insights that the structured form of delivery cannot provide. The nuances of education and knowledge is necessary to be aware of as the spatial designer draws inspiration from a wide range of sources that are synthesised to produce creative outcomes. This inspiration can come in the form of text, lectures, and formal experiences in educational institutes, but they are also absorbed by the designer through lived experiences.

I just have a vision of my mom taking me to church with her, not wanting to be there and sitting there, and her asking me halfway through like, "Are you okay?" or asking me something. I say, "Well, I'm trying to figure out how they've hung that cross." My mom was like, "That's what you're thinking about?" I'm like ... It's always been a real curiosity. (Lina's Transcript)

Experiencing life with family members is a normal occurrence, yet for Lina, the driving internal desire to be curious and to understand the world is always present. The external view of presence is based on the perception of the world as we observe it, and the internal view is a conceptual view of presence and is of how we imagine it to be.

As an experienced designer, I can also attest to the need to be constantly curious and observant of the world around us. With eyes wide open to the nuances of detail, form, and engagement I would experience the world and try to collect, sort, and recall these experiences when designing. So, Lina's description is insightful and reminiscent of my own experiences and those of other designers I have known who would look under a table to see how it is constructed. Observation is vital for designers.

Sandra makes the connection to observation of traditions and human history. She also relates this to the understanding of materials, in particular, cedar, and the indigenous understanding of the material.

Yeah, I believe in that. I believe in studying trades and traditions and that there's a human history of that type of learning that's happened that's really interesting. On the [location], here it's looking at the way indigenous people really understood cedar. Every inch and fibre of a cedar tree, they understood it and how it could be used in different ways. (Sandra's Transcript)

Indigenous ingenuity is not the only inspiration that Sandra speaks about, as her paper spatial product owes its start to manufacturers who also had a heritage of note (See Appendix I). Sandra also comments on the even greater sense of heritage that her material exploration has become a part of.

We were like wow, there's something to this. This is a whole world of things. I've never actually seen anything else made of flexible honeycomb other than paper decorations. Yet the first paper decorations, honeycomb ones, were well over a thousand years ago in China. Yet in all that time no one's really made anything else other than, well... in its flexible state but of honeycomb. (Sandra's Transcript)

This addresses the philosophical question of where a material starts and finishes. Her work continues to explore the nuances of materiality, as her paper honeycomb walls have raised this question.

Yeah so you could take the brick or the tile and think, like do, that kind of analogy There's an incredible system of Catalonian construction made from curved ceramic tiles where they're laminated to create structure. Is the tile material, or is the clay the material in it? Where does the product begin and the material end, or is it still a building material, which a lot of people would conclude. (Sandra's Transcript)

Sandra also discusses, in depth, a moment of inspiration that came in the form of a case study. She addressed the concept of “end-to-end” control of materials for construction by addressing the supply chain process of the material and its relationship to spatial design outcomes. (See Appendix I for a detailed reflection of the Guastavino Tile Company).

Manufacturers and designers working with new and advanced materials are now becoming plentiful, but there are a few that are consistently seen to be working with innovative materials, as Fiona remarks:

I will say like, of course ... there's always new work coming. But people who have been working in the area of materiality, material innovations, they are consistent. ... architects, interior designers, industrial designers, or engineers who have been publishing regularly... (Fiona's Transcript)

Individuals like Blaine Brownell, Shigeru Ban, Anish Kapoor, Jenny Holzer, Robert Ledingham, Elizabeth Diller, Ricardo Scofidio, Nader Tehrani, Phillip Ball, Mark West, Enric Miralles, Bill Pechet, and Alvar Aalto were just a few of the inspirational authors, researchers, spatial designers, engineers, artists, and academics that have inspired some of these participants. Each has left a mark on these participants to help form their unique way of seeing the world and creating it through material manipulation. This sense of individuality is important trait of being a designer. This is echoed by Preya:

Yeah, because they not stopping me from doing things. I dress whatever I want to. At that time, I'm just like everybody along just very fashionable things. I do something different. I always do something different from others. (Preya's Transcript)

Preya continues the comments about her experiences with fashion statements and the use of materials:

I know exactly what I want to do. I want to do something this way. A formal kind of thing, I look ... I make my clothes out of my mother's skirt, but I made it into a blouse. (Preya's Transcript)

Being able to explore one's individual desires and creative self is crucial in being able to understand your world. Travel is another form of discovery that feeds the imagination and also provides a sense of connectedness.

Now I've been able to have the luxury of travelling and experiencing those different types of spaces. You bring that back and go, "Well, yes

but it's maybe not exactly what I would have expected that experience to have been, or that's a great experience, but I want to use it over here for something else." (Michael's Transcript)

Michael retrieves images to be utilised in future spatial projects. Exploring new spaces through travel also allows for Michael to increase his material vocabulary by looking for new materials. There is the immediate sense of creative play, noted in a statement highlighting the potential use of the material in ways that are different from those seen in his travels.

Well, I'm always exploring. Whenever I go to a trade show or I travel ... I'm always looking at new materials and how they're utilised. For me, it's seeing the material in the marketplace, but then thinking about, "Well, what else could I use that for?" (Michael's Transcript)

Michael is an accomplished spatial designer whose practice centres around custom-designed, high-end residential interiors. He comments on how he emerged as a designer from a smaller city that lacked the demand for material resources that the larger centres have. This view of the supply chain of new materials to a smaller centre had an impact on his design vocabulary.

I think in the past as a junior designer, emerging designer, you really relied upon magazines, obviously. Working in an office you were dependent on the suppliers coming to you, especially in the small city like [name of the city]. We didn't have the resources of design centres or manufacturer showrooms per se. It was really limited in terms of what was in the marketplace and that particular region in that particular time, and what the market would bear in terms of cost or availability. I think there was a very limited vocabulary in many respects. (Michael's Transcript)

His recollection of early days is valuable in its honesty about wanting to discover materials, and how material knowledge was gained through the experience of use. It was through trial and error that, gradually, the knowledge of materials grew with his design practice.

I think when you start it's almost in naïveté about just discovering materials. I think certainly I learn from experience and in many cases trial and error. I mean obviously you observe what's around you. I think originally when I started practising, I wasn't thinking that materials had the same potential as they do now. I didn't feel that they were probably quite as integral to a design as I do now. I think I felt them more as a means to the end. (Michael's Transcript)

All the participants practised spatial design to some degree, from product to installations, and from interiors to architecture. Understanding that the actual practice and application of a material will be different in the various spatial practices, the moment of engagement with an unknown material would be the same but the subsequent extension of the engagement may vary depending on their practice. Blair, whose practice focused on architecture, offered insights as to what grounded his practice when it came to opportunities to engage with a new material.

We have to live on what we can build. I guess that's just a reflection of a practice. I guess that's always the lens that I bring to new materials, is how will it interact with people? I don't mean the end-user. I mean, what's the process of getting it on the wall or building the wall from it, and who are the people that are going to do that? (Blair's Transcript)

The reality of practice is echoed by Greg, whose international reputation demonstrates a clear understanding of the demands of spatial design practice. Although an advocate for innovative design, he clearly delineates the priorities in his approach.

Spatial, and then through the spatial, materials come up. Yeah. Spatial and then site in a situation, and then I think material. (Greg's Transcript)

Michael articulates a view of wanting to make a difference in a space, not so much about just being influenced and intrigued with what is new. Reflective thoughts about his practice are expressed with his comments:

Well, I think it's maturity. I think it's when you're an emerging designer you somewhat fixated on what's new, what's happening and what's the hottest trend? What's "in" in interior design this month sort of thing. I think when you've gained life experience, you've travelled. You've experienced different environments and places... that you really start to appreciate that it's not necessarily whatever is brand new or whatever is hot or whatever so-and-so is using but it's, how can that influence? What difference does that make in a space? (Michael's Transcript)

He continues with a modernist view of design and materials reminiscent of Frank Lloyd Wright and the early modernists (Conrads 1997) in his comment:

I think I evolved to, as a designer, really understanding now [that] the materials have to be true and honest. (Michael's Transcript)

The sense of honesty and timelessness is also echoed in a statement by Sandra, who connects the timeless indigenous traditional material experiences and knowledge of materials with the essence of exploration and experimentation.

I think the essence of experimenting will always be there, and that thing that I admire in the example of an indigenous people studying the use of cedar, there's something timeless in what I admire about that. It's something that can be very contemporary. (Sandra's Transcript)

Preya captures the spirit of adventure in challenging ideas and searching for ideas that are new in her comment:

I just enjoy doing whatever. If it is something new and challenging, I think, I'm going to do it. (Preya's Transcript)

She continues by introducing the idea of creative risk-taking and persistence in the search for new ideas.

Yeah, you have to take risks. Because you think that you can do it, you can win it. The risk that you.... Not really like, risk your life or anything. Probably, it's challenging because you can fail it. If you have your

will, strong will, and you enjoy doing it, any way you can find a way to win the situation. (Preya's Transcript)

She also mentions the relationship to material experiences and exploration:

When I started it, I just ... Told you before that I tried in many different kind of techniques, to get different kinds of texture. That's the way I evolve with one material. So, you explore them in many different ways. Which results do you prefer? Which direction that you can ... Use it for real? (Preya's Transcript)

Beyond exploration with developing a new material based on traditional technologies and addressing an environmental concern, Preya—trained as an interior designer—also took on other spatial challenges that demonstrated her passion for exploring new territories of design.

I just enjoy doing whatever. If it is something new and challenging, I think I'm going to do it. I always do something like this, such as other than the water hyacinth, a friend comes asking me He got this project to do a shuttle boat for the [company name] Hotel. A shuttle boat! Asked that I design something. (Preya's Transcript)

The shuttle boat project typifies the spirit of these participants who are eager to try new ideas, to solve problems or to push boundaries.

I think partly, I like solving problems. It comes together. You can solve something that I ... normally do, ... for the interior design work, it's also a challenge as well when you can do something different. You can do something new, you can do something in different angle, or in different way, and it comes out good and you're proud of it, and you enjoy doing it. I think it's the same way when you're involved with something. You want to achieve the best out of it, and you try to find solutions around the plot. (Preya's Transcript)

Design as a practice is clearly part of the participant, and the search for pushing the boundaries quite often is demonstrated in other parts of their lived experiences. Greg captures this in his comments:

For me, I've come from a place where I was so unconfident in myself. Is it one thing? It's been a whole lot of things that have kind of pushed me. I wouldn't say it was more material but more of who I was that made me comfortable with who I am, that has allowed me to say I have the confidence to answer to what I'm doing. You know what I mean? I think that ... I think I'm afraid of heights. I was afraid of heights and I had nightmares about it all the time. My thing is like, "Okay, let's go to the Grand Canyon," and I climbed out onto one of those structures that stand free. Now, looking back, it was stupid because I could have killed myself, but it's like, "Okay, I did that. Now I can do this." It's like I was terrified to talk in front of people, so I was like, "Okay, well, let's ..." I was asked to speak in Vegas in front of 200 people and I'm like, "Okay, so I'll do that, and then talking to 10 people will be fine. (Greg's Transcript)

Material Experience Summary:

The relationship to material experience is clearly shown in the participants, who are reflective in their practice, and used materials to expand their repertoire, and continue to seek new applications for materials discovered in practice, education, travels, or from observation and reading of other creative outcomes. My own experiences of design practice resonate with these experiences of the participants.

The material experiences of the participants were varied and insightful. They recounted pivotal moments in childhood that, unconsciously at the time, but now through reflection, have formed a core aspect of their approach to design. Material experiences that transpired in formal and informal learning encounters were shown to be a foundation of how they design, and how they engage with materials. Inspiration from family, academia, professionals, text, and assorted creative outcomes, formed the material experiences of the participants.

"Reflecting on their biggest breakthroughs, many innovators have described elusive solutions as coming to them in a sudden flash of insight, while artists often describe their best ideas arising as if out of nowhere" (Kaufman and Gregoire 2015, 61). This "Eureka moment" reinforces the idea of the creative

genius. Csikszentmihalyi claims that those individuals are few, and really a category of creativity that is separate from the rest. He explains that: "... creativity does not happen inside people's heads, but in the interaction between a person's thoughts and a sociocultural context. It is a systemic rather than an individual phenomenon" (Csikszentmihalyi 2007, 23).

The domains, fields, and individuals are in a symbiotic relationship with each other. The participants are part of the context that gives rise to their material experiences. Their creative efforts are a reflection of what they gained from those experiences. Now their work and actions will influence others. Creativity is facilitated by a network of experiences of individuals who exist in the context of a field of other creative individuals.

Part C—Material Ideas (Conceptual and Theoretical)

The approach taken in developing the categories of concepts and theory for this analysis stems from the view that ideas are thoughts beyond the immediate experiences of the designer. These are philosophical and theoretical ideas that exist in other disciplines, and through thoughtful text, are exposed to the design community. The participants each approached the ideas generated in a community and incorporated them as they saw fit.

The design drivers discussed by the participants were complex and varied in the sub-themes that emerged. They informed their projects, and how they engaged with materials. Some ideas were more overarching and helped to establish a theoretical position towards material engagement, while other ideas were more directed.

Fiona captures many of the sentiments and sub-themes that emerge for other participants in her statement:

...so, again, that experimentation was going towards sort of building, and having poetry—poetry appearing with rain. ... Yes. So, again, a lot of the questions because prototypes, as you know are not final. They are just conceptual building prototypes. So, I'm trying to push the work further. (Fiona's Transcript)

Within this statement she identifies a personal design philosophy that indicates that creative risk is part of her experimentation with materials. Her comments also allude to the site, building, and the user. There is a sense of place and engagement with materials that helps to define her direction, which plays with poetry and theoretical ideas. These are all sub-themes that the other participants discuss throughout their comments.

Yeah, well something you recognise and don't recognise, that's familiar. There's familiar like taking something familiar, and then also taking something and then being taken by surprise at the same time, is combined in that. Just that epitomises how we want to make sure we walk around the world. We want to make sure we stay curious enough

to learn about everything around us. That's what kids do. That's what I know I love about living. Make sure I never lose that. (Sandra's Transcript)

It has many layers, because that's my need. That's my need, to feel that I'm relevant on an innovative level. I will find out about what can I do by laminating glass. What happens if [you] laminate ... Dot matrix, a real white gold, a palladium onto a glass, instead of aluminium, ... It's my need or maybe partly insecurity that I have to have some element in my work that's more exploratory. (Greg's Transcript)

Nadine always says to me, my famous line is, "What if?" because I always like to explore the other option of it ... (Lina's Transcript)

I think because I'm an interior designer, I have the chance to see lots of things around. I'm always looking for something new to create something different. Material is very important to make your differentiation. When you design, you make things different from others. (Preya's Transcript)

I have always maintained that I am happiest when I am completely lost, that I feel the most comfortable when I have no idea what we're doing, like when we did the gathering place and we proposed something that we didn't know how to build. Up to that point in my career, I had built quite a lot of things, but they were predictable concrete structures with infill and all that kind of stuff. I was really liberated, and I was really ready, at that point in my life, to scrap all of the stuff that I knew and try to take risks. Here was a manageable risk. It was just something inside. It wasn't going to hold up a building. I had no idea how to construct the form that I had put forward. To their credit, the client group, they were supportive and I'm thankful. (Blair's Transcript)

The designer's personal design approach or the design philosophy is evident in the range of statements above. Each addresses their lived experience and their approach to design, seen through the lens of material engagement. For some participants, their views on the lived experience of designing and engaging with

materials were articulated at a deeper level that revealed nuances about their ideas involving materials and design.

When we're actually working and enjoying the mode of working, we just feel a sense of freedom with surrounding ourselves with more abstract inspiration like nature and just materials, raw materials. ... Just to really be able to immerse ourselves in our exploration, be more inward and focused about it. We're just focused, I guess, and less apt to just do what we see happening beside us, because there's nothing happening beside us. (Sandra's Transcript)

The sense of enjoyment in the whole process is a sentiment expressed by other participants:

It's more fun thinking of something that way and how to make use of the things that nobody cares [about] and is useless. ... I think it's more fun for me, doing something like that, this way. It's to prove that if you have train[ing] in design, or you work with this skill, or you try something in this skill, you can use your imagination or your creativity to create something new, or fun, or ... Sometimes help the world get rid of this used thing. (Preya's Transcript)

Other emotions are expressed by the participants, as they reflect on their way of experiencing materials, which leads to their own, and quite often undocumented, personal design approach. These material ideas impact the concepts of projects, but also define how they see the world.

One of the things that could occur, is always that there's that memory-making theme thing. (Greg's Transcript)

Greg connects the process to his constant recollection and his need to recall memories, whether they are real, or memories of images recalled from fiction. Sandra agrees that there is a sense of mystery involved that excites her.

Yeah. That freedom that it will get to unfold into something, but we don't know what. (Sandra's Transcript)

That sense of freedom is also expressed by Michael:

Oh, no, definitely. I mean it's always fluid. I mean you'd never reach the end. Yeah, it is what I thought it would be but I'm not even midway. I'm not at the end. I'm always looking to the future, what's gonna be? How are things gonna change? How is our profession gonna change? How do we fit into the big picture of technology? All sorts of environmental issues. All sorts of things. (Michael's Transcript)

Michael's comments talk about the bigger picture in design, and issues of the environment and the profession are mentioned, but the sense of adventure and the fluidity of the process is clearly noted. The willingness and desire to explore is expressed when he says:

Basically, instilling in me that anything is possible. Just think if you can design it, you can create it with that material, and you can find materials to create. (Michael's Transcript)

Within the sphere of material ideas that drives these spatial designers is the notion of being able to find new and previously unknown materials. Michael alluded to this in his comment above. This indicates a sense of the willingness to explore and to be innovative in the thinking towards materials and the lived experience of engaging with them.

You see something you want to make happen sometimes, which is the opposite end of just the experiment, which we love. We love not having any particular pressure about what it's going to be or when it's going to be, but then there's also, sometimes, you know, you want to get somewhere, and it takes time and trial and error to get there. For us, we were always looking for the Holy Grail of materials where we can have all the properties of strength and fire retardancy and water resistance and all of these things. At the same time, something that's responsible to the planet and can be harvested and made in a way that feels good, right? (Sandra's Transcript)

Then I also believe that we can continue to contribute. We haven't figured out the whole planet and understood materials. There's still

more learning to be done as a whole and then also just more [of an] artistic idiosyncratic level in the way, a subjective way that an individual might come up with once they understand the material. (Sandra's Transcript)

Whereas Sandra ponders the idiosyncrasies of the exploration of materials, Greg and Fiona indicate that a sense of project application is necessary for the exploration.

Some projects require more exploration and further exploration, and more I guess pushing for more innovation. And other times, it's the reinterpretation of... (Greg's Transcript)

As you know, my expertise is in material innovation, so I always take that tangent versus just find the material and apply it. (Fiona's Transcript)

Preya expresses being totally aware of the role of the senses, particular the tactile sense of touch, in the creation of her spatial objects and designs, yet still relates it back to the role of function.

Yeah, it's actually involving all kind of senses. When you do ... The design for the space, it requires all kind of senses. Include functional things. (Preya's Transcript)

There is a clear sense of playfulness in the thinking of Sandra, who quite consciously advocates playing with the notions of practicality. Her comments reflect this sense of curiosity and creativity that is often witnessed in design.

We're interested in both practical and impractical things. They were definitely a learning point, very, because I'd always understood felting in one way but had never picked something up that was as hard as a rock and still felt. It made me think, what is felt? What are these things? If you pick something up that feels like a river-rock but it's been made for a machine. How does that, what's happening here, and how does that happen? (Sandra's Transcript)

The personal design approach described by each of the participants is an exploration that is continual and evolves for a variety of reasons. Blair notes that practicality is a major factor; for him, picking the material that is simple will allow you to pick the battles you can win. His statement also addresses the different practices that spatial designers work within. These range from the professionally driven, client-focused office to the creative studio that allows for exploration, and from the academically-driven spatial design practice to the product-focused designer. There are others beyond this range that were not interviewed, but each one derives creative results through a conceptual lens that translates a theoretical viewpoint of the world into their work.

Since leaving that firm to start my own, it sounds like I've thrown in the towel, but it doesn't [mean that]. I try really hard to start from ... I don't want to stay at first principles, but I try to start at the bottom. What are the inevitable materials that are going to be considered here? Concrete block for a public washroom; steel with timber for a bus stop; or, in-situ concrete for a robust public enclosure. Because you pick your battles when you do this stuff. You've got to try to land on something in the project that will be firm, that is a decision, that is not going to get undermined or eroded when you are fifty percent through the design, and you've got to rethink what you're doing, and you've lost all of that conceptual foundation, or just the foundation, in your process. (Blair's Transcript)

An aspect that emerges from the discussions and statements of the participants is that of creative risk. These responses were partly to the questions asked that were based on the researcher's awareness of a gap in the literature, but also were genuinely offered without prompting. Risk and uncertainty is explored by Lina as she alludes to these ideas, that designing is something requiring trust:

I think it's such a fine balance between it being unsuccessful and being successful. It's just knowing that balance and kind of trusting your gut and saying, "This is going to be okay." (Lina's Transcript)

Yet some designers were measured in their comments about risk, while not disallowing the option of taking risks.

To me ... innovation is taking risks. In anything, really. Because if it hasn't been tried and proven, then... (Michael's Transcript)

Juan clearly brings the conversation about risk back to the engagement with materials:

I think you always have to take risks with new materials, absolutely. It's not taking risk for risk's sake. In doing so you're learning. It's more about learning your own limits of thinking during the process. (Juan's Transcript)

Perhaps the two most vocal participants that discussed risk were the two who have been exploring spatial design through the manipulation of one material. This is not to indicate that others were not willing to examine risk, but Sandra and Preya were most willing to identify the idea.

Sandra clearly indicates the value of creative risk-taking in her spatial design practice, but also recognises responsibility.

Risk is important from a couple of different standpoints, to ask personally like the whole thing we're talking about is actually, really, we value the lessons of not being afraid to fail and just accepting it sometimes; yeah, you will but it's worth it just to try things. Sometimes the things that fail actually lead to something way better than what you were trying to do anyway and all that stuff. Risk is valuable. (Sandra's Transcript)

Yeah. You do have to take measured risks. Like, I don't know, it's prudent to be responsible as well. (Sandra's Transcript)

When asked about experimentation and risk-taking in her work, Sandra clearly referred to the material that is central to her work, paper.

The word innovation is used a lot. Not the word risk as much, but the ephemerality of the paper, I think, is something that is a similar mindset to people thinking of it as risky or less predictable. (Sandra's Transcript)

When asked if she takes risks, Preya opened up about her practice.

Yeah. I still take risks. I still do it. ... Yeah, you have to do it anyway, because it's the way to achieve something different. If you don't take risks, you just ... It's ordinary kind of people, or company, and nobody [is] interested in that. You can't survive. If you don't think of something new, or take risks, and you're always on the safe side, how can you create something different? Just waiting for somebody who can produce something for you. (Preya's Transcript)

When Preya discussed the idea of designing a space, risk was not mentioned, but being able to do something original and different was central to her comments.

It's like, from my experience, the space that we've got, you have to design something particular that will go there. We can do like, hundreds of designs out of that one space. ... I say, "Why don't we do it differently?" Just flipping and doing a different way. (Preya's Transcript)

When asked about reinventing her own practice, Preya expressed her desire to win and to get her own way. These ideas have already surfaced in the transcripts, but are demonstrated again in her comments below:

What drives me to do that? Probably want to win the situation. Yeah. I want this, and how can I get it? I find a way to get around it. Okay, how can I do it? Even, I have to do this and ... I have to do it myself to achieve what I want. (Preya's Transcript)

The idea of winning prescribes the overcoming of challenges and succeeding in achieving a state that is different from the state in which you began. Designers address design problems that are complex and have many variables for which a

strategy to overcome these risks and challenges are needed. When we engage in this type of creative play, there is the inherent risk of not winning, or failing in the game or challenge. Sandra mentions this aspect of creative risk-taking and the relationship of creativity and play:

*... but like the not being afraid to fail is a really important thing.
(Sandra's Transcript)*

When asked to reflect on a moment in her past that indicated a time when failure was a likelihood, Sandra responds:

I've always been like that. As a kid, I was never afraid to do the assignment that wasn't asked for. I always made things in my basement. I always ... I probably felt a lot more like myself in university, because in an architecture school, it's a lot like being in kindergarten in a way. ... Maybe first year architecture school, if there was a moment where I realised as an adult. (Sandra's Transcript)

Juan comments on the learning accomplished in failing:

I think there's value, that's where most of the learning comes from, when we start to see the breakdown of materials and when things fail. Sometimes there's a beauty in the failing too, I find. (Juan's Transcript)

Sandra adopted an attitude in her work that was a playful sense of exploration and discovery. When asked, is it just time that is needed to process information about materials, Sandra responded:

Yeah. and that time to play a little bit and let something morph. If you're in a big hurry to get paid to be, you're not even going to see what happens in between, or [you're] just too busy, too distracted. That's what happens in between either. (Sandra's Transcript)

I shouldn't speak to the digital world as much, but it's definitely something I understand, and I appreciate the physical world by actually playing with something rather than preconceiving what

*you're going to do in your brain, inside your head, inside a notebook.
That it's evolving in front of you. (Sandra's Transcript)*

Sandra expresses her preferred manner of generating ideas, capturing the idea of play, imagination, and creativity. Spatial designers who engage with ideas communicate to themselves and to others through sketching. Preya echoes this process in her comments:

Sketches, I sketch with my paper and sketch with material. ... Make models. I weave, myself. I got very small machine, I weave myself. I think of something, I have to do it by hand. I stitch it, I plat it. I plate with material myself. When we want something different you have to do it by yourself. ... I'm very low-tech. I'm very good in drawing. It's so fast, you don't have to open it. This white, plain piece of paper and sketch it. It's not technically ... It's like sending interior material or whatever. I just sketch the idea. (Preya's Transcript)

Preya suggests that the person's professional identity and the process of creation is expressed through sketching. The act of making through weaving is a tangible connect to the end product, allowing Preya a direct connection.

*Yeah, yeah. I like drawing. Love drawing and I know that I want to be ... First, I want to be an architect, and end up to be interior designer.
(Preya's Transcript)*

Some of the participants in this research comment on how they relate their spatial design practice and materials to the creation of place.

I think a sense of place is to me, becomes more tantalising. (Greg's Transcript)

Greg was the most connected to the idea of placemaking. His internationally celebrated firm has built a reputation on creating places that are both unique and familiar. His earlier comments on material memory reinforce the material nature of placemaking as coming from within the spatial designer and impacting the designed outcomes. Creating that sense of place is aided by his recall of images and sensory experiences.

I always have this nostalgic recall to whatever we do... I may not use that information or what I distilled in the past, but it's still in my brain. (Greg's Transcript)

He relates this nostalgic view and material memory to enhancing the space.

Illusions are an enhancement of an existing character that the material possesses. (Greg's Transcript)

Creating that sense of place requires being aware of all the sensory experiences that occur in spaces, so as to eliminate or enhance them. Research becomes essential in both the formal and the informal sense.

I've been researching store, department store, luxury stores for a client once, and one of the things that came up was I said, "I want ... that Barneys air." Meaning not the actual thing that's inside Barneys, the store in New York. Just that feeling when you walk in, you feel like you're in Barneys. (Greg's Transcript)

He continued his comments with how he used the question of placemaking and the sensory experiences in the spatial outcome for a client.

Colours, or light, nothing. You just know. I just want the feeling when I come in, and one of them said, "I wanted it to feel like you're in [CLIENT X]." I don't know whether I ignored that, or what, but it's that feeling that ... Yeah, that sense of place. (Greg's Transcript)

Juan expresses ideas about intangible sensory and physical aspects that are not often discussed when examining placemaking.

I don't think place can be quantified through space. I think place has much more to do with the time we spend in an environment on a social level as well as the physicality of materials, the physicality not just tactile but acoustically. It could be atmospheric or atmospheric pressure. (Juan's Transcript)

Greg relates the use of materials to the creation of a sense of place.

Yes, so sense of place comes, therefore comes in exploration of materiality, in its locality for sure. (Greg's Transcript)

When asked if the material is the key to establishing a sense of place, Greg fully agreed, and expanded the idea beyond a conceptual framework towards a sustainable and economic view.

Yes... One, it intrigues me. More than anything it intrigues me. Number two, I felt somewhat a responsibility to explore that locally and in a sense for very simple reason. A practical reason and it's, why would I ship all this stuff, material, to another country? (Greg's Transcript)

He also extends the economic view of the importance of placemaking by describing the issues around the luxury retail market that he works within. His view is that providing a spatial design that offers a sense of place helps to differentiate the space from others.

That's important, sense of place. I think especially now with the marginalisation and commoditisation of ... a sector I'm most familiar with right now, so the luxury retailing sector is just everywhere. (Greg's Transcript)

Creating uniqueness is an aspect that most designers strive for in their work. They find that dealing with the tension of the conflicting demands of continuity and contrast (Heskett 1980) is the natural process of design. Preya highlights the issues in making a space different to meet the client's needs, and the design approach:

Actually, for interior design work, we have to deal with the function of the space first. You can do the layout in many different ways, different angles, and you'll find ... Materials have to be involved anyway. You find something for special, for your project. You have to do something differently. Whatever you can, different texture for the wall. How can you make it more interesting with a texture, or a design that [has a] different angle, or whatever? You have to ... When you look into more detail, the space, you look at the space and then more details. How can you make that space more interesting, or the whole thing more

interesting? Using many, many ways of thinking. Colour, texture, lighting, whatever. It's kind of thinking of many, many things at the same time to get the results. (Preya's Transcript)

A sense of place helps to establish the space in both a familiar and unique manner; yet, as the professional designers recognise, they still need to address the concept of their client's brand. Lina captures the material ideas expressed in the handling of a space for an established client who was also very forward-thinking in their approach to business.

It was taking the philosophy of what the company is, and they're very well-rooted and they have a great clientele following and they're really well-known. It's taking what are those properties of how people see them and taking what material represents that. It's looking at a limestone that has that longevity in the... It's saying, "Okay, well, who is this company?" If we have to capture this in architecture, then what are these elements? It's looking at—okay, so it's this limestone. It's their traditional casing, and it's all stone, ... but they're also a very forward-thinking company. They have now over 1,000 employees. It's taking that philosophy that they have, as well as [being] very forward-thinking and pushing themselves, which is where the aluminium structure came from, and saying it's that juxtaposition against being well-rooted and forward-thinking. Let's have it lit from within because it represents their company. (Lina's Transcript)

Lina has a very busy practice that works across design typologies. She is known for award-winning hospitality design, but also producing creative interiors for retail spaces, residential units, exhibitions, and commercial space. What binds her approach is her personal connection to the client's needs and to the users of the space. Who interacts with the space is central to her material ideas.

I'm all about interaction. I think, for me, the most important things of my life happened in the interaction. (Lina's Transcript)

I imagined who it is more than anything. I think that we always design for the who, like who is it going to be in this space? What is it that they

wear? What is their life like? What is it that they're going to expect when they come here? When I look at doing, as an example, the [PROJECT A], and I was saying to [CLIENT A], who's the owner, and I said, "What car do they drive? What car was it that they drove when you first opened?" He said, "Well, the first day that this space opened was the first day of World War II." I was like, "Okay. What was happening at the time? What was the entertainment? What was the family life like?" (Lina's Transcript)

She reiterates the issue with a comment about the objects that are designed for the space.

It's so important because I always say we always design for the who, we never design for the what. Because it's like you can design a chair, but who's sitting in that chair? You can design a table, but who's sitting at that table? It could be a six-year old kid, is it very different than if it's like a forty-year old man? (Lina's Transcript)

Juan discusses a more ephemeral spatial arrangement in an installation dealing with projected images. Although not demonstrating materials directly, the screens were the material of the space, and they were constantly changing in appearance.

I then did an installation of having that being projected onto translucent screens in a space where people could walk around and behind and in front. As well as having cameras on the actors or the bodies that are moving in space being projected onto the walls themselves. It's this interplay of the body within space, the body creating a space, being projected, recorded, and projected in real time on the surroundings. (Juan's Transcript)

The process of designing the space involves the materials being composed to meet the needs of the users. It also involves the act of composing the space. Some participants alluded to the material idea of composition.

[An] experience we never had, like even playing with these things in scale models, we realised that wow, this is actually a tremendous thing.

We grabbed wedding bells from the Dollar Store. We were cutting them up and doing things with it. It all started, we were talking to a friend that's an audiophile and talking about how to make speaker columns. Just thinking about well, how can you make a three-dimensional curved object? What are different ways to make three-dimensionally curved objects? I thought of a wedding bell. That's something where you start, you manufacture in two dimensions and get compound, complex three-dimensional curves. (Sandra's Transcript)

Sandra describes the act of playing and composing with materials. Blair also describes the deconstruction of items to be placed at another scale.

We deconstructed a soccer ball, which is based on Buckminster Fuller's 'bucky-ball'. That's just a strategy for flat pieces stitched together to make spherical objects. It's actually, when you look at it and you start to think about it, it's not too unlike taking flat CMUs [concrete masonry units] and lacing them together with steel rebar. The two simple principles of putting these things together ended up talking to each other in rather unexpected ways. It's a very modest building, but right now I consider it a material tour de force for me. I'm pretty happy with it. (Blair's Transcript)

Greg's insight is simple but profound when he refers to the process of composition; it is not all about addition, it is about careful editing and reduction.

How you approach materials. How you ... yeah. It's the editing and composition and limiting the amount that you use. It's how you judiciously use it. (Greg's Transcript)

The conceptual and theoretical framework is implied in this discussion of material ideas. The participants explained their personal approach to design and how they took creative risks and were willing to play with ideas. They discussed users and interactions within compositions, explaining their lived experience with material ideas. A sub-set of ideas emerged from the analysis of

the act of engaging with the material. Comments were made by the majority of participants, yet all looked at the engagement as essential.

Because material concerns [in] our thinking was the kind of first part in the design process. (Yoshio's Transcript)

Materials sometimes become a kind of key factor for the new design language. (Yoshio's Transcript)

Furniture and product design are the primary professional foci for Yoshio. His work is on the periphery of the world of spatial design, and the difference in approach is evident in his comments.

I think, for furniture design, I see material more kind of as a physical material. And for the design ideation, I see material more like an image source. (Yoshio's Transcript)

Fiona adds to the commentary about the differences in approach in her statement:

... going through architecture and interior design, you think materials are something we apply, right? So, you, well, because it's still practised as such that you just order materials and then typically, it's either its surface qualities or colour or reflection or it's all the surface visual qualities of the materials that guides the decision making. Versus in other fields, it's not just the visual it's about how the material performs. (Fiona's Transcript)

These statements indicate a difference in the conceptual idea of what a material is and how it is used in design. Other participants echo similar views of starting with the material.

Yeah, I think you really look at a project or you start a project and now I imagine well, what will these materials be? It's almost like I approach the material as the starting point and then let the design follow, knowing what the thresholds and limitations of the materials might be... (Michael's Transcript)

I think it's more of when I'm starting to think about what the design is. It's going online, like we just finished doing [Project 4B], so it's looking at how does the ... what is Canadian? It's looking at green housing, okay, if we're going to redo [Project 4B], the whole premise of the design is Canadian design. It's looking at what is the stone? We're using soapstone. Then it's looking at a resin... (Lina's Transcript)

Participants were focused on the newest or alternative material for the project, as they were not looking at materials diversely; rather, they were looking at the diversity of the material.

That's been a conscious thing where we've given ourselves a project several times to try and use only one material on something. The gravitating towards ephemerality is both conscious and unconscious. It's just something that we now understand about ourselves that we do. (Sandra's Transcript)

Preya also provides a clear example of this material idea.

I try to stick into this material until this day. From one material, we can create hundreds and hundreds of designs. We make it different. (Preya's Transcript)

Preya has fully engaged with her work for the last three decades, exploring the use of water hyacinths. Her passion for the continual exploration of a single material is not uncommon with design, particularly for those designers known for their handling of materials.

Although Preya has been recognised for her devotion to the development of diverse applications of one material, she has also explored other ways of recycling a material. She speaks about the use of old newspaper that was rolled up and connected to provide rigidity.

Other materials that I did recently ... It's used newspaper. I show it at the beginning of this year in Singapore, IGFF. You see by yourself. It

looks different and you don't know it's newspaper. It's becomes a furniture. (Preya's Transcript)

When deciding to explore a new material, Preya viewed it as a discovery of what can be done with an existing material, to view it in new and novel ways. This conceptual approach reflects the ideas of Zumthor (2006) and also, sustainable principles of re-use.

I want to do something different and I want to explore. Making use of this in different way. Try to see how far I can go with that. In everything that I'm involved with new material, that is old material and how can I make use this material to ... Whatever I can do about it. How far I can go with that. (Preya's Transcript)

The more traditional view of spatial design is that of interior design and architectural space. Greg's interior design practice falls within this description, and his approach to the application of advanced materials indicates both a keen desire to explore innovation, and a mature perspective for examining the key issues of problem solving in relation to new and advanced materials. When asked about using an advanced material, Greg responds:

Yeah, even that. Because it's appropriate for ... It's an appropriate material. It's trying to solve... it's problem solving in the most traditional way. It's not just aesthetics. Because I like carbon fibre. (Greg's Transcript)

I would be taking that material and perhaps, we would perhaps... use the same material, but I am using it in a microcosm. I'm using it in a way that's very usable. I'm not using it as an architecture. I'm using it to define a space, interior space. (Greg's Transcript)

He also relates to the use of traditional material in non-traditional ways.

They were quite fascinated that we came up with some new materials and some old materials. Some old materials were manipulated in a new way, such as laser cutting or something like that, but obviously very traditional materials such as wood or sheet metal. Then, of course,

new composites and they're never seen before, like natural materials, but re-broken down into particles and put back together again in a more interesting and more cementitious material. (Greg's Transcript)

Here, Greg links the idea of new materials to the broader field of materials used in new ways. His comment indicates that the material idea is about the family of materials: some are new and unknown; some are known but used in unusual ways. He also speaks to the idea of not being swayed by novelty.

Yeah. We're still ... I mean I still love to use innovative components in our work, but not 100%, the whole ... Let's say if doing an installation out of a timber and bamboo or whatever. It's a great art object as architecture, but it's only built for ... You know it's going to be ignored. It's such a big boom, big flame, big press, big attention. The bigger the flame, the faster the flame out. (Greg's Transcript)

When the participants were asked about their reaction to seeing a new and unknown material, in an effort to understand their intrinsic approach rather than the extrinsic properties of a material, Preya and Michael offer perspectives on their thinking.

What I do? I ... I try to see the form. The shape and form that I can make out of this. If I were a fashion designer, I think probably I think, "Should be which part of the dress? Or should it be just like bag?" For me, for interior designer, probably thinking of something I can make use out of this. (Preya's Transcript)

Michael, whose luxury spatial designs dominate his practice, reflects on the potential of the material and how light relates to the material, which infers the relationship of a user interacting with the material in the environment.

... how the materials might convey form, obviously. Might convey colour, might express tension, might create relaxation, and of course, filling pragmatic requirements as well. I think I'm also really intrigued by the transparency or translucency of materials. Exploring light on materials, because, again, without light, materials don't really exist if they can't be seen. ... What does it create to the environment? Does it

make illuminance? Does it create tension? Does it add colour? How does it make a person feel in the space? ...

Because I think so much of the how you feel in a space, the psychology of when you're in that space is dependent upon the materials.

(Michael's Transcript)

Lina was very clear about her approach to an exhibition design project, and explained it with these comments:

The premise behind that was it was for an exhibit at a design show and the premise was, rethink design using materials that were environmentally friendly. Each designer could interpret that in their own way. (Lina's Transcript)

It was our approach... looking at the space that we did for the interior design show, because it was to be environmentally friendly. It was looking at how can we use something to create a structure and then not throw that product away. ... So, 90% of our product actually went back, so our whole booth was constructed of these 2 by 10s and everything, like shelving, everything was friction fit. Shelving all fitted into it, huge cabinets all slid into here, and so it was all fitted off the shelves so it contained the structure and supported everything. (Lina's Transcript)

As well as the deep concern and consideration that the participants demonstrated for the environment and sustainable principles, they were aware of the poetic possibilities for selecting materials that render a certain quality through being in particular environments. The play of light is particularly important in the material concepts that the participants engaged with. Lina and Michael both commented on this relationship.

Just starting with white because we love the colours of the sun and that changes white throughout a day in architectures. Just something I've always loved, a white wall. Then the next natural progression from that is a black wall, right? Especially in a material that's translucent. There's the opacity of the black wall and the translucence of the white

one, seems to be the two counterpoints that are interesting. (Lina's Transcript)

Different opacities that would allow at certain times light to stop and at certain times allow the light to come through the glass. (Michael's Transcript)

Two participants also commented on wider theoretical issues that framed their lived experience of materials in design.

Yeah. As mortals, I think there's something that is very appealing to looking at the physical world around us and just relating to it and how it might age. That age can be graceful. You don't always just throw something out because it changed from age. (Sandra's Transcript)

So, I think it's energy related, and I think the next material direction is very much like how we can generate, or how we can use less energy. (Fiona's Transcript)

To conclude this discussion of material ideas that combine the categories of concept and theory, Juan is perhaps the one whose practice has led him towards a philosophical view of material engagement. His thoughtful insights show the breadth of investigation and consideration taken into account by the participants.

Once I laid it out, I thought I was done but at that point I then started to incorporate colour to it, and at the time I was reading a little bit about Wittgenstein's theory of colour. It went into the philosophy of how we see things and how also how we can interpret things in different ways, whether they actually exist or not in reality, or whatever may constitute reality is a different story. What we contrive to be reality can certainly be subjective, which is just of a real experience as an objective of reality. If we feel it and we see it then it becomes a part of us. I started to think about how that could be translated through colour in this poem. Then I started to think about using the colours of CMYK as light projections, how that would change our perceptions and how it would change the readings. ... I'm starting

to look at materials less about the physical properties of materials but more about the philosophy and the theoretical situations that occur with materials. (Juan's Transcript)

Material Ideas (Conceptual and Theoretical) Summary

Through the phenomenological lens of the lived experience of engaging with materials, the participants all demonstrated the ability to translate the world through their mind (Bohm 2004) within a theoretical framework that engaged with conceptual ideas directed towards a project or material manipulation. A number of subsidiary categories in their material ideas emerged from the analysis of the transcripts. These are:

- Evolving a personal design approach or philosophy
- The ability to take creative risks without the fear of failing
- Allowing oneself to play and discover new pathways
- Allowing the idea of placemaking to be a strategy
- Being thoroughly aware of user needs
- Understanding the use and composition of materials in spatial design outcomes
- Being aware of how to engage with advanced material.

Summary of Intrinsic Factors

The interview transcripts were read and re-read and coded using Giorgi's Phenomenological Method to find the central themes. These were then examined together with the re-examined text, looking at the voice of the participant. These textual descriptions led to the interpretation of the data to identify two key terms: intrinsic and extrinsic. The examination of the composite descriptions identified codes to further define the data; these material memory and material ideas had the majority of linked comments. Material practice was a smaller section, yet still indicated many intersections of thoughts and linked concerns with both the material memory and material ideas sections; it also had links to extrinsic areas. Material memory is a powerful

intrinsic factor that drives many designers. It supports the generation of a memory bank that feeds the imagination.

Participants indicated, throughout their interviews, the use of both primary imagination and fantasy through their creations that accessed material memory. The majority of statements analysed draw on intrinsic factors, indicating that the theoretical view of the world is a filter for the designers, who intrinsically assess the stimuli. In particular, they assess experiences, memory, and ideas to make their own mark in the world of design. This aspect is best captured by Greg, who recently responded to a question from a design magazine, that asked: what was the spark when you were young that inspired you to be a designer?

My father was a craftsman, a woodworker and boat builder for fishermen on the west coast of Canada. He made a wooden bath in the basement for all eight of us in the family for a steaming hot scrub-down and soak. There were hand tools he'd brought from Japan and, one day, he was working on a wooden bowl with a strange looking saw. He explained it was better design than western ones, because when you cut wood with it, you pull the saw—it's more accurate; when you push a saw, it tends to wobble, not when you pull it. That was the moment. (Greg, cited by Clancy 2017, 41)

His response references all three intrinsic sections: material experience, memory, and ideas, and captures the importance of intrinsic factors.

Chapter 5:

EXTRINSIC FACTORS INFLUENCING THE ENGAGEMENT WITH
UNKNOWN MATERIALS BY A SPATIAL DESIGNER

Introduction

In this chapter, the nature of the lived experience of the spatial designer is examined through the comments of the participants. The focus of the comments is on factors that are outside of their control. They engage with these factors and work with the constraints towards a spatial outcome that involves unknown materials. The statements are taken from an analysis of each participant's interview transcripts, which were coded to assess common traits among the spatial designers. The coding procedure, as part of the research methodology, is discussed at the end of the research methodology chapter, in which the terminology is defined.

This chapter is divided into three areas that group similar coded descriptions under a related heading. These headings—derived from coded transcripts—all relate to the spatial designers' engagement with materials, experiences, and ideas in terms of factors that are external and extrinsic. The headings are grouped as follows:

- a. Material properties (properties of an unknown material)
- b. Material project concerns (client, site, and budget concerns)
- c. Material community consultation (a larger context of consultation with the community through regulations and consultants' comments).

Part A—Material Properties

One thing I should say just while I'm thinking about it is ... it's definitely not just the intrigue of mystery, but there's a deep belief that by truly learning about a material we'll be able to make something better than we would have been able to make otherwise. (Sandra's Transcript)

Material Knowledge

Sandra's comments about her deep belief demonstrates that an intrinsic factor of a belief or value is linked to an extrinsic factor of a material's properties. It clearly relates to the idea that attaining material knowledge is essential; that is,

knowledge is both intrinsic and extrinsic in relation to the objective properties of a material. Sandra describes the need to understand the true nature of a material:

That it will be possible to really understand the material and craft it in a way where there's a level of elegance that it gets because you're paying attention to the nature of the material itself and able to respond to it. (Sandra's Transcript)

Material knowledge is a factor that is essential for the spatial designers to truly feel comfortable in their specifications for their projects. The dimensional properties are important to know when considering whether or not it will fit into the design scheme you are proposing. Lina describes this issue:

You can't design anything until you know what it is that you're using. It's like you can have an idea of what it is that you want, but if the product doesn't work with the properties, if it won't work with your design, then you can't really use it. It's different thicknesses of it, so you can't design something until you know exactly what it is that you're using. (Lina's Transcript)

Michael adds his professional perspective when asked about the challenges of using unknown materials:

I guess the unknowns of their tolerances, their capabilities, thresholds—the longevity, is it going to last. (Michael's Transcript)

They need to be confident in how the material will perform.

Well, when I look at a piece of joinery with wood, just using that as an example, ... [we need to] understand that wood expands, contracts. Join those pieces in a way that that material can actually live and breathe and work because the person who made it knows that wood expands and contracts and that it does it a negligible amount in one direction and a lot in another direction and a minimal amount in the third direction. (Sandra's Transcript)

Sandra delves deeper into what a material really is.

..., I want to actually know what a piece of wood really is. I want to get it. I want to know what I should do with a piece of wood. I've seen lots of wood furniture my whole life, but I want to actually know ...

(Sandra's Transcript)

Although the material may seem familiar, the designer looks at every material encounter as if it were new and adds it to a growing base of knowledge.

Let's just say it is a panel of wood. It could be ranged or articulated on different angles or cuts and grains and all shapes and sizes. Then of course the voids in between and the connections in between. It's at that point then I start to think about how the material... At what point, I start to ask myself, at what point does that material start to transform into a different formation than I originally had thought of or had thought of as the limits of that material? At what point does it become, say more plastic, if I start to say, think about bending that wood?

(Juan's Transcript)

Potential Use of the Material

Lina was asked about the potentiality of a material, and whether it was something taken into consideration during the design process. The tactility of the material was immediately agreed upon as being important. In the dialogue between the interviewer and Lina below, although her statement is essentially an agreement with the comments from the interviewer, she would later expand, in her own words, the idea of tactility.

INTERVIEWER: *Okay. You look at potentiality?*

Lina: *Oh, absolutely.*

INTERVIEWER: *Not only of material but of functions, do you prescribe function? When you prescribe those functions, in your mind you start stretching and pulling it and twisting it and squishing it and holding it up to the light, do you envision some of the things you mentioned earlier about the personal space or the place that you think would be in the whole sort of lighting and the ambiance and the ...?*

Lina: Well, I imagine someone sitting here and someone else being able to touch it. (Lina's Transcript)

Lina emphasises the importance of tactility when it comes to working with the client. The designer will usually introduce materials known or unknown to the client for approval during a presentation.

Yeah. I get people to touch them because that's what sold it, I think. Like if you want to stick your fingers on the back of it. (Lina's Transcript)

In questioning how material properties are examined by designers, Preya explains how she explored the opportunity to exploit the properties of a natural material found locally. Water hyacinths—a natural waste material that floats down the river—inspired Preya as she recognised their potential.

You know, everything possible with the material. I saw it floating around. I haven't seen it, the real one. I don't know. What does it look like when it's ...? The stem? Because I saw the green one and it flowers. Started from that and got the material, and just wondered, "How can I make use of this fibre, in a way that we can sell it as well?" Make it into a cottage industry. You have to use hands, because you have to give this to the villagers to work. (Preya's Transcript)

Working with One Material

Designers constantly work with a variety of materials when designing; very seldom are they asked to design with just one material, and issues arise when materials are joined (Abercromie 1990; Verghese 2003; Holtzman 2008). However, at any particular time in the process, they need to examine the properties of one material. As this research is focused on examining the lived experience of an unknown material, it is important to at least examine the experience of a material in isolation. In seeking to explore this experience, the interviewer asked Sandra if there was a particular moment that was a significant moment or “tipping point” in her thinking around materials? Sandra instantly responded:

The project in Alaska is definitely one where we were building with primarily snow and a little bit of ice. No other materials at all. That one, I think, because we put ourselves in a position where we would end up having no choice but to improvise and try to understand the material on its own terms and how it was going to be that day and under that temperature, and how does it bond and how does it work? Realizing that snow can be many different materials in a way, depending on the temperature conditions that it was formed under and whether it's been tossed around. The crystals have their little tines broken off. (Sandra's Transcript)

Sandra and Preya share the approach of exploring their spatial outcome through the lived experience of just one material: paper for Sandra, and water hyacinth for Preya. However, Sandra clearly identifies with the examination of one material. If it is known, she approaches it to find out everything about it:

That epitomises, again, we've given ourselves the project several times of taking one material only and seeing what you can do with it. If you have one material, a piece of paper, a snowflake; how does it join to itself? Particularly, if you can get away with not bringing even binders or anything in it becomes particularly interesting to us. Felting, or working with snow, where you can understand how something bonds to itself when you're given conditions. It appeals to us on several levels. There's a purity to it that's a psychological level. It's also to recognise [it is] very practical because it allows for easy recyclability in things. (Sandra's Transcript)

Sandra continues by describing another project that just used one material. Again, her description really captures her lived experience of pure joy in working with materials.

Well... we, at one point, decided that the teapot is a good example of deciding how do you make something out of one material? Glass or borosilicate glass is a fantastic material to use in that way because you can weld it to itself. There's so many different ways to manipulate it. It has negligible coefficient of expansion so it's exceptionally forgiving in

terms of how you work with it. You can heat up one spot till it melts and the other one could be sticking in ice and it's not going to fracture from a difference in thermal expansion. (Sandra's Transcript)

The simplicity of glass teapots, and spatial dividers made from paper, is at a product scale, and manufactured to high tolerances. Preya discussed the properties of a single-material craft project that also required fine tolerance. Her paper tables were constructed of finely rolled pineapple paper—another re-used, environmentally conscious material.

It's handmade paper and it's left over in the factory. He knows the owner of the factory and got the leftover of the paper from its pineapples. Pineapple paper. From pineapple. Leftovers. (Preya's Transcript)

She answers a question about challenging the properties of the material and pushing the material to its limits. Her answer comes back to the idea of material properties as a key factor in the engagement of materials:

How can I push it? It depends on the nature of the material, itself. (Preya's Transcript)

When the participants were asked, what makes a material interesting? The question was aimed at understanding what was at the core of working with unknown materials.

It's property. Property. It depends on the material. I can't say. But, for example, it's a translucency, or a type of sense, or smell, or how can I say it, rigidity, or colour, those defined properties. (Yoshio's Transcript)

Discovery of a New Material

As noted earlier, the purpose of this research was to examine the lived experience of spatial designers with unknown materials. So, a critical moment in the interviews came when the designers were presented with an unknown material. The range of materials that they already knew and whether or not they were still available to them was not known. Yet all the materials discussed by

the participants, although not identical, were previously unknown to them. The introduction to this material added to their material knowledge.

They were all asked: What do you do when you see a new material? When the question was asked, the material was simultaneously presented to them. This question was supplemented with a material that would be unknown to the participant.

To truly understand how the lived experience of a spatial designer engages with an unknown material, the participants needed to participate in the act of engagement. When the participants were presented with the unknown material, their reactions were observed, and their comments and reflections were recorded whilst in the act of engagement.

Their statements were similar, in that they all indicated a fascination with the material presented to them. They immediately reached out for the material and felt it, squeezed it, twisted it, and bent it. They all turned it around a few times and held it far from them—then brought it closer. Then, depending on the actual sample, they held it up to the light to check on its translucency. Some pulled at part of it and broke off a small section, others smelt it, and one almost took a bite from it. All the senses were at play in the examination of the material.

Sandra's Discovery of a New Material

Sandra immediately began to squeeze it, roll it up, and bend it. Touch is the most obvious sense used, but she was also closely examining it visually and even smelling it for odours. When questioned about her actions, Sandra responded affirmatively:

*Yeah [I am manipulating it], which is to learn physically from it ...
What qualities does it have? There's nothing in particular to look at,
you just start feeling it, and then what it is it is. (Sandra's Transcript)*

She was asked if there was any comparison to past experiences during her examination of the material.

Probably, naturally. It's a little unfair because it says the word Gecko right on it, which immediately biases you to grass. I read that, and I started thinking about the natural grippiness of a thing. (Sandra's Transcript)

Greg's Discovery of a New Material

When presented with a new material, Greg was visibly intrigued and excited. He responded by pulling it and pushing it and holding it to the light. He expressed questions about the material, not wanting answers, but as a way of working through the thinking process of assessing the potential and the properties.

Try to figure out how to use it. Because it's so appealing, tactile. Its profile, shadow, and the highlights, and the shadows, little bumps. This is very thorough. The light hits it. What's the practicality of it? What's it made out of? It's primary, one of the primary properties is its elasticity, so why not take advantage of it. For instance, why bother making it into a wall mass. It should be ... You should manipulate its properties to its maximum. There's no point in doing that. It has to be moulded onto something or is the material itself, and can it support you? Interesting. (Greg's Transcript)

He started to imagine the potential configurations of the material in terms of mass and structure, based on his observations of the properties without objective classification of the material. Experience in handling materials of many kinds was playing in his head as he made a mental comparison of rigidity and elasticity. He did an initial mental scan of the performance of the sample that accessed his memory bank of reactions to his handling of similar materials. His further comments indicate that he had reservations about this unknown material—a reservation that lies in the essence of what the term unknown means. At that moment of engagement, there was no immediate information about the material, there was no knowledge about it, so it was unknown. The lack of tested knowledge of the material properties is evident in his comment.

We don't know it's physical properties, the practicality. How will it evolve, or something with a particular finish change colour, over the years? Change, finish? We don't know. (Greg's Transcript)

Greg continues with his concerns about the appropriateness of a material based on its properties and not just on its sudden appeal. He states that if they use a material that is “radical”—his expression for a new and unknown material—he would only use it if it were appropriate, He stated:

I don't like to use it because it's sexy to use. Its appropriateness is really important in the work. How will this look 10 years from now? Will my client be happy in this? ... Physical properties we don't know. They are not time-tested. (Greg's Transcript)



Figure 5.1 Greg holding an unknown material.

In reflecting on the unknown material, Greg returns to a creative material that he is fully aware of and is therefore not unknown.

I'll use moulded fiberglass in a measured way that I know 100% that it's responsible, it's doing what it's supposed to do. (Greg's Transcript)

This statement demonstrates the need for Greg to make sure that known performance standards are met when using a material. It reflects a sense of assurance that any unknown material can be mapped onto known parameters of standardised tests.

Lina's Discovery of a New Material

Similar to other participants, Lina goes through a process of questioning the material and almost talking directly to it. There is the similar process of manipulating the material by physically engaging with it and examining it, also the process of projecting potential uses for the material.

... so, it's just like, what could you do with this? Why was this? ... It makes me stick my fingers in the back of this and makes me think of ... Can you stretch it? Does it become a seat of a chair? Does it become a wall? It has these little holes in it. Do you backlight it? That's the little thing. It's looking at what is it made up of and it's almost like a wetsuit material, covered in ... It's cool. It's just like it excites me. (Lina's Transcript)

Lina highlights the practical aspects of using a new and unknown material, noting that the properties of it and its previous applications should be investigated. In that way, the material is classified from past experiences in terms of properties, use, fabrication, and structure—all objective information.

I think, if it's a new material, I think the challenge is how has it been used before and what of the properties of it, so you can understand the structure of the material or how is it fabricated. Or, if you're going to use it in a different way, making sure that whoever's fabricated it is okay with using it in this way. (Lina's Transcript)

Preya's Discovery of a New Material

When asked about what occurs when introduced to a new material, Preya moves directly into a process of projecting potential ideas. This is done in a playful manner of examining the disciplines that could use the material. This is a form of categorisation that assumes processes based on the initial sensory clues from the material. As categories of fashion and interior design are mentioned in

regard to the spatial design discipline, Preya connects the material to the idea of use and function. Performance capabilities are not discussed.

What I do? I... I try to see the form. The shape and form that I can make out of this. If I were a fashion designer, I think probably I [would] think, "Should be which part of the dress? Or should it be just like bag?" For me, for interior designer, probably thinking of something I can make use out of this. (Preya's Transcript)

Yoshio's Discovery of a New Material



Figure 5.2 Yoshio holding an unknown material

Initially, Yoshio examined the material without making any gestures or sounds. He was allowed the time to just be with the material before being asked what the process was that he was undertaking. He discussed the senses of touch and sight. The shade and structure were mentioned, indicating that the thoughts were of the materials' potential application and use.

The semi-structured interview process allowed for questions to probe into the process that was presented to the interviewer. Questioning of the very moment

of the lived experience revealed the act of projecting material ideas at the moment of introduction to the material.

Interviewer: *And when you were doing that, what were you thinking?*

Not just feeling. Were you projecting?

Yoshio: *Yes. Thinking of kind of possibilities.*

Interviewer: *Yeah. Because you said: Was it used as a chair? So right away you were thinking furniture.*

Yoshio: *Yes. (Yoshio's Transcript)*

Michael's Discovery of a New Material

When presented with the material to examine, Michael was quite excited at the novelty, and instantly went into an examination stance, asking about the properties. This demonstrates an approach to understanding the scientific classifications that defined the material.

Wow. Do they add elastomers to it? That's wild. It appears to be solid though, isn't it? (Michael's Transcript)

Michael 's reactions were similar to those of the previous few participants in how he manipulated the material. He concentrated on the properties of the unknown material, particularly its flexibility and translucency. He reiterated that it is important to recognise the tactility of the material.

*I see, does it deflect? Can you see light through it? Is it going be strong or is it going be flexible? Tactile, yeah. I have to touch it, yeah.
(Michael's Transcript)*

Juan's Discovery of a New Material

When presented with a different unknown material than that shown to Michael, Juan reacted in a similar manner. The mechanical properties of stress and strain were key to his initial reaction to the material. Relating to similar woven materials, he notes the weave or the warp of the material.

I think one of the first things I'd like to do is see where it breaks. I often do the stress and strain test and looking at, in this case, it might be the weaving or the warping of... Smells of polymer. (Juan's Transcript)

Juan continued by noting the mechanical property of stress and breaking point. He noted how the material reacts to light, from being opaque to transparent. Throughout, like the others, he was constantly moving and shifting the material in his hands.

Yeah. I'm always looking for what the threshold is of the breaking point. Second thing I like to do, if it's not opaque material, then I look for how does it react with available lighting, artificial lighting. Then I start to think about uses of external, internal elements. (Juan's Transcript)



Figure 5.3 Juan holding an unknown material.

In his closing comment, Juan alluded to the potential use and application of the material. Projecting the assessed properties to a hypothetical application is a creative act of imagining things that are not in our physical world around us (Folkmann 2010).

Blair's Discovery of a New Material

Blair, a practising architect known for innovative use of materials in small spaces, instantly started physically manipulating the material and challenging it to stress and strain by pulling and pushing it. His comments were strictly in the form of classification. He assessed it by reflecting on its possible commercial applications to a building.

It's probably something that might go behind a shingle, or something like that, to keep an airspace. It's not particularly rigid, so I don't know. It might be a landscape mat of some sort. It's the wrong colour for that. Maybe in a green roof, maybe it's an absorptive membrane, possibly. A water retainer, but a sponge. (Blair's Transcript)

When Blair was told that the product was made from polymerised corn, he discussed the parameters around utilisation of the material. His comments were focused on practicality and suitability for use in his architectural practice.

What's its suitability for being inside? It has the ability to keep a cell, so, can we use it for anything acoustically? As far as its flame spread, has it got any VOCs, and all that stuff, get that off the list right away. Can it go inside. (Blair's Transcript)

Many questions were asked by Blair, not for immediate answers, but as a form of dialogue with himself.

Fiona's Discovery of a New Material

Clarification was first sought by Fiona as to the process whereby the material was presented to her. Her questions were about whether there was a need to find the material, or whether it was discovered by chance, alluding to the concept of intent.

I mean say I'm not searching [for it] myself. It came just in front of me. I would touch it, smell it. This is definitely a, a PVC product of sorts. Smells icky. So, you know, it's kind of like check its physical properties, try to understand how it could have been made... obviously this is something spun. And then see where I can use it... maybe just kind of

like a mental note. But if I'm looking [at it] as project specific, then obviously I would tear it apart a lot more. I would kind of put it through the grinder and burn it... poke it, rip it... Yeah. Smells terrible but looks good. Nice colour. (Fiona's Transcript)

Her statement breaks down her process into clearly defined steps. First, the sensory analysis through touch, smell, and sight. This is for a quick analysis of properties, followed by deductive reasoning to assess the way the material is made. This is followed by hypothetically considering possible applications. She concludes that the testing would be more severe if there were a real project, and not the sample presented for the interview.

Engaging Others to Explore

If you consider that designers are change agents that prefer to exist on the margins (Verghese 2009b), they are constantly searching for new ideas and applications. One aspect of this constant search is working with others who are encouraged to also stretch the boundaries.

Lina discussed conversations that she had with a local quartz manufacturer. She witnessed that all quartz manufacturers work in the same manner, producing the same flat slab of quartz. She asked him:

Well, what else do you do differently? You have this product, and what sets you apart from the other four companies in the world that take this product that starts off as not a solid and you're forming it into a solid, but you're all forming it to a sheet good. Why are you doing that? Why don't you form it into a different way, and all of a sudden, you're setting yourself apart from your competition. (Lina's Transcript)

She continued to push the boundaries with the manufacturer, asking about additional materials that could be added, and pointing out that all manufacturers are only thinking of the colour range, so that there is no differentiation in thinking within the market. She suggested an organic tile as an alternative to the flat sheets currently produced by all manufacturers. She

concluded that there is a need to think of things differently, and not to follow what the original manufacturer did.

You start back at the beginning and you say at the processing stage, "Let's think of our product differently." You're taking this moulding material, you have it. You can form it into anything. Because there was a manufacturer that thought of how to get it to a slab, everyone's going to follow that process. (Lina's Transcript)

When discussing another project that involved silver leaf on some ceiling panels, Lina questioned the material properties of each material:

It's looking at all the properties that each material has and how do they play together; and making sure that each person that's touching that is aware of all these sensitivities that need to be taken into consideration. (Lina's Transcript)

There is a constant demand for spatial designers to work with suppliers and clients towards a greater understanding of unknown materials. Many suppliers have identified those who are more inclined to work with newer material technologies or materials that are unknown to them. Greg talks about a rare find when a supplier discussed with him the discovery of a Chinese Elm tree that they could provide to the designer. He was excited when describing the colour of the leaves and the nature of the tree. Greg expands on his relationship with suppliers when he discusses how his office staff are trained to work with suppliers that bring in new and unknown materials. The materials librarian rejects many, but when they agree, there is a likelihood that it will be used.

Primarily our librarian and some of the designers get involved. Right away she goes, "No, no, no. Yes, possibly. Yes, maybe, maybe. Get rid of this. Get rid of those." Sort of, "That's crap." At first, they were taken aback by it and almost offended by that, and now they understand. At [Greg's company] when they like something, they're not wasting their time with the other stuff. We know they're going to use it, so it's interesting. (Greg's Transcript)

This a vital screening process that brings new materials to Greg's attention, based on a system that has been set up, and the understanding of the design process that Greg undergoes when dealing with materials. It is a process that involves staff, suppliers, and Greg. The process may not be explicit, but it is understood by all. It also allows Greg's practice to assume a different place in the design industry. The suppliers utilise Greg's design practice as a testing lab for materials that may make it to a finished commissioned work.

A lot of our suppliers they must have first dibs on a lot of new materials, because they think, "You guys can figure out how to use these materials, so you get the first ones to figure out more than these other companies." They sort of test out what you think... It's like a lab here. They come with all this stuff, and a lot of it is crap. 95% is crap, but the five percent is fantastic. (Greg's Transcript)

The support and relationship that a designer evolves with their suppliers are essential in the process of introducing new and unknown materials to clients. Lina describes this relationship:

I think it is important. I think it's challenging and it's relying on your supplier of that new material if they can answer your questions and make you feel confident that you're choosing something that will be backed. If something goes wrong with it, and you're the first testing ground, are you going to have the support that you need? You need to basically give that to your client, to say, "It's new, but here's the research they've done and I'm going to get them to" (Lina's Transcript)

Lina describes that this three-way relationship between the supplier, the client and the designer can lead to her bringing them all together to understand the properties of the material. She describes wanting to know what happens in scenarios in which the material may be damaged.

Okay, for the bar, what happens if it chips? How durable is it? What happens if it's smashed? What are the properties of this material? ... [The client is] getting it first-hand and I'm not the one... It's not my

product, but I'm saying, "I think it's a great product for this, but let's hear together what it is," so he has more of a comfort level as well because he's paying for it. (Lina's Transcript)

Independent Research and Exploration

Independent research into the properties of materials is occasionally needed by designers to provide assurance for their clients. They realised that their own base-knowledge is inadequate when considering a new and unknown material, they would undertake additional research to attain more knowledge of the material, as the participants note:

Knowledge...because my knowledge about the material is limited. For example, how can I say, what's the kind of limit of using that material? Like heat. The performance of the material. And also cost. And also, how it's made. Those [pieces of] information, sometimes, not enough. (Yoshio's Transcript)

In Preya's case, the research was not to see if the material had the properties suitable for a given design project, it was more towards a basic understanding of the material to find out all its properties; in particular, the surface treatment of the water hyacinth for protection from disease and colour retention. She faced the problem of wanting to make the material useful, but it had a high water content of more than 80%. She decided to undertake independent investigation at a university research lab that specialised in plants.

They took it and did research about these fungi problem and how to dye, how to protect it, and how to treat it right. They used about more than a year to get some conclusion, solution. (Preya's Transcript)

Preya was not only looking at the opportunity to explore an unknown material that had the potential for craft products she also recognised that it served to solve an environmental problem without costing anything. The material was floating down the river and clogging up the waterways. The extrinsic factors were dominant, yet at her core, she wanted to provide something useful.

She continued with comments about how she engaged with the material after the classification of the properties were received from the lab.

When we got the sample that we want... from the other research and everything. We have the right way to treat these materials. Again, we have to try to see how can we make use out of this water hyacinth?. I try many different ways. Weaving, make it flat and sew it together, make into just one flat sheet and you can cut it and do something with that. Weave it with the wood frame, weave it with the rattan. Every way possible, we tried many ways to make use of the water hyacinth. Then, mostly it's furniture because it suits me well. (Preya's Transcript)

Preya and Sandra both explored a known material but tried to see it in a fresh light—one through research, and the other through exploration and experimentation.

Well, we started with the literal tissue paper, the wedding bells. The first full-sized wall was six and a half feet tall and 600 sheets of tissue paper. (Sandra's Transcript)

After starting production with a company that was not willing to continue experimenting, Sandra had to find someone willing to take a risk with the process.

We found someone that was really interested in experimenting. They were in the opposite position. They were sitting there going, "I have all these tools and people but the things we make are completely disposable. The only thing we can compete against other companies in China that are making wedding bells and turn-keys our cost." So, it's over who's cheapest and that's the only thing anyone cares about in our industry. (Sandra's Transcript)

Independent research is quite often an investment of time that is not suited for a fast turnaround in the project. So, the experimentation process for Sandra's project was not completed quickly. The manufacturer of the spatial divider and system really believed in the idea and strove to sort out the technical issues.

He really believed in the idea of making something else but with the tools they had. They experimented for two whole years before they got the Tyvek to work. Because we had to get a non-toxic glue that would be compatible with the machines, that wouldn't yellow in sunlight and wouldn't delaminate. The viscosity, everything. It seems all simple at first, that you're just going to switch out the material, but it actually takes a lot of trial and error to get everything humming and working right. (Sandra's Transcript)

Greg related the issues of creative risk-taking with research into assessing the physical properties of materials. He also alluded to the necessity of function being fulfilled.

Just sort of taking the risk, and then the risk has to be backed by solid research. Researching the characteristics of properties, physical properties of new material that we're using, or the technique that we're using has to stand up. (Greg's Transcript)

Playing with the Material

Creative risk-taking in the process of exploration was explained by Yoshio as playing with the material. As a child discovers something new through the process of play (Brown 2009), the spatial designer also explores a material through play. Yoshio noted that appearance and usage were important in the first stage. He then discussed the origin of the material and how he decided to look at an alternative use of it:

How I can say, appearance, and also I know the usage of the materials was a kind of... a key to that design... That kind of perforated metal. That is usually used for the heat insulation in the building. Or the sound insulation in the big buildings. And nobody used it for the outside of that fixture. It's usually the kind of back side, popular material. I thought, it's very light and easy to use, so I thought it's good to create a new chair using that material. (Yoshio's Transcript)

Yoshio described more of his process, and how there is a need to explore and play with a material to really know it.

... when I get to know new material, I get the sample, and I play with it. And I check the metal kind of properties of that material. And then, I start to think of how I can apply that kind of new... property to the design, my design. That's kind of the way I think. But at the same time, I feel, I'm more kind of open sense to that, five senses, not only visual but also tactile sense. And also, kind of, how can I say. The way I see material, it's changed. I know it was changing. (Yoshio's Transcript)

In the following passage from the transcript, Yoshio responds to questions about playing with materials and how it relates to the sensory impressions of the user:

INTERVIEWER: *Okay. But the idea of playing is the really important thing. And that I've noticed this consistency with others I've talked to. There's a relationship of playing with it. Right?*

Yoshio: *Yes. Yes.*

INTERVIEWER: *And when you play with it, you're thinking of the senses. Is that right?*

Yoshio: *Yes.*

(Yoshio's Transcript)

Affirmative responses from Yoshio indicate an agreement with the notion of play and exploration through the senses. Michael commented on his early days of practice after graduation as a period of naïveté in terms of material knowledge and understanding. Recognising this, Michael tried to exploit the materials he knew about as far as possible.

I guess it was partly that it was a naïveté about materials at that point. I certainly would have like to have explored other materials, but I think I knew the restraints of the vocabulary I would be allowed to use in terms of materials, so I tried to manipulate them as far as I could. (Michael's Transcript)

Light and Materials

The participants commented on the importance of light as they explore an extrinsic factor impacting their relationship to an unknown material.

Juan explored projecting light to create an experience with colour in a spatial composition. By projecting a colour on text with the same colour, the text would cease to be visible, but other colours would appear. The text of a poem would be digitally projected and mapped, challenging the boundaries of perception of space and questioning the viewing of a material image seen for the first time (Juan's Transcript).

Sandra's comments reinforced the importance of visual properties of materials:

Completely opaque, yeah. Even though it's the exact same material, the bamboo charcoal ink that we ended up using makes it completely opaque but it's also this beautiful black that allows the lustre, the fibre, to show through, and the combination of the fibre lustre and the quality of the charcoal gave me these silvery sheens in the light. Yeah, deep shadows. (Sandra's Transcript)

Design Process

As the interviewer I maintained a phenomenological epoché, allowing the participant to explore the question in her own words. Yet I had a particular interest in this aspect of the research through my own knowledge in exploring design methodology in both practice and academia.

Sandra's description moved towards her design process, illustrated through a series of questions to herself. In reading the text, a sense of a design thinking process is understood. The process is non-linear and iterative.

If I were to play with this like my set of things, like it's akin to having a scientific method, or something where you would apply a set of things to any particular material or object. One of the things we would do is, how do you attach it to itself if you have no other materials? But you need to attach those to itself, how is that accomplished? I'd look at this and I'd start to think, well, you can probably fuse it to itself. You can probably use heat. Then so you just try that and see if that works. Chemicals probably work too, but obviously heat is easier to work with.

Then, can it hold a fold? Are there different ways to crease it and make it fold? (Sandra's Transcript)

Juan describes a willingness to totally reassess a position taken at the start of a material investigation by being willing to go in an opposite direction.

I mean it has to go in a 360 [degree] process where I start off on one point. I have to exhaust the 180 turns of where I start to think "Oh, this could be done in a completely different way or with a different material." (Juan's Transcript)

Transformational Form and Detail

Participants reflected on the iterative design process in relationship to technology, cost, and sustainability—key factors that impact whether materials that have been used can continue to be used.

I think I first look at the way that the so-called traditional material is typically seen and articulated. Then once I understand the perceptions of how that material is conveyed or how it's used, I then look at different ways in which that same material can be interpreted. (Juan's Transcript)

Juan described a scenario in which he might move away from traditional material thinking and applications.

Then I'm changing, altering the concepts of what I would call traditional wood, other than wobble board, or something like that. If I'm wanting to create this type of curve or this bend, then it's at that point that I start to think about other materials, what else can express that same form or formation? (Juan's Transcript)

Juan reiterated that the idea of form is vital in determining the type of material to be used. Simultaneously, it was recognised that a material needs to be able to perform appropriately by maintaining its structure, finish, and material integrity when undergoing typical stress while functioning. Participants discussed the structure of an unknown material in relation to their projects.

Because folds give structure. Those two things, like how do you attach it and how does it fold, are like something you might take to any material whether it's glass or paper. (Sandra's Transcript)

Greg also comments on the necessity of being able to fold a material, not just for attachment, but to provide structural rigidity in the design of a piece of furniture, as seen below.

I said, "I just want this line to read that it's folded, and this, it's a flat part of a horizontal plane, which is just so that it defies gravity." Put a lot of weight on it, tons of weight on it. (Greg's Transcript)



*Figure 5.4 Detail of table being designed by Greg
This detail shows how Greg pushed the limits of the material to achieve the desired profile.*

When considering the material to be used for an exterior exhibition project, Fiona had particular demands for the material properties that needed to be met.

So, I knew roughly it was gonna be in an exhibit, and it had to be thick enough so that the sensors and wiring was invisible, but I also thought, given the direction of Integrative Technology's 3D printed fabrics, uh, would be interesting. So, then I did the research, and... I found this sandwich material, 3D printed sandwich fabric from [manufacturer's name] in Germany, and so we got the samples integrated with the wiring. (Fiona's Transcript)

In closing this discussion of material properties as a series of extrinsic factors, Fiona captures multiple levels of insight in her comment. She described another material used in an exterior spatial design—a material that was previously unknown to her but needed to meet particular conditions of performance. When nothing was available, she turned to a product not usually used in spatial design, but one that had all the correct performance properties. This material, when applied to the substrate, enhanced the properties of the panel in order to meet the demands of the project.

I was prototyping a material that would have hydrophobic and hydrophilic qualities, meaning like it would, portions of it would, absorb water, and portions of, of it would repel water? So, since that material is not available, or right at the proportions that I needed, so we used Scotch Guard. (Fiona's Transcript)

Material Properties Summary

The participants have clearly indicated that lived experience demonstrated that extrinsic factors play a central role in how materials perform in spatial design outcomes and that the performance of a material is heavily dependent on its properties. Core aspects of the whole research question are addressed in this section, analysing what the participants said in relation to dealing with material properties and with particular, unknown materials. There are a number of subsidiary categories that emerged in this analysis of the transcripts:

- Material knowledge
- Potential use of the material
- Working with one material
- Discovery of a new material
- Engaging with others—pushing others to explore
- Engaging with others—independent research and exploration
- Playing with the material
- Light and materials
- Design process
- Traditional form and detail.

PART B—Material Project Concerns

The participants' reflections on the relationship of materials usage to a client's brief, site, and budget constraints indicated a clear connection to extrinsic factors.

Challenges of Site Conditions

This provides the ideal context to the exploration of the lived experience of spatial designers in relation to the unknown materials in terms of the extrinsic factors of site, client interactions, and budget implications. Lina gives a clear description of the connection of all three when she comments on a restaurant project for a noted restaurateur.

I mean, there's so many elements that come into play when you're choosing something because this is a concept that we developed for [Client 4 XX] and it was looking at these limestone walls that reflect that of an old bank. (Lina's Transcript)

Lina then continues to describe the constraints of the site, which was on top of a parking garage, with a stair structure above it that was removed in Lina's design scheme. She discusses the use of lighting at the joints of the paving elements that connected the two levels of the site through the use of a translucent material.

We've taken aluminium cladding and had it powder-coated and it's all backlit. The reason that we started doing that was because we were faced with two separate venues that were over a parking garage, so we were restricted with weight. Looking at aluminium as it was the lightest structure that we could have.... I think that it was the powder coating of it, looking at the durability of it in the winter, and the Canadian winters, with the salt, and it was the best product that would withstand the elements. (Lina's Transcript)

The exterior elements are factors for many spatial designers, and the materials are selected to mitigate the damage to the design from these elements. Fiona discusses the factors that she faced in her exterior spatial installation, which had to deal with difficult weather conditions. Wind was an element that she

wanted to capture in the installation, to transfer the signals of the external weather conditions to the interior space.

...there is a material fit to what you want to do. So, take the example of wind quills. So, we needed something that oscillated with the wind. Well then, you know, we started testing like Mylar, and then Mylar was too thin. It had a beautiful effect but then we moved to sort of thin PVC, like translucent PVC that still oscillated, but it wasn't too rigid to kind of capture that wind movement. (Fiona's Transcript)

The installation details were important for Fiona to describe, as it dealt with how the materials were selected for a spatial design outcome 15–20 feet (4.6–6m) by 10-15 feet high (3–4.6m). The work was directly impacted by the local environment. She discussed the nature of the reflective material that was being used for the first time in an exterior setting. This demonstrates how the work represented the process of creative risk-taking.

There was a chance that because it hasn't been used in that context that it wasn't going to work because you know, most reflective fibres are within eye level, like a light has to hit the material within your vision of cone for you to see it... (Fiona's Transcript)

She continued her discussion about the nature of light and how it reflects back into your cone of vision. Fiona also noted that the external light source provided light at the wrong angle, so the material selected did not respond appropriately until an alternative light source was added. The description demonstrates her design process in the light of the extrinsic site conditions that she faced, and how she had to make creative adjustments. Her closing comments on the project indicate her willingness to find a solution.

So, a reflective material suddenly on a building façade is not reflective at all. So, you have to kind of make it work. (Fiona's Transcript)

Blair discussed a spatial project for a bus shelter at a local university. He described the use of a veneer of glass that allowed for a different experience depending on your position relative to the glass.

It's a building that also works with a veneer of glass that is outside of it that is slightly reflective and gives one ray as one looks at it in elevation, and then one when one is under it, perspectively and experientially. (Blair's Transcript)

Sandra discussed how the studio space in which she started to work was too small and required her to think of alternative ways to divide space. The necessity of working conditions led to her overcoming the challenges. Her reflections on new materials, or yet to be conceived, unknown combinations of materials or assemblage of materials, linked the design process of cross-fertilisation of ideas with her immediate site challenges.

Sometimes something new, and it's not necessarily a new material, it's sometimes something new comes of the study because you're cross-fertilising two different thoughts and putting them together. In that case of the wedding bell, the speaker cone, and interest in it, we were at the time thinking about urban living, and trying to live in a tiny apartment and doing a lot in it, which happened to be our situation in life at the time, but we were also realising it's an urban condition. (Sandra's Transcript)

Minimal Use of Material on the Site

Sandra continued to explain the rationale of selecting design projects that are linked to competitions. This was done in order to examine different types of people and how they lived in space. Through this research, they noticed the need for flexible space that folds away, underscoring the need for minimal materials on the site. This aligned with their design process of research into folding and flexible products. She was not the only participant that examined the minimal use of materials on the site. Lina previously described a project that used minimum materials of stacked lumber in a national design exhibition.

Sites for Working with Unknown Materials

There are many ways in which spatial designers work with unknown materials. Some explore the work in their studios as a site for working in; others require sites that their clients own; some need labs to test and explore material

innovation; and others need sites for manufacturing and assembling the materials into spatial objects. Their lived experience with the material is still the same in terms of their engagement. Their context of work, in terms of a site, has an impact on how they engage, due to the extrinsic factors that provide opportunities or challenges to the use of the materials.

Preya had to deal with the source of a material that was originally unknown. The original brief concerned the water hyacinths originating in the Phayao region of northern Thailand. Environmental damage was caused by them floating down the river and clogging up the tributaries of the rivers. Many lakes were total clogged with the stems that floated in the rivers (Preya's Transcript). Sites where the material was collected and sites where the villagers worked on the craft project were all part of the network of sites that were a concern for Preya when working with this unknown material.

The one that floats along in the rivers is a rather short one, but the one in the small canal, it's a longer one because of the water. It's more still, I think. We test... Convincing probably... 5, 6, 7-10 different villagers to train. We go there and collect it. (Preya's Transcript)

The spatial design exercise can be considered as an opportunity to test ideas and explore juxtaposition of form and material to affect the experience of users. The test site could be the building site, the prototype, the craftsman's workshop, digital space, or the laboratory space. Fiona refers to the latter as a challenge. For a spatial designer and educator, the need to have a laboratory is not fully understood by an institution that sees science and engineering as the legitimate custodians of labs, and not spatial designers.

I mean this may be a bit of an institutional setback because I don't have a lab where I could test these things... I don't always have a lab set up to just experiment at my heart's content. I have to always put it together, make it happen. It's tough each time... typically, these kinds of labs are given to engineers. It's more like tinkering in a lab setup to see what comes out of some of these experiments. (Fiona's Transcript)

The Impact of the Client and User on Material Engagement

Fiona's reflection is informative on many levels. A lab to allow tinkering to occur indicates the sense of playing with a material and exploring its potential. It also tells us of the lived experience of a spatial designer, intent on researching the materials in an institutional setting. The challenges of not having a site to perform tests indicates that those granting access to a site fail to see the need for an equitable balance of lab space for engineers and spatial designers. These institutions could act as a client giving access to a space for the exploration of a design outcome.

Juan also bridges the world of being within an institution and working directly with corporate or private clients.

Well there's external challenges and then there's internal challenges, I think. The external challenges are predicated on the framework of where I'm working with and whether it's an institution or whether it's the brief that I'm given from a client. I always look for the loopholes or I always look for the things that aren't stated so that I can try to bring some new thinking or innovative thinking outside of the brief. (Juan's Transcript)

Internal and external factors—site, client and brief—are captured by Juan in his statement, yet he is not alone in highlighting the client's impact on the outcome of the project.

I think that each client brings something new to the table and pushes your envelope and you say, "Okay, well what can we do with this client?" or, "What is it they want and how can we make them think differently about what they do?" ... Then taking that and saying, "It's part of your job to educate the client and they only know what they see." If it's taking your product and using it differently, or if it's introducing them to using something the way they've never seen, I think that's the excitement of that as well. (Lina's Transcript)

Preya describes how a world banking organisation approached her to work on a project involving the water hyacinths. Here, the client broached the idea of exploring an unknown material to the designer. The process that was to follow was largely the result of the efforts and insight of the designer, but the introduction of the material was from an extrinsic source.

There is one... organization [name of organization]. The vice-president, it's a woman vice-president of the bank. They have a project helping villagers to get more income. Their marketing people came to see me and asking me whether I'm interested in designing something out of the Water Hyacinth. (Preya's Transcript)

Here, the clients were separate from the users. The final users were customers who purchased the product in its final finished form, but the craftspeople who directly used the material to construct the product could also be considered users. They needed to work with a material that was known in terms of its impact on the environment, but unknown in terms of its use in their world of craft. The designer brought insight into the material to the craftspeople. However, for many of the designers, the users were those who used the end product, so careful consideration was given to addressing the needs and aspirations of the users. In particular, designers need to consider the applications of materials in relationship to the users. Many participants commented on the relationship of users to their application of materials within the design.

The client, [CLIENT X] asks to reinvent them, and one of the surest ways of reinventing them was to radically change the shopping environment for them, and how people shop, and impart a new, obviously a new look or freshness to the interior design concepts so that we can attract a new crowd of shopper that they've never had... they really latched on to an expression of materials, new materials... (Greg's Transcript)

I think that it was to bridge a gap between an 18-year old and an 80-year old. It's a family restaurant and it's having a material that an

elder person would respond to, which is the stone, and yet be attractive to a younger person, which would be the aluminum and backlit. It's that marriage between the two. (Lina's Transcript)

Yoshio commented on a particular type of user and how their senses, or in this case lack of senses, contributed to how they engaged with the world. He proclaimed that visually impaired users can sense materials quite differently than can those with sight. He highlighted the need to be conscious of the differences when designing.

When I understand how people perceive this world, I sometimes find new way of thinking for the material. For example, the visual impaired people, we have several workshops. And after that, I felt the way they perceive the world and the way we perceive the world are different, because we have eyes, and we can see visually. It means that we have X and Y axis in our brain. Okay. When I see this paper, this does not show X and Y grid. So, we have a grid thinking because of have visuals. But for the visually impaired people, especially born visually impaired people doesn't have that kind of sense. Their sense is basically hands, right, and sounds. If it's about the hands and the sounds, there's no X and Y grid. It starts from one point in the spread. It's a different mentality. (Yoshio's Transcript)

When asked: is materiality is always an expression of your client, not you as a designer imposing your material language? Lina agreed, and added:

It's being inspired by the client and using something that they're totally not expecting... part of your job is to interpret who it is, like if I was to take something and say, "Okay, well, if I was to apply material to this client, what would that be?" (Lina's Transcript)

Blair also reflects on the relationship with a client and material choices, by indicating his preference for a material that has superior qualities and is unknown to the client.

[I say] "I've got something that is going to be bulletproof, and you're going to be able to maintain it every day with a can of paint, and I

know how to make that material do something that you won't have seen before. It's going to dance. This is how I'm going to do it." That's the way I need to position the beginning of my projects... (Blair's Transcript)

The Relationship of the Design Process with the Client

When reflecting on the design process and the lived experience of engaging with an unknown material, the participants considered the project brief as a catalyst in their approach to materials. The client is heavily involved with determining the factors of the project brief, and the participants noted the client's role as being an external factor that impacted the material selection. The client, and the subsequent project brief, can either limit the exploration of engaging with unknown materials or enhance it. My own experience has seen that this engagement is an iterative process of continued exploration, and assessment.

When discussing the challenges of working with unknown materials, Yoshio responded with a comment about the expectations and restrictions in the project brief, stating that they are the challenges faced (Yoshio's Transcript). He went on to say that his process of engaging with materials adapts, depending on the project. He would use a new material if the project is one of ideation, but not if it's a commercial project. In his comments, there is a sense of professional responsibility that resonates with the hesitation of any creative risk-taking in projects that are not just ideation.

If it's ideation, definitely, I would try. But if it's a commercial work, I need to make sure... Plus, the kind of result [that comes] out of usage, use of that new material. Otherwise, it's very dangerous... The designer should think how the product or material is used. And resolving possible problems. And, if there's a possible problem, then you need to solve that problem. In other words, without thinking of that kind of thing, it's very dangerous [just] to use new materials because it's interesting. (Yoshio's Transcript)

Not all briefs are restrictive. Sandra noted that they gave themselves a project brief to launch a chair by Spring. Her approach differed, as the brief was not

provided by a client, and allowed her to play with materials and explore options that she did not know existed at the start of the process. She also connected this process to the notion of tactility and learning by making that seem to be part of her lived experience.

We didn't have a mandate from a client or anyone else telling us, "We need a chair and we need to launch it in Spring." Just play. No brief at all and being able. I think that epitomises the way we definitely liked that freedom to maybe even how we might even start in one direction, but the freedom to learn from what we're doing and improvise and maybe take it somewhere that we had no idea we wanted to go [to]. That's the real gift of working with the physical world rather than the digital world. (Sandra's Transcript)

The luxury of being able to explore materials without a client brief is not always available to designers. A careful balance of risk versus rewards is needed when approaching the notion of being innovative with a project.

Now as an independent designer, you weigh the risks with the rewards and you hopefully engage with the right type of client who's willing to try some innovative things. It can be very challenging to convince a client to try something that's not tested or proven. Yeah. You need very liberal clients. (Michael's Transcript)

Michael introduced the concept of reputation. He discussed an alternative to the idea of creative risk when he mentioned the notion of a trust account that is generated through experience. This connects to the application of the lived experience of unknown materials over a period of time. Michael refers to this as the maturing process gained through experience.

Well, you're more matured and experienced. People trust you. They respect your experience. When you're a junior designer, people will give you chances, but there isn't a trust account there. (Michael's Transcript)

Relationship of Budget to Innovation

Greg, the most senior of all the participants, has clearly established a trust account with his clients. He connected not doing vanity projects with the firm's longevity in practice. He also introduced the element of budget constraints of a project.

We don't make it a vanity project, because we wouldn't last very long. That's part of our longevity, I think... We're dealing a lot with entrepreneurs, which, they're innovative and creative in their own way. You're using that money out of their pocket. (Greg's Transcript)

The relationship between doing innovative work and clients' payment for that work represents the extrinsic nature of being innovative. As Lawson (2010) indicated, the client and other users are crucial in the design process. Other participants echoed the sentiment:

As an architect, you don't have the money, you don't control the capital. You are doing something on somebody else's pay check. I've had buildings that have just been gutted right before they go for tender. There's nothing more crushing and soul-destroying. I actually start from a position that is more conservative than it used to be. (Blair's Transcript)

The extrinsic factor of dealing with clients who pull away from innovative ideas for the project due to finances has had an impact on Blair's lived experiences. He now is more cautious in his approach and works towards making smaller gains to meet the variety of client demands in a project.

When asked about whether it was dealing with the trades or market forces that impacted on the availability of new materials, Michael said that it was simply costs (Michael's Transcript). As a spatial designer with a solid reputation for contemporary residential interiors, his comments express an experienced viewpoint. However, it was clear that not all projects gave the opportunity to explore innovative materials. Reflecting on an early project that explored materials, he commented:

... very tight budget. Client that was open to some innovations and ideas but really didn't have a lot of money to spend. How I approached this particular project from materials' point of view was to use fairly rudimentary materials like plastic laminates and just inexpensive carpets, and things like that. But really utilised them to manipulate forms and create forms and used the colour and the material to express the forms to give the energy and the excitement of the space.
(Michael's Transcript)

What comes out of his comments is his stated desire to be innovative with materials even if the constraints of the project budget were against him being able to fully express novel ideas.

Cost, availability, and the material's inherent uniqueness were all aspects noted by Michael. It can be assumed that these factors play a role in the lived experiences with materials. When reflecting on a later project he referred to costs and the expressiveness of the materials.

This was quite a generous budget, yeah, which allowed obviously for the expression of the materials as well as the detailing and connections and things like that. (Michael's Transcript)

Blair, also working within the tight confines of budgets, described a project that used the most basic of building products: the concrete block. It was a material that was not unknown, but it was approached in an exploratory manner to optimise its properties.

... it is a humble little public washroom building that is a low-budget, low-nonsense kind of project. Very much a durable building, and low-budget, and all that kind of stuff. We started that project with the lowest common denominator material, one that I have avoided working with my whole life, concrete block. It's a \$2 material. We started that, and we decided to make ourselves love this material.
(Blair's Transcript)

The conscious decision to shift the perception of the material to make it seem more appealing than previously thought meant that the lived experience was altered. This exploration of concrete block allowed Blair to explore poured concrete in different manner.

... also a very small experimental project for us. It's a simple outdoor pavilion and rain cover. For that, we used self-consolidating concrete and conventional concrete, and worked very hard on the concrete formwork technology. Through designing the way that the formwork would be constructed and using CNC tools to cut the formwork in precise ways, we found geometries that were both orthogonal and conventional and related to the context and geometries which were non-orthogonal, non-parallel... (Blair's Transcript)

Sourcing the Materials

To be able to be expressive with materials, the materials have to be available and fall within the scope of the project budget. When asked about the challenges of working with materials on a project, Greg immediately noted that cost and availability were primary factors.

Cost and... Sometimes now it's availability. All of a sudden you realise material like stone comes out of the ground, but that particular vein. You're not going to find again, or not to say I'll never find again, but you may not find it again. You're certainly not going to ask the crew to start rooting around just to find that. (Greg's Transcript)

Sandra commented on the challenges faced by her small practice when it started out and how it did not have the size and reputational clout to obtain the materials that she needed at the price that was necessary (Sandra's Transcript). She also noted that the global trend to recycled material makes access and costs a challenge.

It's the fact that there's a global movement and pressure towards consumers wanting recycled things that makes them available. Because otherwise a small company, like, we pay more for the recycled paper than we'd pay for virgin paper and that kind of thing. That's just

the reality of it. Any company making things right now is in the same kind of boat, often that where the recycled one is going to be more expensive in some ways. (Sandra's Transcript)

Difficulty in sourcing material is also a factor of location. Michael commented on how difficult it was when starting out in a smaller town, and how advances in communication have made a difference in attaining information on new materials.

Oh, I mean it's so much easier now I mean with access to the internet, you can find any material that really intrigues you or interests you. Living in a larger city you have greater resources and local representation of materials. (Michael's Transcript)

Blair also discussed the relationship of material costs and local sources. While discussing the opportunity to use a custom-made brick, he said that the logistics and scheduling proved too difficult to successfully complete the project.

It's a bit of a hybrid. In the end, it's a standard white glazed brick, which is important at [client's name]. White glazed brick is their backbone vocabulary. Then, the coloured bricks that are within it, in the end, are grey and a dark grey. We had hoped that during the process... One of the researchers has a rapid prototype room. We thought we could actually get some custom-made bricks in various metals that they used... we didn't end up following through. It is, in the end, an off-the-shelf brick. (Blair's Transcript)

Economic Incentives and Constraints

More complex financial implications and economic considerations were noted by many of the participants as impacting on their experience of practising with materials. For some it included investing time and money into a project to see benefits only years later.

They were all for it and so for two years neither of us made any money from the collaboration and the time we were putting in to trying to get the stuff to work together. Now we are the biggest part of their business, by far. (Sandra's Transcript)

Sandra also commented on the financial risks and sacrifices taken during the early stages of the project, in which a space was hired for the display of their designs in a large international exhibit. The design at that time was not completed, and the deadline—with the real financial penalty of a non-refundable deposit if they were not ready—created an incentive to complete the work. These extrinsic factors enticed Sandra to finish the work (Sandra's Transcript).

Macro-economics of labour issues, and government tariffs and duties have an impact on the materials used in Greg's designs, since he works on an international scale.

*... practical side of what we do has changed, in other words, the money spent on materials versus labour is reversed. In other words, we spend, try to spend less on labour here in the developed world, more on materials. Material costs are so high with the unions and all these add-ons. Over in places like India or China, there's so much labour to use, so you can do some intricate work, handwork, but you can't ... You have to use local materials as much as possible, because the cost and import duties... It has changed our design, what we insert into interiors.
(Greg's Transcript)*

Preya's investigation and material development of the water hyacinths demonstrates that there is economic growth in the community due to her material ideas. She was prompted by the organisation—the client—that initially approached her to work with the material and the community of women in the local villages.

That's the main concept of this organisation. The villagers gain more income. Normally, they do... It's like, they work, go to the rice fields. They have lots of spare time, so use their spare time to do some handy work for sale. (Preya's Transcript)

Preya then described how she supplements the income of the villagers who do the weaving. They grow the water hyacinths, cultivate them, and weave them.

They were eager to be part of this cottage industry. She was always concerned with making the products more cost-effective whilst still maintaining the concept (Preya's Transcript). She explained that working with craftspeople allows for greater flexibility. This forms the core of her business model; yet she admits that costs escalate due to the huge amount of production time.

You see that it's our advantage of handicrafts work. You don't have to invest in the machine. If you have machine, you have to stick with something you have to do with the machine, but in handicraft, you can do whatever. You can do thousands of samples and you don't have to invest anything out of that. Only your time... and time consuming, and people don't understand why it's so expensive. (Preya's Transcript)

Material Sustainability Issues and Costs

Preya also commented on the difficulties of creating something new from a material that is the heart of the whole enterprise:

From water hyacinth, I've learned that if you want to create something new, it takes lots of your time and energy. If you have to build up the business with this as well—not as a researcher that you can create some material... but only [with a] material that... can't find a market—you can't really use it. (Preya's Transcript)

The concerns of using materials in a sustainable manner can allow designers to be creative and examine the material in a manner that is new and offers insights into sustainable use. Not necessarily a new material, but a new approach to a material. Lina used this approach in one of her projects for an exhibition.

So, there was no cost involved, because we hadn't paid for everything, so there was no cost involved. Basically, they lent it to us, and then we fabricated it and took it all down and shipped it back to them. There was no waste. (Lina's Transcript)

Greg, however, is fully aware of the impact materials have on the environment and holds back from using nickel plate, due to the toxicity of the material.

They are old materials that we won't use or avoid using. I love to use, I love to use nickel plate. To get the impact, that warm, metallic, white metallic finish, but it's highly toxic. The whole process. (Greg's Transcript)

To close this section, Juan brought these ideas into focus when considering material exploration of new and unknown materials and the constraints of site, client, and budget.

I would say it's practicality. I mean, once again, it goes back to the budget and time aspects too. I think it ultimately needs to perform at a base level of practicality. (Juan's Transcript)

Juan extended his comments in a manner that summarises the other comments, connecting numerous constraints and considerations of time, budget, the notion of play, exploration, and the client.

There are certainly challenges with a lower budget but sometimes you have to be more creative... there comes innovation with that. I would say that it's a two-part thing with budget and time. Budget and time, if you have the two on your side, and innovation, I think that's a sandbox I love to play in. Of course, we don't always have that luxury. There are certain limitations that to come into play for sure. It sometimes is quite direct, where a client will say, "I want this. This is what has worked. This is what we would like to do." There's always the role that I feel that I need to play, or I need to bring about, where I like to push them to say, "Well, we can also do this." Then we try to explain the value of doing things differently and still meeting their target. (Juan's Transcript)

Material Project Concerns Summary

The participants clearly reflected on the need to work differently through materiality and identified the material project concerns as extrinsic factors impacting on how they generally experience materials, and in particular, unknown materials. The subsidiary factors emerging out of the analysis of comments were:

- Challenges of site conditions
- Minimal use of material on the site
- The impact of the client and the user on material engagement
- The relationship of the design process with the client
- Budget relationship to innovation
- Sourcing the materials
- Economic incentives and constraints.

PART C—Material Community Consultation

All the participants reflected about the impact of the material community on their lived experiences of unknown materials. The community that they had to deal with ranged from the local community to the regulatory authorities, and from other consultants to craftspeople using materials for their projects.

Regulatory constraints

The spatial designers who practice in architecture, interior design, and product design deal with different regulatory guidelines from those who explore materiality through the academy or exhibitions. Other regulations impact their work, dealing with patents, university research grant requirements, and manufacturing controls. Professional spatial designers need to constantly consider code regulations whenever they are applicable. Blair's comments reflect his reactions, previously noted, when he was faced with an unknown material. His desire to test it and understand its properties were central to his thinking. Also core to his practice was the liabilities issues associated with using unsafe materials:

I think the misuse of materials is super important. Of course, you do your due diligence, and figure out why somebody made this, what are the flame spread ratings, and what's its intended use, and all that business. Then, what can you use it for? What can you do with it? You take it apart, and you destroy it, and try to figure out what it might be. How long does it last? (Blair's Transcript)

He continued with comments about the unknown material and potential usage and restrictions.

It's probably going inside. You get your due diligence on the environmental safety and fire stuff. Then, what can it do? What does it look like from a distance? Can I put that in a ceiling? It's probably going to droop. How would I retain it? If you fire holes through it or pins through it with good washers, that would be interesting, because it will have some acoustic absorption. Is there any STC rating? (Blair's Transcript)

He concluded his comments on material community implications in the use of materials when he discussed the need to test materials and the payment for such testing.

Has anybody done any testing on it? Usually, you come up against that right away. Has anybody tested it for anything, and am I going to be on the hook for trying to get somebody to use it and pay for the testing? You want to know all of that stuff right away. (Blair's Transcript)

Participants raised comments about the regulatory and procurement policies that impact the practice of spatial design. The issue of professional liability becomes an issue for inappropriate and unsafe selection of materials for use in a spatial design. Michael comments on this issue when asked about risk:

... because I mean we have liabilities. We have responsibilities so yeah, but I don't let that deter me from trying something new or attempting to try something new. (Michael's Transcript)

Working with materials in a different context

The context in which the spatial design outcome resides has an impact on the experience that the designer has with that material. Codes and regulations vary between countries, and also within a country. Sandra noted the lack of regulations for her project in the Arctic.

There's no building codes, no railings, it's made out of snow. Nobody cared but it's a public room. If you made a public room out of anything

but snow, somebody—in a North American city—somebody would be after you to make sure the railings were there if the kids were running around and platforms ten feet in the air... because it was made of snow and everything on this entire project even though it was a very public project and planned well in advance, the only building material is snow... that's outside of people's preconceived notions of what a building inspector would pay attention to... (Sandra's Transcript)

Fiona had a different issue related to the context —the experimental space for her research into spatial applications. She commented that nearly all the materials in interiors and architecture are traditional, and that is due to the safety issues related to the material. As she was experimenting with materials her context and need for testing were different.

What I'm experimenting with really is just in lab context and then conceptual exhibition or experimental space concept that I'm able to exhibit. To date, I can't really build anything in real life because it hasn't gone through the life span of developing it, testing it, further research, tested some more. (Fiona's Transcript)

Duration of Time Implications During the Process

Fiona alludes to the cycle of testing and the implied period of time necessary for experimental material investigations to be built in a public space. It is not only the testing phase, but the whole design phase for projects that are experimental in nature in terms of material use. Lina commented about the relationship of time to unique material investigation:

"I can't believe how many hours have gone into it." It's like, well, no one's ever done it before. If you want to take a leap of faith and you're wanting something that is completely unique, then you have to understand that hours have to go into it to research if this can be done. (Lina's Transcript)

Preya stated that creating something unique takes time, particularly in the research time required. She noted that it took two years to do all the research with the water hyacinths, and in the end, she could not have the intellectual

rights protected (Preya's Transcript). Fiona also mentioned her dilemmas with patenting a design idea versus the compromises of exploring the ideas in a research setting (Fiona's Transcript). Yet this did not stop her from continuing her exploration in material compositions.

Juan also highlighted the need to have a sense of the availability of a material. This factored into his timelines for a project. Product availability is part of a larger system of industries and clusters.

I started to think about what is the availability and what are the normal sizes of materials? That eventually was a great service to me because then I started to think about budgets as well. (Juan's Transcript)

Collaboration Issues

Sandra commented on the building process in terms of collaboration. This is important within the lived experience of a designer working with an unknown material, as there are always other consultants or individuals involved with developing the idea to a final outcome.

It's also at that point in the building process if you're making a building and you have two trades meeting, it's that the spot between two materials is the one where everybody is pointing past each other going, "That's not my problem." It can often, that spot between two materials usually adds cost to a project, can cause problems in detailing, different things like that. (Sandra's Transcript)

Sandra's reflection of the conflict of trades when dealing with materials is not consistent with other experiences of collaboration. Most were positive about the potential of developing further activities. She discussed her research project with labs at a local university, a more open-ended experiment with materials, involving mechanical engineers and material scientists. With fluid mechanics and chemistry being discussed, Sandra was soaking it all in and enjoying the learning and exploration process in the paper and material lab (Sandra's Transcript).

There're different types of cross-fertilisation. We might make a new material with these guys out at [local university], right? That's the idea. (Sandra's Transcript)

She also discussed the collaboration with the first manufacturers of her paper wall system. It was a 100-year old company that had a steady business of making paper decorations. They did not want to work on the project at the start as they had something that was working and did not want to change it. The whole town was involved in the company in some manner.

They're friendly and all and they made us our wall but as soon as it came to experimenting and trying to ... We wanted to use the Tyvek straight away. We wanted to try that. They'd give it one shot, or whatever, and then it didn't work out. Because the laminations weren't holding, and it just wasn't working. They weren't willing to keep trying because they already had a business, it just wasn't their interest. (Sandra's Transcript)

Limitations and Opportunities in the Material Community

Sandra's comments about the collaboration with industry are insightful, indicating that not everyone is geared up to be innovative. Just because the idea is unique, and the opportunities are present, not everyone is willing to be an equal partner in the exploration. Innovation relies on a network (Tuomi 2002) or a cluster (Moskowitz 2009) of innovation centres that support unique ideas. The idea of communities is also expressed by the participants, who had to work with artists, craftspeople, or technicians to accomplish the final spatial design. Sandra discussed the craftspeople in Europe and the material community:

There's such a long tradition, particularly in glass in Europe. This is something that men who are craftsmen do. They make the glass. They don't design what's made with it, almost never, but it's a highly skilled profession. It's done by men and the design is done by somebody else. There's a lot of boundaries around it that have been there for hundreds of years since Moreno when no one was allowed off the island ... (Sandra's Transcript)

Most spatial designers work with consultants within a material community of suppliers, craftspeople, other designers, and consultants. It is a network that is dependent on the market and the economic limitations of that market. Michael described his relationship to the supply chain of new and innovative materials, and how that had an impact on his life experiences. He stated:

Well from suppliers and I think it then trickles down then to the design community because if they only feel that there are only X number of materials available... that's what they work with rather than seeking out ones that aren't just common or emerging. (Michael's Transcript)

Beyond the suppliers, he also noted that there is often resistance from tradespeople working on the project.

Why were tradespeople not willing to work with them? That was always a limiting factor, as is the trade's reluctance or being afraid of trying new materials or exploring new materials. (Michael's Transcript)

Michael was made aware of fixed methods of practice and the fear of the unknown. He added another experience of a supervisor who had a limited viewpoint on materials. Michael stated:

Working for someone years ago, you're limited to the limitations that they place upon you. Saying, "Oh, well that'll never work. That's too expensive. It's not gonna stand up. It's not gonna be durable." All sorts of things. (Michael's Transcript)

Juan had a different experience that he shared in his comments about collaboration with others in the material community. He described how he was going through a global sourcing process in which he would interview various manufacturers. He would probe their capabilities and approach to working with material ideas.

I would suggest a particular material such as break bent steels that could be powder coated or something like that, but it still needed to perform with lightweight characteristics, had to be modular, had to

withstand extreme temperatures through transportation. Then they came back with a couple of options... which... really sparked this secondary level of dialogue that was now transcending the initial form. Because we started to come to a solution of this lightweight material that could break apart but be reinforced. It ended up being this laminated corrugated cardboard, which was perfect, especially for transportation purposes and very economical in that way for that purpose. (Juan's Transcript)

Dialogue in the Community

Within any community there is the need for members of the community to find common ground and listen to the others in a process of dialogue. Schumacher (1984) describes communication as a two-way translation from thought to symbol and from symbol to thought. This idea was played out by Blair as he described the balance he needs to play in meetings with his client, builder, and other consultants, all wanting to hear something and place their mark on the project. He likened it to a game in which he had to balance all aspects to achieve the optimum outcome. It was about understanding that the poetry of the project, and the exploration that allows that to happen, must simultaneously exist with the pragmatics of economics, materials and buildability.

It's a chess game. You are, as I said earlier, you're trying to maintain control... However, if I'm not really careful about how I script and manage that conversation, I know that individual has the ability to make a conversation about a material all about economics, buildability, schedule, and so on, and maybe not at all about poetry, longevity, legibility, what's the building saying. (Blair's Transcript)

Greg described the excellent working relationship that he had built up over the years with one of his lighting consultants. The consultant is an expert in his own right, and he works with an elite list of clients. Greg stated:

He's really important for my work, because he makes our materials come alive. He's a... I call him a lighting painter, because he paints... our materials and brings the best out of them or makes other parts recede that are not important. He works the material... More

*successfully, if I come with materials with me. Explain what I'm trying to... what those materials are trying to do. He brings up the best of it.
(Greg's Transcript)*

Greg also noted the manner in which he dealt with craftspeople who were part of the material community and helped to deliver aspects of his work. He stated that the challenge is that he needs to convey to the consultant or artist that it is not about the artist's or craftsperson's installation, but about the overall design intent that the selected materials need to convey. He described this understanding of his lived experience of dealing with the craftspeople in a spatial design project in India.

That's one of the things I think that we've figured out. How to best use these, the crafts, the crafts people there. How do you use whatever they're good at, and use that technique in a different option, instead of on the screen, maybe on a piece of furniture? (Greg's Transcript)

He admitted that the cultural approach to materials in that community was different than the aesthetics that he was trying to achieve. There was little restraint, as the carver would attempt to make it too ornate. Constant quality control was needed (Greg's Transcript). Another cultural experience in dealing the material community was that labour was inexpensive, allowing work to be completed that would not be possible in the West.

*It's hard to get floor to ceiling height slabs of stone and [get them] installed, because unions would refuse to do it in North America. Anyway, I don't know about Europe or other Western countries, but they won't touch them. Can't get them. You have to cut it down to a smaller size. Because of the danger, health and safety matter. In India you see these walls, bathrooms full-on, thick walls, book matched.
(Greg's Transcript)*

Lina also discussed her conversations with the consultants in her material community to push the limits on their thinking and to challenge preconceptions of how materials could be used.

... we have put a fireplace around the structural column and calling people and saying, "We have this idea," and people are saying, "No. We don't want to do it," because everyone's afraid of it. My thing is like, "Okay, we're going to have it built and you are going to be sorry that you weren't the one doing it." (Lina's Transcript)

Lina agreed that she pushed the artists and other consultants beyond their comfort level.

Beyond their vision of what they could do with their materials... because I think that each of us get caught in what it is that we're doing in life. If no one questions that or doesn't ask anything different from you, then you'll continue doing the same thing. (Lina's Transcript)

Preya recognised that at times the designs were too difficult for the villagers in the workshops to produce. The techniques were too difficult for them, and if they were allowed to continue, the end results would take too long and would be too expensive (Preya's Transcripts). However, she did support the principle of collaboration with researchers and other consultants but noted that there were not enough opportunities. She took her material sample to a material expert to assist in creating a process that was suitable to train the villagers to easily make the products. Her short statement below reiterates her belief in the collaborative process with material researchers to enhance the project outcomes.

I think if we have lots of collaboration between material researcher and a designer, you can achieve something. (Preya's Transcript)

The questioning of the participants in the interviews aimed at looking at the process of making design decisions about materials and how the designer was informed, either through primary research or through secondary research. Participants reflected on being able to make decisions on materials from a stance informed through dialogue with those in the material community that allows for an appropriate material outcome for the design problems.

The responses in the interviews showed that working with consultants also requires the consultants to be willing to explore beyond their own boundaries, to be able to align with the spatial designer who wants to stretch the ideas of materiality in a project. When Sandra wanted to expand the range of product by introducing a black version of the paper system, she approached manufacturers but was disappointed in the results.

The black took a long time because we weren't happy with any of the first test and samples we got back when we asked our manufacturer to make a black version. (Sandra's Transcript)

Greg found that even other design consultants have an inherently difficult time to transcend their rational approach to design—a product of their training. Greg described the challenges he faced when asking the consultant to go beyond the standard responses, and to strive for a new form by questioning the traditional solutions.

It's funny, because [industrial designer's name] is more like that which is a classic industrial designer. He doesn't understand the sensuality component, the romance component. He'll only go so far into the tactility of the material but doesn't understand what happens when you reduce or increase the radius of the leg. (Greg's Transcript)

For Fiona, it was a matter of commitment to conceptual ideas that not everyone has the time to invest in. Fiona's comments not only stressed the need to invest time but also alluded to the attitude necessary to work with conceptual ideas.

... there are a couple of people I enjoy working with but not everybody has the time and energy to invest in some of these conceptual prototypes. (Fiona's Transcript)

Material Community Consultation Summary

In closing this section on Material Communities and the relationship between regulatory authorities and the engagement of individual artists, craftspeople, and consultants, it is useful to relate both of these issues back to the lived experience of the spatial designer. Their engagement with an unknown

material, or with the spatial arrangement that tests the boundaries of existing material application, is a constantly unfolding narrative that is built on everyday experiences. They discussed the need to know the limits imposed by codes and regulations, but they also need to know when to challenge them and exhaust the possibilities. In doing so, this led them to correspond with numerous consultants in the material community to extend the idea and test it with the aim to make it a reality. Lina clearly captured this in her comment that addresses an embedded attitude:

I came back thinking, I will never take no for an answer anymore, and I haven't. I always want to know why. It was everyday it affects me. When we looked at the structure for [name of city] and sitting around at the table with 20 people and everyone's saying, "No, you can't do it because it's over a parking garage." We'll be saying, "Well, why?" Then, "Well, the square footage of the pounds per square foot will not allow that." I'm like, "Okay, well what are the pounds per square foot?" It's just: keep asking and asking and asking until you've exhausted it. If the answer is no, then you know you've at least tried. (Lina's Transcript)

The participants understood the professional need to protect the health and safety of the users of their work by following appropriate guidelines and frameworks for best practice. Yet, in doing so, they were always looking for ways to extend or challenge the existing code restrictions. In the same manner, they constantly worked with others in the community of materials to push these boundaries through the testing, manufacturing, and application of materials in a spatial design. Through this process, a number of subsidiary factors emerged out of the analysis of comments. These were:

- Regulatory constraints
- Working with materials in a different context
- Implication of duration of time during the process
- Collaboration
- Limitations and opportunities in the material community
- Dialogue in the community.

Summary of Extrinsic Factors

The examination of the coded transcripts led to textual descriptions that revealed that the participants indicated aspects of their relationship with materials that were influenced by extrinsic factors. This primary data provided insights into the influences on how a designer may engage with a material that is unknown in terms of factors external to the designer. The data indicates that extrinsic factors come in many forms. Coding that has been discussed in the research methodology chapter reveals that the factors can be described at different scales: the extrinsic factor that impacts the individual designer; the factors at the scale of the project; and lastly, factors at the scale of the community. The latter two are largely out of the control of the designer, but the former, which deals with the factors impacting the individual designer, is central to this research.

The factors of material properties lie at the heart of the research, yet not in a material science perspective, but as the transcripts indicate, about the embodiment of the engagement with the material. The extrinsic factors that are revealed indicate how an unknown material is a phenomenon that enters the lived experience of the designer and subsequently how they had reacted to the phenomenon.

The richness and breadth of these textual descriptions allowed for a thorough understanding of the lived experience that spatial designers encounter when faced with a new material experience. The factors that are largely out of the control of the designer, in project concerns and community consultation, are essential to an understanding of the larger context in which this phenomenon of material engagement resides. They do represent concerns that occupy the spatial designer as they seek to apply the material in a context. Their coded text revealed the implication of site, client, consultants, and regulations that impact their decisions towards bringing forth the unknown material into a spatial application within the world.

Conclusion to Analysis of the Findings

These last two chapters offer an analysis of the findings from the spatial designers' coded transcripts. The coding led to the separation of two factors that best described the insights that they indicated in their interviews. Intrinsic and extrinsic factors were identified that impact the relationship that spatial designers experience through their engagement with materials. Yet it must be understood that in practice the designer does not separate their approach into these two factors as they seamlessly move between the two.

The nuances of how they explore material knowledge through play, experimentation and embodied engagement with a material is a key finding from this analysis. These extrinsic factors are working in concert with the intrinsic factors within a spatial designer as they access their material memory and exercise conceptual thinking in their engagement with the material. Knowing that these designers have a propensity towards taking creative risks, the engagement that is revealed in the textual descriptions and coded transcripts indicate that they are trying to unconceal something within the material that will align with their own approach to their practice. Whilst being willing to explore and address intrinsic demands, they are also cognisant of their professional role in meeting extrinsic factors. This ability to reverse their focus and bi-laterally address their engagement with a material is a key attribute attained from the textual descriptions. This reinforces the iterative design process of developing spatial design outcomes. It also reaffirms my own perspective of practice and engagement with materials in architecture, interior, and product design. Working with the multitude of factors does not always mean that all are addressed equally in each project, but each progresses your own material knowledge.

The next chapter will discuss how this knowledge can lead to a new way of understanding and engaging with this experience, as phenomenological research is not about solving a problem, but about understanding.

Chapter 6

DISCUSSION OF THE RESEARCH FINDINGS

Introduction

The primary qualitative research described in the previous two chapters explored the lived experience of the spatial designer in terms of intrinsic and extrinsic factors impacting on how they engage with an unknown material. This chapter draws together the factors that reinforce the findings of the literature review to answer the research question. It concludes that for a spatial designer, the understanding of how they engage with a material will provide a theoretical framework that may allow for greater exploration with materials.

It is important to briefly reiterate what was the reason for the research; how it was conducted; and why it is important. The thesis has clearly indicated that the reason for the research is to examine the lived experience of a spatial designer undertaking an activity that is central to their practice. This activity involves the engagement with and exploration of a material whose properties are unknown. This question led the research to a phenomenological study of the lived experience of designers. The research took the form of a series of semi-structured interviews. This type of study is not about solving a problem but rather about stating what is there. The study is important, as the ordinary can expose the extraordinary (Manen 2014), and the ordinary experience of the engagement with an unknown material helps the designer attain a finer examination of their process of engagement. Having this insight assists the designer in being able to have an explicit understanding of this engagement and how it contributes to their practice.

This discussion and findings present a synthesis of the common actions and traits of the individual designers, but not of the individual actions themselves, thus staying true to phenomenological research methodology. The research used textual descriptions to explore the lived experiences of a diverse group of participants. The findings from the textual descriptions inform the investigation into the research question, which is: What is the lived experience of spatial designers when they engage with unknown materials with particular reference to the phenomenon of those willing to take creative risks in their work?

Significant insights were gathered from the textual descriptions that provided a thorough understanding of this question and informed the analysis. As the literature review discussed, phenomenology in its purest form highlights that it only seeks to describe, and not to explain (Lester 1999). However, while explanation of each participant's reasons for their actions is not sought, a heuristic model of their experiences can be suggested. The Material Engagement Model (MEM) will be presented as a conclusion to the research that allows for explicit understanding of a designer's engagement with an unknown material, in doing so establishes a theoretical framework of such an engagement.

Reflection on Structuring of Primary Research

A thorough examination of participant's textual descriptions revealed two clear groups of influences on their engagement. While the categories of intrinsic and extrinsic factors are useful to organise the text, it must be understood that both factors are constantly being considered by the designers as they process the material presented to them—cognitively, emotively, and kinaesthetically.

While responding to the interview questions and reflecting on their engagement, many participants were grateful for the investigation into something that is at the root of their design approach, yet which no one had asked them about before. This insight was noted in their recollection of their various experiences with materials throughout their lives. The reflections that they gave on their practice were analysed and indicated two directions. One involves internal or intrinsic factors that impacted their engagement with materials, and the other dealt with external or extrinsic factors that were mostly out of their immediate control.

The intrinsic factors that were examined fell under three key headings: material memory; material experiences, such as personal design experiences, educational, and inspirational; and material ideas, such as conceptual and theoretical. The intrinsic factors were not explicitly defined by the participants but indicated memories and encounters that shaped how they engaged. The

literature review has discussed Merleau-Ponty and his views on perception in terms of embodiment. The participants clearly noted that there is an engagement that happens when introduced to an unknown material followed by different levels of embodiment throughout the act of engaging further with the material. Merleau-Ponty's account of the phenomenological gaze at the introduction places this action into a perspective of embodiment of the experience.

Intrinsic factors also reflect the personal experiences from travel, education, or from other inspirational design outcomes that may be known. These and material ideas that are envisioned internally by a designer form a data bank for access when there is a time to understand something unknown. It is this process of uncovering knowledge about the material that comes from a searching within us to assist in *unconcealing* what is at the core of the material. This core is more than the pragmatic physical properties of the material that are present; it is the relationship to that presence and the internal conceptional relationship and consciousness of that presence (Merleau-Ponty 1968, 2004; McAuliffe 2016).

The second category of textual descriptions was extrinsic factors. Here, the participants' comments dealt with three key areas: material properties; project concerns; and external community consultation. These concerns tended to be of greater concern for those having a propensity towards commercial practice, yet all had a varying degree of connection to the extrinsic factors.

These factors that had an influence on their thinking were external and involved material science, client concerns, budget implications, and comments from the community through other consultants or through government regulations. These were all goal-oriented factors that aimed to avoid any negative consequences such as material failure or non-compliance with regulations. This is opposite to the activity-oriented intrinsic factors that are process-oriented and seek exploration of ideas. The primary research outcomes were not a linear

process of intrinsic followed by extrinsic. There was an oscillation between these two factors.

Key Moment of Engagement

Schön (1983, 138) discusses the reflective practitioner as one who draws from a repertoire of examples that are built upon experience. His hypothetical design instructor, Quist, is noted as one that has such a repertoire.

The practitioner has built up a repertoire of examples, images, understandings, and actions. Quist's repertoire ranges across the design domains. It includes sites he has seen, buildings he has known, design problems he has encountered, and solutions he has devised for them.

He continues this reflective thought on his practice that deals with unfamiliarity and with problem-solving, both aspects that are at the core of the participant's thoughts.

It is our capacity to see unfamiliar situations as familiar ones, and to do in the former as we have done in the latter, that enables us to bring our past experience to bear on the unique case. It is our capacity to see-as and do-as that allows us to have a feel for problems that do not fit existing rules. (Schön1983, 139-140)

At the conclusion of the interviews with spatial designers, the pre-determined closing experience was to show each of them a material that was new to the market or experimental. These materials were all considered to be materials with alternative or advanced properties, so were unknown to the designer. Each designer picked up the material, and there was an immediate reaction: touching, bending, smelling, examining it against the light and, in various orientations, stretching and deforming it. The time spent doing this varied between participants, but the common trait was the physical connection with the material. This key moment experienced during the research is central to the findings of this thesis. At this moment of engagement lies the uncharted

territory of understanding how their thought processes work, and the impact they have on how they translate their emotive connection to this process.



Figure 6.1 *Typical Material Engagement: Juan Holding an Unknown Material*

The tactile examination of the material through all the senses was an examination in search of a synchronisation with the Being of the Material—in reference to Heidegger—or, as Merleau-Ponty (1945/2004) identifies, the thing and not the object. The designers are trying to understand the material through tactility. They are, as Merleau-Ponty further describes, examining the material through a gaze, and with tactility, trying to access “... the thing itself from which they are, as it were, suspended” (Merleau-Ponty 1945/2004, 370). Their gaze reaches beyond their body to access the Material Being and to gain a sense of knowing it.

When the spatial designer is introduced to an unknown material, their experience is both momentary and continual. In terms of an action, it is the moment in which the designer connects in a sensorial manner with the material. However, it is much more than just the physical connection to the material; it is a comprehensive process of discovery.

The designer's entire engagement with the material could be described thus: it was as if time had stopped for them; they were using all their senses to read the material, as they asked questions of themselves about the material through a process of discovery. The moment was of different duration for different designers, but their intensity of gaze, exploratory touch, and expanded sensory inquisitiveness were common.

The moment of examination also indicated a balancing of the past with the potential for the future. They examined the material with an enquiring mind to see what it was, what it was like, and what it could do, which would lead to doing something with the material. I argue that it is at this moment of introduction that the designer is weighing the value proposition of whether or not to venture into the unknown and to take a creative risk with the material.

Relationship between Primary and Secondary Research Findings

The thesis describes one core aspect of a designer's approach to practice, and the process that they go through that makes them want to investigate the potential of an unknown material. The literature review examined the many issues relating to the design process. It was followed by the textual descriptions that deepened the researcher's understanding through a phenomenological lens. The research process of the literature review and textual descriptions led to the discovery that the spatial designer's interaction with unknown materials can be described as a process proposed in this theoretical framework.

This thesis makes explicit what has been experienced and practised by these spatial designers during the moment of interaction with unfamiliar materials. Describing this process allows for a deeper examination into this aspect of their approach. The process does not supersede their current design process—each having a particular approach to working through a design brief. The proposed theoretical framework of material engagement presented in this thesis presents a particular design process that they may undertake when faced with an unknown material.

Relationship of Theoretical Insights to the Lived Experience of the Design Process

The philosophic insights of Heidegger, outlined in the literature review, were confirmed in the textual descriptions of the participants, who were often involved in the process of *unconcealing* the potential of a material.

Witnessing the design process in action through the final request at the interview—noted above—illustrates the designer’s lived experience with an unknown material. This was not memory of a material interaction, but an unfiltered examination of an unfamiliar material at the moment of introduction. As explained in the literature review when discussing Heidegger, the principle of seeking “...indefinite if not infinite number of ways to characterize the properties of any particular thing” (Wrathall 211, 32) is clearly what happens at the moment of engagement. Seeking new ways of being is core to any designer. The idea of *unconcealing* appears to be central to the internal dialogue that the designer undertakes in their quest to know about the material.

In his seminal text, *Being and Time*, Heidegger introduces his term *Dasein*:

Dasein is a being that does not simply occur among other beings. Rather it is ontically distinguished by the fact that in its Being this being is concerned about its very Being. (Heidegger 1927, cited in Krell 2002, 53)

This thesis argues that the spatial designers begin their questioning of an unknown material in search of its being—its real being, as intuited by the designer in their discovery and exploration of the material. Each designer has a suspicion that there is more to the material than first imagined, and a belief that they can get to the core knowledge of this unknown material to make it known. As noted earlier, belief is a way of justifying knowledge (Abel 1976). It is understood that this process is not explicit in the minds of the designer, but the process undertaken when faced with an unknown material is one of discovery. Merleau-Ponty’s work on perception provides a clear understanding of the nuances in the act of viewing an unknown material. He understood the phenomenon being observed is not something outside of our consciousness. He

noted that “We need to reject the old assumptions that put the body in the world and seer in the body...” (Merleau-Ponty 1968, 138). This embodiment of the material is seen in the eyes of the participants as they engaged with the material. This view is a guiding view for them and will assist them in the articulation of their design outcomes with the material.

Merleau-Ponty’s view of perception depends upon the idea that the background of our perception of objects and their properties, like the background understanding of a thinker, must recede from view and yet functions everywhere to guide what is focally articulate. (Kelly 2004, 75)

Merleau-Ponty puts his attention on various things and the natural world, and his writings examine light, shape, form, colour and tactility—key aspects of the world of spatial design. He insists that perception is achieved through tactile perception. This was clearly observed with the reaction of the designers to the material in which they had to hold, bend, twist, smell, and even bite the material. It is concluded that this tactile perception lies at the crux of the lived experience of a spatial designer with an unknown material.

The literature review also indicated that the ideas of Bourdieu could throw light on the phenomenon being researched. This proved to be the case, as the text from the interviews was clearly falling into two categories: intrinsic and extrinsic factors. Bourdieu identifies the two main tenets of this logic of practice as practical and reflexive knowledge. The former is about the feel for the game and entails the ability to comprehend and negotiate—both simultaneously and non-reflexively—the rules, discourses, regimes of value, and contexts in which the game occurs in both cultural and socio-cultural fields (Schirato & Roberts 2018). The second tenet of the logic of practice is the actualisation and interrogation of the habitus through reflexivity.

The idea of practical and reflexive knowledge supports the findings from the textual descriptions and provides additional depth to the proposed model of material engagement. Bourdieu’s ideas were conceived to be used: “... a unique

set of conceptual terms to be employed in the course of analysis and discussion of findings. These terms, [are] what he called his ‘thinking tools’...” (Grenfell 2010, 2).

The spatial designer’s journey with materials exists in a temporal context, in which the designer evolves their practice. When a designer is exposed to a new idea, material, or experience, their cultural capital increases, together with their position in the field and understanding of the game. This shift in the cultural capital restructures the habitus of the designer, and together with the existing habitus—a disposition to the world—a practice is formed. Practice, habitus, and cultural capital reside in a social field, as illustrated in Figure 2.9.

Importance of Material Memory

A key concept coming out of the literature review and the textual descriptions is that of material memory. Those interviewed each had a strong connection to their memories of material engagement. These designers also discussed the idea of rapid learning when working with memory, utilising different memory systems to their advantage.

Through this research process, the participants were asked to access their memories of materials; these were sensory/iconic memories as well as long-term memories, yet these could be prone to unconscious alterations (Surprenant and Neath 2009). Despite being an invaluable personal insight, memories cannot be explicitly examined in terms of the exact experience of engaging with the unknown material, although clear descriptions of the engagement could be available. Regardless, memories are an important part of the design process (Malnar & Vodvarka 1992; Pallasmaa 2005; Zumthor 2005, 2006; Treadway 2009), and together with experience and knowledge, they help the designer to shift unknown materials to becoming-known.

As the literature review noted, the acquisition of new knowledge is part of the learning paradox in which the new is created from the old. This core process of design was echoed by the participants. However, this has never been made

explicit as part of a design process. The participants' insights about the moment of engagement, gathered through this phenomenological research, reinforce the intuitive practices of seasoned designers. The synthesis of them also offers guidance for young designers through a heuristic model that discusses the modes of engagement necessary at different times in the design process. These new insights enrich and inform the design process.

Creative Risk-taking through Seeking New Expressions

The literature review examined the attributes of a spatial designer that impel them to take creative risks and work with unknown materials. These attitudes were evident in those who were interviewed to varying degrees. Risk taking is an essential attitude of creative spatial designers willing to explore material innovation and ideas through working with unknown materials.

This research has indicated that the greater the experience the designer has in practice, the more their knowledge of materials expands. It has also identified there is little research of the moment into how knowledge in materials is gained—a crucial junction where the unknown is discovered. The examination of a material that is new to the designer's awareness is treated by all designers interviewed as a process of discovery. They tactilely enter into a conversation with the material. The findings and data derived from the interviews reveal this reflective practice.

Although each designer who was interviewed saw the world differently and experienced it in their own unique manner, the phenomenological analysis demonstrated that there could be a synthesis of their viewpoints of the unknown. It was noted that they were not afraid of something new, as searching and being receptive to new ways of enhancing the outcomes of their design process is a natural tendency for them. The interviews made this idea explicit, while the literature review provided insightful, supportive, background knowledge. The findings of this research are not only beneficial in making the ideas explicit, they also inform a model of engagement that expands the idea of

what happens at that innovative moment of contact with an unfamiliar material. This model came out of the findings and is described later in this chapter.

Gallagher (2011) describes how biologists, social scientists, and information technologists have used the term neophilia for the last hundred years. She notes that the term does take on slightly different meanings, but she uses it in an expansive way to discuss “...our species’ unique affinity for the new and the different” (Gallagher 2011, 6). She describes three different character types: of these, the neophilic is an extreme novelty seeker, and their opposite is the neophobe who avoids risk—both about 10-15% of the population. The remaining 70-80% of the population are neophiles, who have a balance between different degrees of risk and desire for novelty.

As the purpose of this research is to examine the engagement with the unknown, it is useful to note the science behind risk-taking, which is inherently about dealing with the unknown. A full investigation lies in the domain of science, yet the insights that Gallagher offers are useful to this research. Gallagher explains that the larger brain of homo sapiens has allowed for the greater exploration of their “environment and [the] risk-taking, learning and creating that life in their challenging environment demanded” (Gallagher 2011, 18). She also notes that:

Our ancestors’ neophilia was boosted by their modern nervous system’s sophisticated circuitry for the regulation of dopamine. One of our brain’s major chemical messengers that mediate our emotional responses to the world, this neurotransmitter is particularly important to the seeking and the processing of both novelty and rewards. In fact, our dopaminergic differences help explain why some of us are eager to explore new horizons, while others focus on the risks involved. (Gallagher 2011, 18-19)

The interviews with participants demonstrated that the connection to material discovery is part of who they are as designers. As Gallagher has indicated, this

process is fundamentally linked to who we are. It has allowed us to adapt to a changing world and survive.

When considering the spatial designer who has the potential to take a creative risk, it needs to be understood that all designers are change agents. They are tasked with providing an experience that alters the existing state of those whom they are doing the work for, whether it is a client or themselves. In this state of change, designers constantly deal with uncertainty. They feel at home in this space, as it creates a sense of tension that good designers are attracted to in order to elevate their work. Dorst (2006, 111) declares that it "...makes you realize that design is a very risky profession." So, for those attracted to exploring materiality in their work, the uncertainty of working with an unknown material is all part of the natural tension that drives them in their practice.

This moment of introduction to material places the designer on the threshold of something unknown, as the material in front of them is untested, unfamiliar, and therefore unknown. The literature review has discussed the various insights into what is considered 'creative risk' (Bernstein 1998; O'Shea 1999; Kingwell 2003).

The designer's quest to search for the new is a dominant idea that appeared in the comments of the participants. As noted by other writers, both Diyanni and Csikszentmihalyi add insights that the participants echo: "We use imagination to envision images of past experiences and to create mental pictures of future events..." (Diyanni 2016, 137). And

Without a good dose of curiosity, wonder, and interest in what things are like and in how they work, it is difficult to recognize an interesting problem. Openness to experience, a fluid attention that constantly processes events in the environment, is a great advantage for recognizing potential novelty. Every creative person is more than amply endowed with these traits. (Csikszentmihalyi 2007, 53)

In terms of undertaking a design project, Dorst explains the relationship of design to risk, uncertainty, and process:

As a designer, you work on a complex design problem, possibly for months on end, without really knowing for sure that you will succeed in creating a satisfying solution. This creates a certain tension, a restlessness. (Dorst 2006, 111)

Education, both formally and informally, examines changes in society and prepares the designer for them through understanding the inherent risks. In an overview of the bold ideas shaping the world, Bruce Mau (2004) prescribes, in *Massive Change*, that it is an investment in the future that spatial designers and all designers need to consider. Diamandis and Kotler (2015) also extend the ideas of disruptive thinking and put forward the need to be bold in your entrepreneurial approach to ideas. As professional designers, those interviewed were well aware of entrepreneurial opportunities—each involving a degree of risk and of reaching into the unknown. Kaufman and Gregoire (2015, 86) also comment on the traits of those ready to explore the unknown possibilities: “Individuals who are high in the openness to experience domain get energized not through the possibility of appetitive rewards but through the possibility of discovering new information.”

Yet despite an appreciation of change, and education in its dynamics, there is a gap in the literature around understanding the experience of individual designers who have a propensity to address change, which they demonstrate through their lack of aversion to acceptance of advanced materials. The embedded relationship of change to creative risk-taking has been discussed in the literature review, indicating a gap in our understanding of how this is addressed by a spatial designer who explores new materiality.

Relationship to ‘Play’ in the Engagement with an Unknown Material

When interviewed about interactive design, Svanaes (2011) discusses how a child plays with a new object and relates this to the insights of Merleau-Ponty. He describes a child saying “see” and then biting it, which he explains as active

perception. The idea of the phenomenological gaze is mentioned, and how Merleau-Ponty understood that being in the world involves interacting with it. Svanaes considers that the more one interacts with an object, the deeper one gets to know it. Playing with ideas is often seen as wasteful, but it is essential for the embodiment of the perception and allows for a degree of risk when interacting with an object. This approach to the creative act is demonstrated by the participants when presented with an unknown material, as they displayed a tactile sense of intuitive knowing and desire for discovery—they played with the material.

The act of playfulness and its relationship to creativity and curiosity is discussed by a diverse range of authors (Postman 1995; Zukav 2012; Robertson and Aronica 2010; Diyanni 2016). Quite often the idea of creative risk is seen as potentially reckless for clients who engage designers to meet their needs within a budget, yet still want something innovative. Working in that budget requires stricture in relationship to costs, but still there is a need to explore and quite simply ‘play’ with ideas. Many of those ideas are driven by new or relatively unknown materials.

The idea of winning prescribes the overcoming of challenges and succeeding in achieving a state that is different from the state in which you began. In his book, *Play—How it Shapes the Brain*, Brown (2009) unpacks the connection of play with creativity. He also describes the different types of play and personas. When discussing the topic of winning in the act of playing, he says: “The competitor is a person who breaks through into the euphoria and creativity of play by enjoying a competitive game with specific rules, and enjoys playing to win” (Brown 2009, para 9).

Yet the intrinsic intent to be curious and playful with an unknown material, and to engage with a design process to attain knowledge, is held in a balance with the extrinsic intent of achieving a spatial outcome to meet the intentions of the project. The participants in this thesis tended to move seamlessly between the

intrinsic factors and the extrinsic factors while discussing how they interact with and experience materials. Through the process of exploring the factors in their reflections, it is evident that they were searching for knowledge. Knowledge through a focus on a goal or an activity.

The findings from the interviews have led to the need for an additional theoretical view that supports the literature but explains the motivational oscillation between an outward focus and an internal focus. This approach demonstrates an outcome of the research as a model that describes their lived experience and may provide insights for others.

Apter's Reversal Theory/Van der Molen's Bi-Stable System

Accepting that we live in a dynamic world, and that exploring the unknown is registered in individual dopamine levels (Gallagher 2012; Malgrave 2015), the challenge is to synthesise this knowledge with the findings of this research. A scientific analysis in relation to the phenomenological descriptions would be an important study to undertake in detail but is beyond the scope of this research. However, as Apter's reversal theory (Apter, Fontana, Murgatroyd 2014) is based on the rejection of the principle of homeostasis and a recognition of the dynamic nature of the world, it proves to be an appropriate model to examine. His approach is developed through extensive analysis that describes a theoretical framework around actions occurring in practice.

Man does indeed inhabit two worlds, the world where activity is its own end, where arousal means excitement and where play and illumination are allowed to flourish, and the world of purpose and intention where arousal is avoided, and the emphasis is upon rationality and serious-mindedness. (Apter et al. 2014, 87)

When examining the lived experience of a spatial designer, the participant designers in this study have taken various paths. Yet there is consistency in their experience of being excited about a new material. Quite often, the materials that come to them are not commonly used in the industry, and many of them offer advanced properties. It is, however, the excitement in the

discovery and the anxiousness of holding the ‘unknown’ that drives the designers. At that moment of discovery, there is the potential for material applications and modifications. To understand the journey and the motivation for what happens next, there is a need to consider the notion of emotional engagement at that moment of contact, and the consequences of the arousal of those emotions felt when the designer is introduced to the unknown material.

The idea of engagement, curiosity, exploration, and play has many similarities to the ideas that ground design processes. Design at its heart is about seeking change, either change in conditions that are not successful, or change in appearance that provides a psychological shift in appreciation. Design constantly re-invents itself and is constantly adapting itself to new contexts and criteria—a form of open learning (White 2002; Bohm 2004; Reckwitz 2017).

In the late seventies, Michael Apter proposed a radical new way of examining motivation, which differed greatly from the existing theories of Freud, Lorentz, Hull, and Zuckerman (Van der Molen 1984), who all indicated an innate desire in humans to maintain a homeostatic state and reduce drive and sensations. Apter discusses the shortcomings of this view, and cites H. F. Harlow (1953), who critiques the prominent view at the time as limiting. He argues that the homeostatic approach does not explain why certain members of society engage with exploration, curiosity and play (Apter et al. 2014, 3).

Reversal theory provides a grounding for Van der Molen’s ideas. Van der Molen (1984) explains how a bi-stable system, rather than homeostasis (i.e. instability), of emotions and motivations leads to an open-ended capacity for learning (See Figure 6.2). Van der Molen notes that most people experience a range of arousal states during the day, and that there are periods of transition between the different states for survival during high stress periods, or to allow for proper (neuro-) physiological functioning.

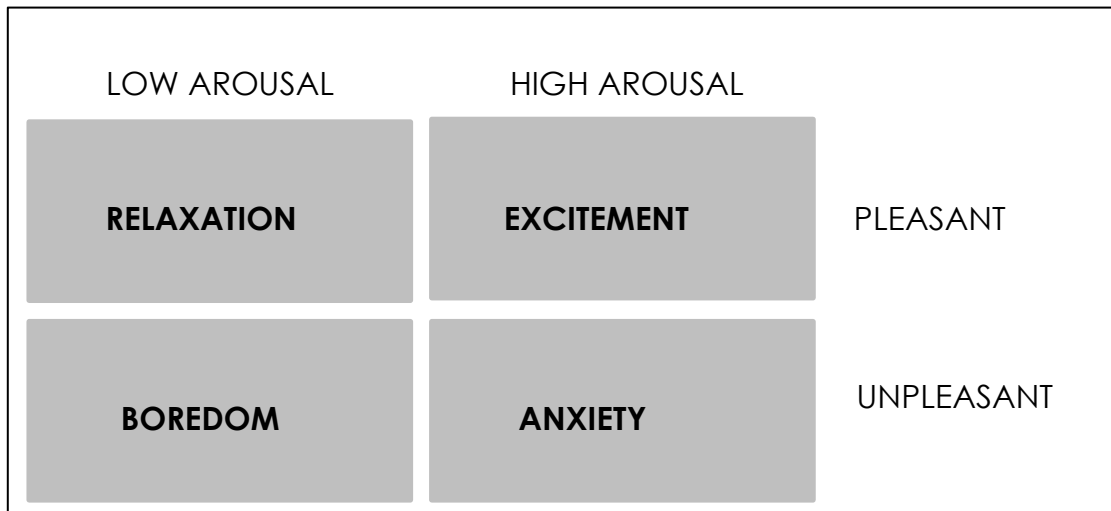


Figure 6.2 Key Emotional/Motivational Bi-Modality Model (Van der Molen 1984, 229)
The range of arousal states that supports proper (neuro-) physiological functioning.

Using Apter’s reversal theory, Van der Molen identifies two distinct tendencies (See Figure 6.3):

- A tendency to seek high-arousal evoking situations whenever surplus energy is available; and
- A tendency to seek arousal-reducing situations as soon as an emergency occurs or as soon as the surplus energy is exhausted. A person would seek high arousal at certain times, which delivers a sense of excitement. At other times, that person may seek a state of low arousal, at which time a state of high arousal would seem unpleasant. When in the state of excitement that is pleasant, the state of low arousal would be boredom, which would be unpleasant. This mode of excitement-seeking can be reversed to one of anxiety-avoidance (see Figure 6.3).

Van der Molen’s diagram aptly describes the sense of reversal that takes place at times of high arousal. The two terms that are essential to understand the Reversal Theory and the proposed model developed from the findings of this research are telic and paratelic. *Telic* comes from the Greek word ‘telos’, meaning goal oriented, focused on the end, closed. *Paratelic* is behaviour-directed, and about seeking fun, being playful and spontaneous (van der Molen 1984). Figure 6.4 elaborates these terms and signifies a strong relationship to the phenomenon being researched, and how the designers interviewed have expressed their response to working with materials. “Designers familiar with

reversal theory have a deeper understanding of the human experience of space” (Augustin and Apter 2016, 8).

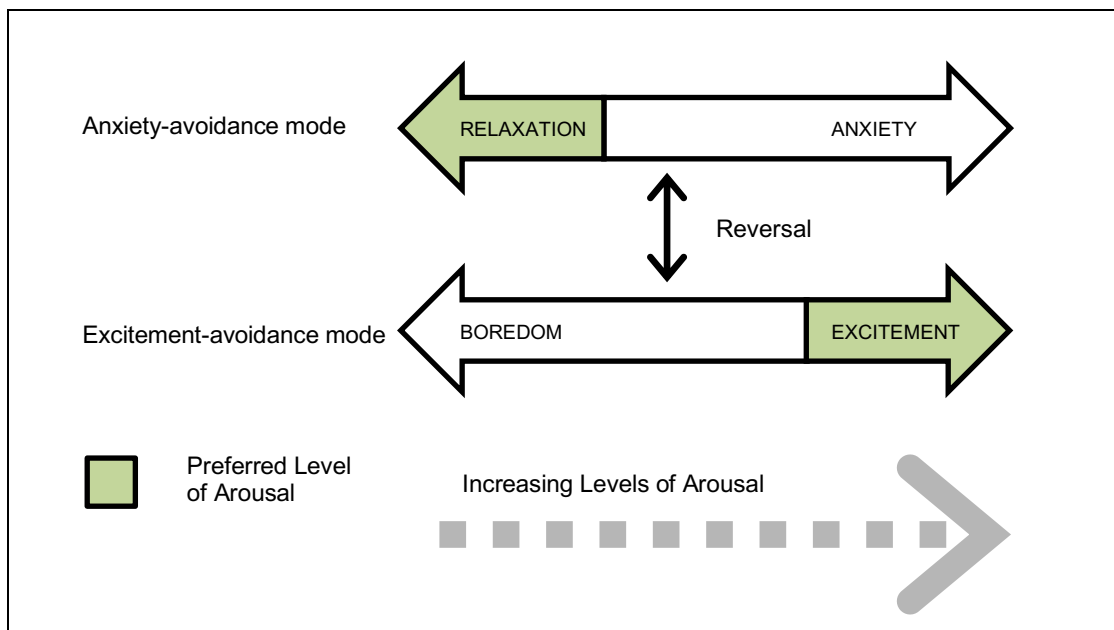


Figure 6.3 Reversal Model (van der Molen 1984, 230)
Preferred levels of arousal is kept in balance through an oscillation of telic and paratelic mode.

Apter (1982) refers to this motivational reversal that suggests a bi-stable telic/paratelic system as reversal theory. Apter et al. describe the theory:

Reversal theory is in fact directly concerned with motivation. More specifically, it is concerned with the structure of human action in terms of the ways in which individuals experience the motives they have for the actions they undertake... it is concerned both with experience (phenomenology) and with the systematic interpretations given to events within experience by the person (structure). (Apter et al. 2014, 1, 2)

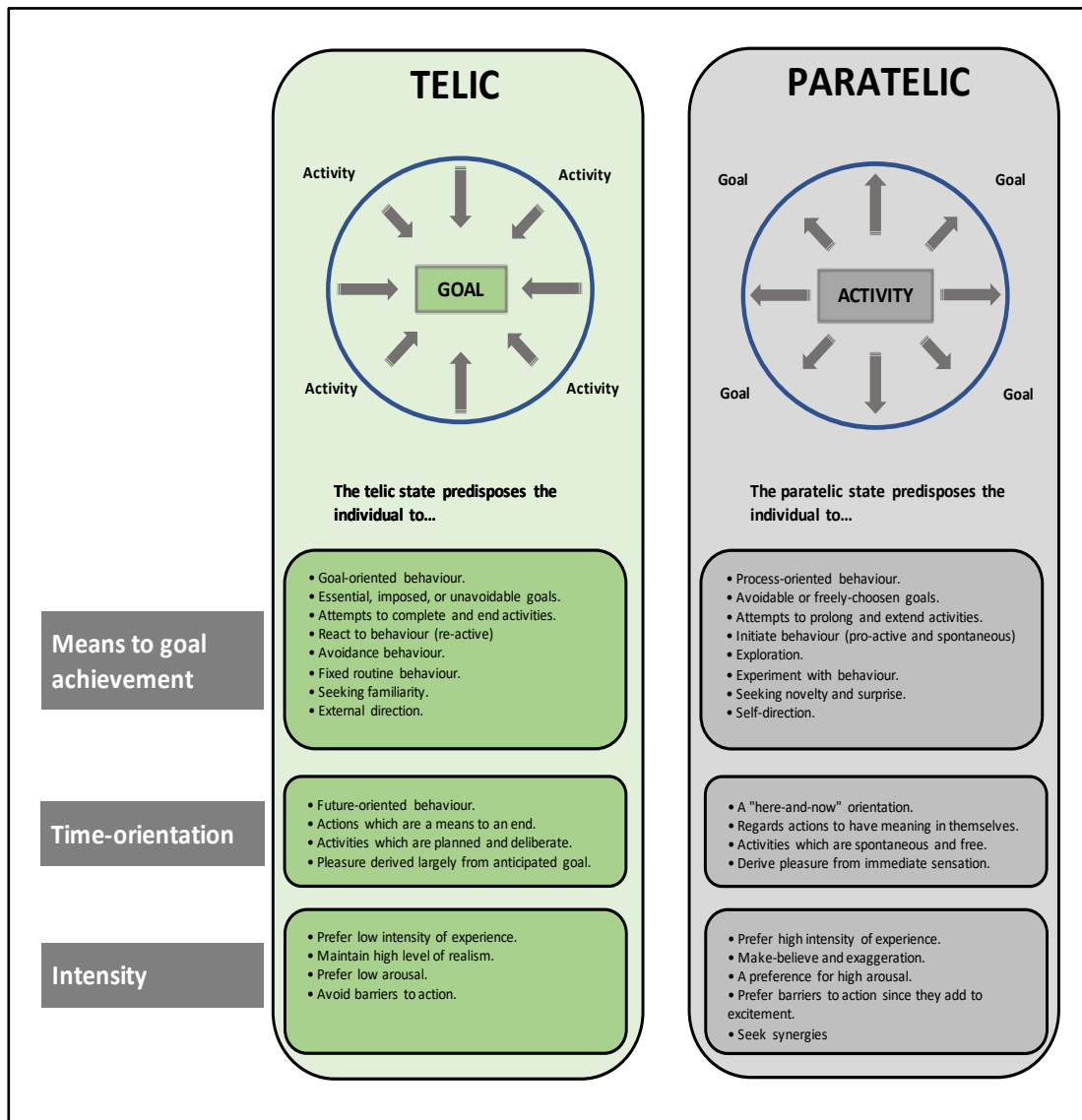


Figure 6.4 The Telic and Paratelic Mode in Relation to Means-Ends, Time, and Intensity. (van der Molen 1984, 233). Various factors that vary with either a telic response or a paratelic response to a state of arousal.

Apter's theory connects the idea of having a clear framework for examining human action and a strong phenomenological basis (Apter et al. 2014). This provides a foundation for further development in accordance with the findings from this research. Smith, Pfeiffer & Apter comment on the explorative behaviour of the opposing factors of familiarity and novelty: "In the telic system, familiarity is the dominant member of the pair and novelty is the dominant member in the paratelic system" (Smith et al., 1975, 10-11). The two states of telic/paratelic prescribe a bi-stable system in which the arousal generated by the discovery of an unknown material drives the designer on a path of

engagement. The *telic* state is structured and goal oriented. The *paratelic* state is focused on process, spontaneity and exploration. Each new discovery begins a new path, but each path is re-structured from the memory of the past. As noted by one of the participants:

By imagining yourself in the future you're actually, you're thinking about the past. (Juan's Transcript)

These insights arising from the findings in this research provided the grounding from which the proposed Material Engagement Model (MEM) emerged. The key findings were synthesised from the intrinsic and extrinsic factors outlined in the previous chapters and triangulated with the analysis of Apter's theory and the literature review.

Material Engagement Model (MEM)

... during revolutions scientists see new and different things when looking with familiar instruments in places they have looked before.
—Thomas Kuhn

The proposed model of material thinking is derived from the phenomenological analysis of spatial designers' lived experience of advanced materials. The mixed method analysis drew out key ideas of engagement with materials throughout their careers. The research of lived experience indicated a process of oscillation between creative exploration and responsibility to the project brief, client, and society. Their level of emotional connection to the tasks varied, and their behaviour during the time when creative exploration took place was different from their behaviour when there was a necessity for responsible actions and material application.

The aim of the model is to clearly indicate a path towards increasing one's level of proficiency in material thinking, with particular emphasis on the engagement with new and advanced materials. It aims to reconcile the different approaches needed at different times of the material journey, addressing the type and intensity of energy needed to accomplish the necessary activities. The purpose

of the model is to articulate the material engagement phases, highlighting the binary relationship of telic/paratelic states. It is proposed that for the development of a habitus that has propensity towards the use of innovative materials—new, advanced, or unknown—there needs to be adequate time in a paratelic state.

The terms ‘new’ and ‘advanced’ are problematic, as new indicates something that is not yet known to the observer. Advanced indicates properties and characteristics that are at a higher level of performance or satisfaction, which is contextually bound to a particular user. However, they are all materials with their own individual characteristics. This model is not about their properties or duration of exposure to the world. It is about engagement with a material that is at that moment unknown.

Material Engagement Model and Skills Acquisition

The model was also informed by Dreyfus’s theory of skill acquisition, which identifies five levels: novice, advanced beginner, competent, proficient, and expert (Dreyfus 2004; Lester 2005; Lyon 2015). Limitations in the scope of this thesis prevented further connection and elaboration of this model with reference to these levels.

Dreyfus’s levels of acquisition allowed the conception of the Material Engagement Model (MEM) to be cyclical, in that it aims to increase the level of proficiency in engaging with unknown materials at different levels of skills.

As Kuhn (1996) indicated, we use the same tools in any scientific revolution; the designers are still working with the same worldview of design, and their existing skillset, yet they are rethinking outcomes with a restructuring of both the skillset and their worldview. This restructuring of the structure is the cornerstone of the theories of Pierre Bourdieu in his views on habitus; it is also clearly articulated in Michael Apter’s reversal theory.

Table 6.1

Levels of Skills Acquisition (Lester 2005, 3.)

Level	Stage	Characteristics
1	Novice	Rigid adherence to taught rules or plans. Little situational perception No discretionary judgement
2	Advanced beginner	Guidelines for action based on attributes or aspects (aspects are global characteristics of situations recognizable only after some prior experience) Situational perception still limited All attributes and aspects are treated separately and given equal importance
3	Competent	Coping with crowdedness Now sees actions at least partially in terms of longer-term goals Conscious, deliberate planning Standardised and routinised procedures
4	Proficient	Sees situations holistically rather than in terms of aspects Sees what is most important in a situation Perceives deviations from the normal pattern. Decision-making less laboured Uses maxims for guidance, whose meanings vary according to the situation
5	Expert	No longer relies on rules, guidelines or maxims Intuitive grasp of situations based on deep tacit understanding Analytic approaches used only in novel situations or when problems occur Vision of what is possible

Basic Format of Material Engagement Model

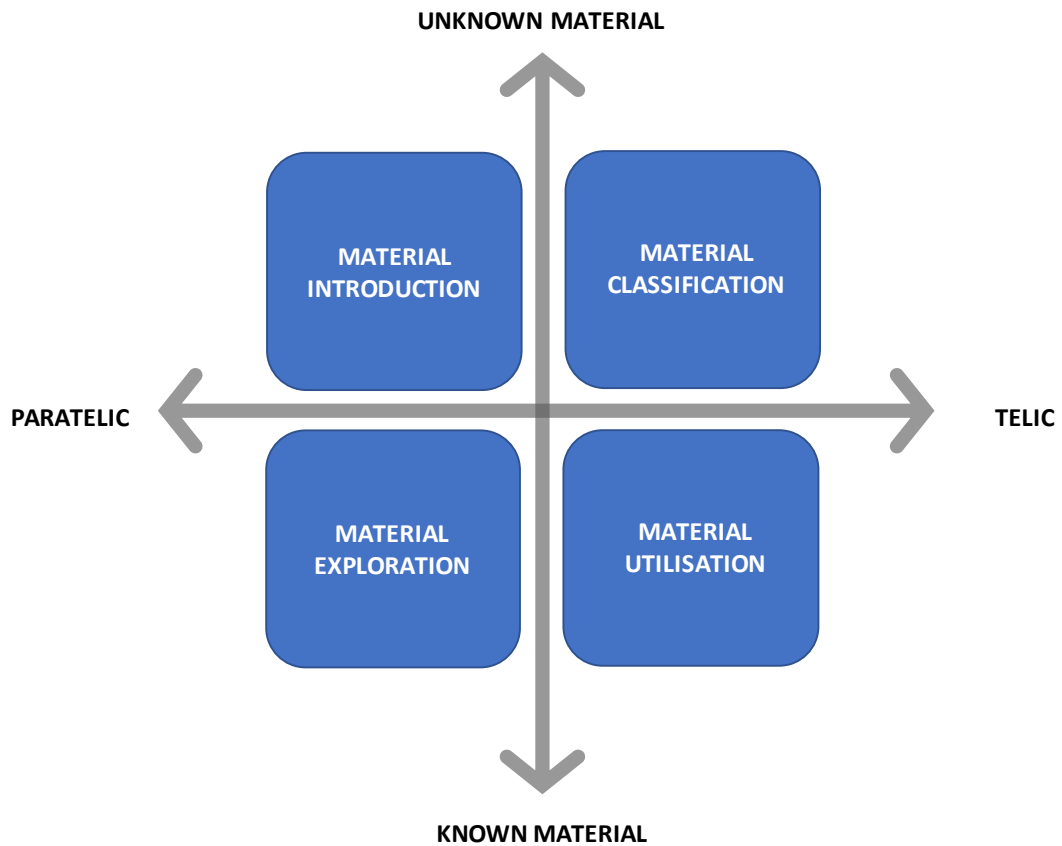


Figure 6.5 Material Engagement Model

There are four zones of engagement that are sequentially located around two axes. The four zones are: material introduction, material classification, material exploration, and material utilisation. The two axes are: the axis of unknown/known materials; and the axis of telic/paratelic states.

The proposed model addresses the act of material engagement and makes it explicit. It synthesises the descriptions of all the participant designers, while simultaneously using the idea of practical and reflexive thoughts proposed by Bourdieu. The model is also devoid of any temporal sense, as the whole sequence can be over very quickly or last much longer. It clearly addresses the moment of engagement with an unknown material as a sequence of events—proposed in the four zones—that represent the lived experience of a designer.

Material Engagement Model Pathways

The model begins within the paratelic state in the material introduction zone. It then moves to the telic state of material classification. The time to move between these zones could vary, from an instant of fascination with the unknown material, to a habitual sense of wanting to classify the material against known parameters, to a lengthy paratelic engagement with wonder and play, to finally rest with the utilisation of the material, in which the closing in of the telic state occurs.

The introduction zone is the key moment of the research findings when the unknown material is introduced into the lived experience of the designer. It is also a zone that is revisited when a material utilisation produces an outcome and the designer sees the idea afresh. As the work produced could exist in different forms from drawings to models, and then that process is examined, the material introduction zone begins again. As the level of acquisition increases the time spent in each zone may vary.

When engaged in the structured investigation of the material's properties in the zone of material classification—a telic state of engagement—the arousal levels are lower, allowing the emotive state to swing back from the more dynamic period of the material introduction zone. After the period of material classification, in which the point of emotive arousal with the material begins to wane, there is a shift back to a state in which there is more emotive arousal with the material. Apter's and Van der Molen's ideas of reversal theory are clearly evident in the bi-stable system of high and low arousal.

The engagement in the paratelic state of the material exploration zone is a space that is full of discovery, creative risk-taking, and informed experimentation. The information is derived from the previous material classification zone. The engagement with the material exploration zone is one of high energy and excitement that eventually needs to end. The duration of time in this zone is again dependent on the habitus of the designer, and whether they have a disposition to explore the boundaries of the material that is now known through

the process of classification. This is a paratelic state in which high emotive arousal occurs.

The last movement between zones is towards the telic state in the material utilisation zone. It is here that the known material is put to use in a design outcome. At this point, material memory exists as past moments of material utilisation by the designer or by others. When introduced to another unknown material, the designer looks back to the past to look forward as they start the process again (See Figures 6.6 and 6.7). Each cycle allows the designer to attain greater insights and move from being a novice designer to becoming a master—as noted by Dreyfus’s (2004) theory of skill acquisition.

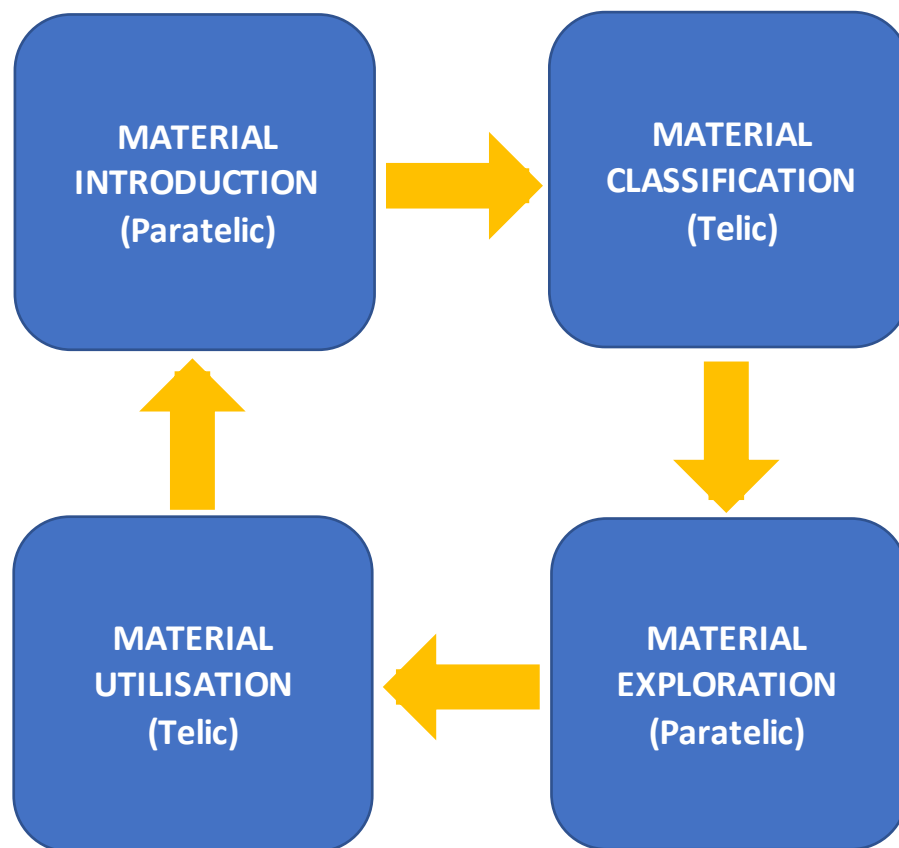


Figure 6.6 Material Engagement Model Pathways
The model is a continuous model that allows for the iterative process of cycling back to an earlier stage, and that the duration of each stage could vary.

Yet it is a sense of balance that must be achieved in the continuous process, with some designers finding that the time in the paratelic state is too unstructured and frantic. Others might find that they can maintain that emotive arousal for longer periods in the paratelic state, and that the telic state is restrictive and inhibiting. Yet, being professional designers, they find their own balance between the states, so that they take creative risks in a paratelic state, and ensure that extrinsic demands of site, safety, client, and budgetary constraints are met through the telic state. The findings from this research indicated that those with the propensity towards creative risk-taking tended to feel more comfortable for longer in the paratelic state.

All of us feel and function best when we achieve a balance between the need to be safe and the desire to be stimulated, which produces the ideal state called 'optimum arousal.' Too much exciting novelty and change, and you feel jittery or even panicky; not enough, and you're overcome with ennui. The level that's just right for you largely depends on your temperament, or your personality's more biological, heritable foundation. (Gallagher 2011, 56)

The model is sequential, as each step is progressed in a particular order. Yet the model also allows for simultaneous cycles to exist. A designer may be introduced to an unknown material while simultaneously working with the classification zone on another material, or for that matter, on any other zone.

Material Engagement Zones

The four zones are self-contained and, as noted above, progress in sequence. The path is from introduction to utilisation, so encompasses the total experience that the spatial designer will have with an unknown material, which becomes known, explored, and then utilised. Each zone will incite a question that the designer will ask themselves in order to engage with the activities necessary for that zone of engagement. (See Figure 6.7)

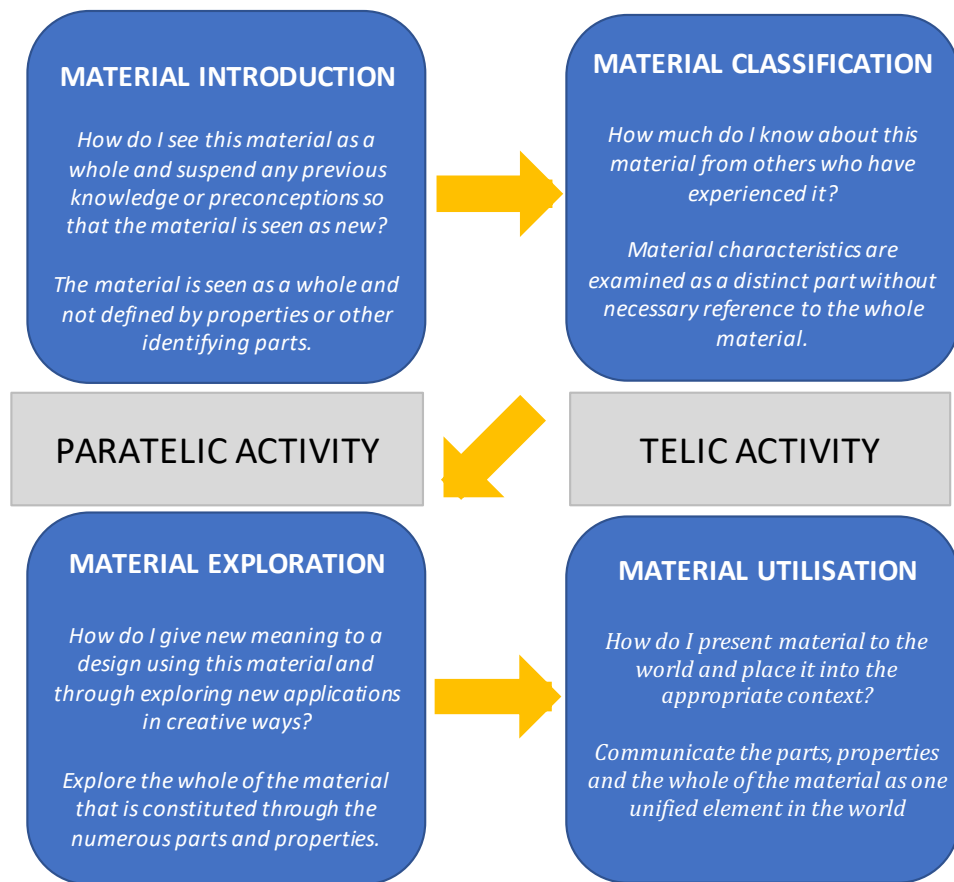


Figure 6.7 Material Engagement Model: Core Questions and Actions

Material Introduction

As the designer is introduced to an unknown material, there is the immediate sense of tactility and heightened awareness of the senses, much like a child discovering a new toy, or about to go into a new social setting. There is a sense of curiosity in wanting to process the novelty of the situation or material.

Children are such curious creatures. They explore, question, and wonder, and by doing so, learn. From the moment of birth, likely even before, humans are drawn to new things. When we are curious about something new, we want to explore it. And while exploring we discover. (Perry 2001, para 1)

However, a designer is not a child that is discovering the world afresh, but an individual that has gained from past experiences, yet is open to new ones. They

exist within a social field that consists of their practice, which is the product of their own personal disposition towards the world, and in this case towards the world of materials, and the capital (symbolic, economic, and cultural) that they have attained. Previous experiences with materials add to their cultural capital, thereby expanding their knowledge base. When faced with an unknown material, they immediately react in an open, explorative manner that draws from the outcomes of a previous cycle of material engagement modelling (MEM), or from secondary sources of material memory.

The material introduction zone exists as a paratelic state that is focused on discovery, which is spontaneous and self-directed. It involves the notion of play and has a time orientation to the here-and-now, which derives pleasure from immediate sensations. When told that the unknown material that was presented to him was made from corn, Juan commented “I should have eaten it!” (Juan’s Transcript). This not only connects with sensations, but also with experimental behaviour that exists in the paratelic state. As a child, knowledge of what can or cannot be is not established when faced with an unknown.

At the moment of introduction, the designer is not inexperienced in relationship to materials, as they have used and have knowledge of many materials in their education and work practice. However, using the Dreyfus categories of novice, advanced beginner, competent, proficient, and expert, it cannot be said that the designer is a novice at the very moment of introduction to the unknown material. They are in a pre-novice state of skill acquisition, as they are not being supervised nor mechanistic in their behaviour. They are expansive and open to possibilities, as is the behaviour in the paratelic state. It is much like a state of play. They see the material with eyes wide open and a sense of wonder.

The material memory is accessed to extend the play, by essentially asking themselves “What is this material?” In this stage, they are not seeking an answer, but only seeking other doors of wonder, to be allowed to ponder and play with the material. They ask themselves the question, “How do I see this

material as a whole, and suspend any previous knowledge or preconceptions so that the material is seen as new?" This is where the material is seen as a whole and not defined by properties or other identifying parts.

Material Classification

Each designer would move into the next zone at a different rate, depending on their aptitude to play, question, and be open to possibilities. In this study, those who tended to move out faster had a tendency to a telic perspective, and those who stayed longer indicated a propensity to expansive, demonstrating, paratelic thought towards materiality. This represents the first reversal in the proposed process of material engagement, in which the focus shifts from an outward and high intensity sense of discovery, to one of goal-oriented direction, in which a sense of familiarity is sought.

Greg captures that moment of introduction in his comments below, which reflect the experiences demonstrated with other participants.

Try to figure out how to use it. Because it's so appealing, tactile. Its profile, shadow, and the highlights, and the shadows, little bumps. This is very thorough. The light hits it. What's the practicality of it? What's it made out of? Its primary, one of the primary properties is its elasticity, so why not take advantage of it. For instance, why bother making it into a wall mass. It should be ... We shouldn't manipulate its properties to its maximum. There's no point in doing that. (Greg's Transcript)

The material classification zone is where the designer reverses their focus to examine the material more pragmatically through comparison with familiar materials. It is a zone in which the material is examined extrinsically through the experience and classification of others. It is a zone in which standards are assessed, and the material is tested to meet past levels of acceptable performance. It is where the mechanical properties are considered in terms of what exists. The material is compared to see how it bends, twists, tears, smells, reflects light, feels to touch, and other tactile and visual properties. In doing this,

the designer compares the material to other materials they know. Thus, the unknown is assessed through the known, with existing categories used to define the material.

The designer would be asking themselves: how much do I know about this material from others who have experienced it? This process of investigation is driven by external factors, with the designer personally removed from the source of knowledge. The engagement with the material in this zone is one of detached rationalisation, in which the material characteristics are examined as a distinct part without necessary reference to the whole material. The unknown material is examined to extract the facts of its performance based on the past. This zone of searching for facts can be revisited, but the initial engagement is done prior to the exploration phase.

Material Exploration

One designer may stay in the material classification zone for a longer time than another designer, depending on their tendency to want to explore versus their desire to know the facts. When the peaceful examination of facts reaches a level of low arousal, which can be indicated when the designer feels that the saturation of facts is sufficient to move forward, they will undergo a second reversal.

At this point the designer will shift to a zone of expanded thought and discovery. Armed with more knowledge of the unknown material, they begin to explore it, usually towards a project brief, yet it could also be in a structured explorative manner, where the material governs the direction. There was not a consistent balance, as the habitus of the designer has an impact on their degree of paratelic engagement, as do the contextual constraints. Either way, the zone of material exploration is one in which the paratelic tendency to expand and push boundaries occurs. It is quite often misunderstood that this is the first stage of material engagement, holding the interest of the designer, who seeks the freedom to explore new possibilities. Yet, the previous two zones are essential, even if they occur over a brief period.

During this stage, the designer engages with material manipulation and exploration as a process-oriented behaviour towards a greater understanding of the material. A spatial designer usually instructs others in the manipulation of materials; they will take the knowledge gained in the telic examination of the classification and extend their knowledge of the material by instructing consultants to push the material further. We can revisit Lina's descriptions, which captured this idea:

Well, what else do you do differently? ... Why don't you form it into a different way, and all of a sudden, you're setting yourself apart from your competition. (Lina's Transcript)

During each stage, the unconcealing of the material becomes more evident. The exploration allows for the knowledge of the material to be comprehended. It is an intrinsic activity that allows the designer to access their material memory to explore the potential possibilities of the material. During this paratelic discovery zone of exploration, the designer would ask the question: How do I give new meaning to a design using this material and through exploring new applications in creative ways? They seek answers by seeing the whole of the material that is constituted through the numerous parts and properties.

Material Utilisation

Material utilisation is the final zone of the Material Engagement Model, but it may not occur immediately after the engagement in the material exploration zone. Depending on the designer's propensity to take creative risks and explore, the paratelic activities may go on for a longer period of time. The exploration may also stay dormant in that zone and may not move immediately to the final zone of engagement.

The activity is extrinsic in nature, as the material knowledge is put into practice and enhances the cultural capital of both the designer and those engaging with the material. Delays in adding to the cultural capital are generally external, and, as the participants described, are impacted by the client, site, contractor knowledge, capital, the technology available, and even government standards

and control. These factors may prevent the designer's engagement with the material from entering the final zone.

Since the final zone deals with utilising all the knowledge gained from the playful introduction, through the classification and pragmatic enquiry, and then the knowledgeable exploration, its focus is putting the material into the world. When the designer is ready to take the step to make the unknown material known to the world by utilising it in a final spatial outcome, they will enter the final stage of their lived experience with an unknown material.

Upon entering the zone, the designer would ask themselves the question: How do I present material to the world and place it into the appropriate context? In doing so, they communicate the parts, properties and the whole of the material as one unified element in the world.

Material Engagement Model Summary

The Material Engagement Model is meant to exist as a way of understanding the processes undertaken by the designer. It is not a procedural model to be strictly adhered to but acts as a more focused understanding of the lived experience with an unknown material. In particular, it provides a heuristic lens on the different ways we can engage with a creative investigation, in which both telic and paratelic approaches are valid. The model also identifies the moment of introduction as a vital moment of a process of engagement. It is a moment of opportunity that the creative designer, who has a propensity to take creative risks and pursue innovative applications of materials or the use of unfamiliar materials, would feel to be a natural fit.

The Material Engagement Model that is presented in this chapter allows for an explicit understanding of the experience of the material. It utilises Heidegger's ideas on unconcealment as the foundation and Merleau-Ponty's understanding of embodiment and phenomenological gaze to devise a synthesised structure derived from Apter's and van der Molen's work with reversal theory.

Chapter 7

CONCLUSION

We are artists and designers and creative educators—more like explorers on a journey of discovery, interrogating practice, venturing into new territory, mapping the terrain, locating a position, exploring difficult places, making new maps or reinterpreting old ones, staking a claim to new ground, and eventually knowing where we are and surviving to tell the tale to others. (Gray 2006, 6)

This thesis explores the experience a designer has with the discovery of an unknown material. The moment of engagement is emphasised and exemplifies a phenomenological approach to the world in which the ordinary can hold extraordinary knowledge of the world we are in. This world that is technologically advancing will always be faced by the process of engagement with the unknown, and this research is focused on the unknown material.

Manzini (1989) has identified the gap between technology and human experience: “If we follow the thread of the relationship between technology and culture, it is as though we are watching a gradual process of separation of the self that thinks and the matter upon which that self operates” (Manzini 1989, 47). This thesis explores this separation through the experiences of a selected group of spatial designers whose views put themselves in the world and not separated from it; a phenomenological perspective illuminates the process of engagement. The perceived gap between the self and material is at the centre of a moment of engagement marking the designer’s gulf between prior material knowledge and an unconcealing of what needs to be known from an unknown material.

Summary of Chapters

A substantial literature review is presented that examines the three key elements of the research question. This chapter examines spatial design and the different views of how that term is considered in practice and philosophically. The second key factor examined is the term ‘unknown materials,’ and how the knowledge of advanced materials would assist in understanding the term. Prior to examining the lived experience, a review of phenomenology and the work of

Husserl, Heidegger and Merleau-Ponty led to looking at how the lived experience affects the sense of place. The review then briefly examines aspects of knowledge, as the research question deals with the engagement with something unknown. The chapter ends with a detailed review of the lived experience that is broken-down into: the experience and material memory; the design process; and the application of design, drawing upon the ideas of Bourdieu to demonstrate the connection to cultural capital, habitus and practice.

The research methodology chapter supports the process of qualitative research aimed at making sense of the social world, describing it and developing explanatory models to understand it (Denzin & Lincoln 1994; Morse & Field 1996). Phenomenology is used as a research method to examine the lived experience. A reflected research journey utilising the phenomenological attitude of bracketing biases led to the use of thick textual descriptions. The process, questions and participant selection are outlined to define the scope of the research. Numerous central themes coming out of the research are analysed leading to the identification of intrinsic and extrinsic factors emerging as two influential categories in the study.

Chapters Four and Five presented key statements from the primary research of the semi-structured interviews with the participant designers. The categorisation into intrinsic and extrinsic factors provide an overall structure to the textual descriptions, that were sorted into six key factors: memory; experience; ideas; properties; project concerns; and community consultation. Reflective statements binding the participant's comments together and aligning them to the key factors allow the statements to stand unaltered yet prescribe a deeper understanding of the phenomenon.

This is a unique body of work, as these designers have not been in a similar research study, and the ideas that came from the findings bring together different philosophical and theoretical ideas into a proposed model for

understanding the design process of engagement. This outcome is discussed in Chapter Six, which presented the Material Engagement Model that addressed the various moments of the lived experience of an unknown material.

Identification of a Key Moment of Engagement with an Unknown Material

As phenomenological research is directed towards observing and understanding the “what” and “how” of the lived experience and reflecting upon the practice that is observed (van Manen 1990; Whiteley 2002; Giorgi 2009; Vagle 2014), a reflection of a key moment witnessed in the interviews was identified to allow for a deeper understanding of the phenomenon. The moment occurred when an unknown material was witnessed and assessed for the first time by the participants. Merleau-Ponty discusses the embodied perception that involves tactility to understand what is being observed, and this moment demonstrated this idea. What follows is what Heidegger considers the process of unconcealing.

I have demonstrated that this is a key moment in understanding the initiation of a process of engagement, which has, to this point, largely gone unnoticed in research on the design process involving materials. The existing body of knowledge consists of research into material classification, exploration, and utilisation. Other design processes have tended to fold this moment into the overall analysis phase of a process and neglected to investigate this meaningful moment of engagement. This heuristic model that explicitly frames a process of material engagement is why this research is important and relevant, particularly when there is currently an exponential growth in advanced materials. The contributions of the study are summarised below.

1. Contribution to Design Process

Many art and design educators argue for engaging the senses in the process of teaching creativity (Robinson and Aronica 2010). How we learn through our senses and being aware of tactility and kinesthetics as a way of processing our world and enriching the design process (Tharp 2003).

We have seen this process of direct engagement with the senses fully in action in this research. By observing how designers respond to being introduced to an unknown material, we can see the rich, expressive responses that often result in the form of their final designs. In an increasingly immaterial, virtual world, we can see just how this direct interaction plays out, and how human-material interactions can fuel creativity—highlighting why this contribution to explicitly identifying the embodied engagement is important.

2. Contribution of the Impact of Material Memory

Through the participants' interviews, we heard how they accessed their memories of materials in a variety of ways. These are sensory/iconic memories that extend over time periods and can be prone to unconscious alterations (Surprenant and Neath, 2009). The lived experience is the focus of the research, and memories—although valuable—are not always the exact experience. However, memories are important in themselves in providing insights and inspiration, despite not being totally accurate. Memories are an important part of the design process (Malnar & Vodvarka 1992; Pallasmaa 2005; Zumthor 2005, 2006; Treadway 2009) and, together with experience and knowledge, they help the designer to shift unknown materials to those that are known. This thesis contributes to our understanding of the connection of material memory to the design process that is activated through embodied engagement.

3. Contribution Towards the Understanding of the Material Engagement Gaze

The actions with which a designer engaged with an unknown material indicate a common process—a disposition of the designer that has formed by the habit gained over time. This thesis proposes that these form part of the habitus of a spatial designer. The work also indicates that those who participate in a paratelic manner when engaging with materials are those inclined to take creative risks with materials. Bourdieu may have considered habits to be mechanical and repetitive (Bourdieu 1977), yet scholars identify the fluid nature of the definition (Crossley 2013; Emmerich 2016). However, if we look at the core aspect of habitus as an individual's disposition, it leads to what Bourdieu refers to as a gaze. "Consider, for example, the idea of the (bio)medical

gaze—or, indeed, the idea of the (bio)medical ethical gaze—or the characteristic ethos of medicine” (Emmerich 2016, 279).

The research also elaborates on Merleau-Ponty’s relationship to the phenomenological gaze and how his ideas assist us to understand the sense of embodiment through perception. It relates directly to the phenomenologist’s view that we are in the world and not just an observer of it.

This research claims that there is a spatial designer’s gaze in their engagement with a material; it is part of their habitus or disposition towards a particular action based on the activities that they are involved with—in this case, the engagement with an unknown material. This claim contributes to how we currently consider the engagement in the design process, to appreciate the importance of the phenomenological gaze into an unknown material.

4. Contribution towards the Relationship of Material Engagement to Phenomenology and the Reversal Theory

As van Manen (1990, 15) states: “... theory enlightens practice. Practice (or life) always comes first and theory comes later as a result of reflection.” Reflecting on the data of these practitioners, in association with Heidegger’s philosophical insights into *unconcealing* knowledge (considered in this research as *material knowledge*), a primary framework for understanding the phenomenon has been established. Merleau-Ponty’s views of perception equally provide valuable insights into the need for tactility in the ability to fully perceive.

The thesis contributes to our knowledge by relating the work of Heidegger and Merleau-Ponty to Apter’s Reversal Theory. This connection enables us to understand how the lived experience of an unknown material involves the telic and paratelic engagement to fully unconceal its potential through an application in practice.

4. Contribution through the Development of the Materials Engagement Model

The Materials Engagement Model is theoretical framework that identifies a process model. The model offers designers an uncomplicated tool to explicitly understand the actions and demands of the four stages of engagement: introduction; classification; exploration; and utilisation. The model also enables educators to work with emergent designers to enhance their skills and understanding through exploring different ways of thinking and acting at these stages. The model offers a unique synthesis of the participant's lived experience, phenomenological insights, and Reversal Theory that discusses variation in arousal and actions. It defines the paratelic and telic processes that occur, and how the acquisition of skills are enhanced. This synthesis is highly significant in examination of the ordinary being extraordinary.

The unconcealing of the material knowledge through an explicit process can contribute to our knowledge of the design process and engagement with materials and can offer an alternate or additional procedure when designing new spatial outcomes. The research makes explicit a process that occurs intuitively (and often implicitly) for designers when they engage with a material. By making it explicit, MEM becomes a heuristic device that can be applied in design education and in professional practice by developing methodological enquiries into various stages of engagement.

Limitations

The limitations and delimitations of this study have been articulated in the research methodology chapter. The main limitation was the sequencing of time to complete the work, which impacted the continuity of writing, and the dislocation from the university community, which led to the lack of informal feedback. However, this was turned to an advantage as the separation provided time to personally reflect on the work and work completely independently.

The delimitations were with the research design and the initial decision to use Giorgi's descriptive methodology. Although extremely useful in mapping out the content from the interviews it did not immediately address the core element

that was being researched. It was with the shift to the use of textual descriptions that the phenomenon of the engagement was evident. The boundaries of having ten participants were later unnecessary as the evidence could have been achieved with less. The initial thought of an international perspective was useful in demonstrating universality in the ideas but did not provide any new insights.

Closing Comments and Future Opportunities

This work offers new knowledge into the design process and the lived experience of spatial designers with unknown materials. It contributes to the body of literature of design processes and innovative thought with advanced materials, that sits within the overall body of knowledge of design. MEM offers insights into a crucial moment of material engagement that has been overlooked. In making this moment explicit, it allows the designer a comprehensive understanding of their actions. It can also enable manufacturers of advanced materials to thoroughly understand the thought processes of their customers—that they are not just based on telic responses, but also involve material memory, tactile connection, and paratelic engagement.

In an age of exponential growth in material advances, the need to maintain an embodied engagement is essential, so the MEM tool to engage with unknown materials reinforces why this research is relevant and important. As Žižek (1992) reflects on the lived experience of examining a phenomenon from different angles to see it with a new lens, this work is relevant to designers to being able to utilise a heuristic process to uncover aspects of a material that they encounter. Such encounters could lead to a more comprehensive engagement with materials.

The thesis contributes to the existing body of design knowledge and points towards further research in design and creative thinking. Future research can delve deeper into each stage of the MEM model and explore synergies across various design domains. Case studies on the commentary of creative risk that were presented would reinforce the MEM process. Future research can extend

this examination on the unconcealing nature of the engagement with materials. Such as study can focus on a smaller sample size and delve deeper into their thought process at the moment of engagement through neuroscientific analysis and also through other qualitative methods.

The MEM is based on the human-object interaction that pushes the designer into a state of discovery of the affordances that an unknown material can offer. There is the obvious exploration into other design domains that will identify nuances of the model and other sub-factors that need to be considered. However, the elegance and simplicity of the model allows for great diversity of use. Future research may also be undertaken to explore how such a model can be applied to other domains (for example, personal development) when addressing other material or immaterial 'unknowns.' This model may also be applied to a meta-view of how to engage with an unknown idea. Do the same stages of engagement exist, and if so, how do they manifest? It is foreseeable that the stages of introduction, classification, exploration, and utilisation could be explored with other unknown phenomena, and even provide insights into how new ideas could be considered. Applications of such research to the fields of, for example, biomedical science, agriculture, or civil engineering, will enable designers and scientists, engineers and architects, to find new ways of thinking about their interactions with materials and to tackle some of our most pressing challenges in alternative ways. Exploration of other materials from different cultures, or an in-depth case study of one particular material and how it is seen at the different stages of the model, may also provide valuable insights.

The field of design, as discussed in the thesis, enables the cultural capital to expand if new and insightful design directions proceed. This research has determined that understanding the process of engagement with materials allows the designer to be cognisant of their own disposition or habitus, and in doing so, has made explicit the process that they go through whilst engaging with and experiencing an advanced material or one that is unknown.

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- Cambridge Dictionary. <https://dictionary.cambridge.org/dictionary/english/>
- Longman Dictionary. <https://www.ldoceonline.com/>
- Oxford Dictionary. <https://www.oxforddictionaries.com/>

MATERIAL WEBSITES:

- A to Z of Materials. <http://www.azom.com>
- Core 77. <http://www.core77.com>
- Material ConneXion. <http://www.materialconnexion.com>
- Materials Education National Resource Center:
<http://www.materialseducation.org/resources/types-of-materials/>
- Materia Symposium of Future Materials. <http://www.materia.nl>
- Mat Web—Material Property Data. <http://www.matweb.com>
- New Materials International. <http://www.newmaterials.com>
- Trans Materia. <http://www.transstudio.com>

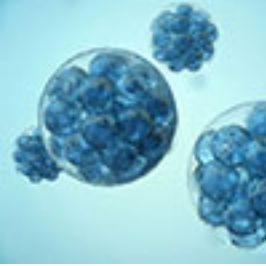


PROFESSIONAL ASSOCIATION WEBSITES:







- Association of Registered Interior Designers of Ontario. <http://www.arido.ca/>
- International Federation of Interior Architects/Designers
<https://ifiworld.org/>
- International Interior Design Association <http://www.iida.org/>


APPENDICES

APPENDIX A: Types of Materials

(<http://www.materialseducation.org/resources/types-of-materials/>)

MATERIAL	NAME	DESCRIPTION
	<p>BIO-MATERIALS</p>	<p>A biomaterial is any substance that has been engineered to interact with biological systems for a medical purpose—either a therapeutic (treat, augment, repair or replace a tissue function of the body) or a diagnostic one.</p>
	<p>CERAMICS</p>	<p>A ceramic is a non-metallic material composed of inorganic molecules, normally prepared by heating a powder or slurry.</p>
	<p>COMPOSITES</p>	<p>Composites are the mixture of multiple materials, which in combination offer superior properties to the materials alone.</p>
	<p>CONCRETE</p>	<p>Concrete is a ceramic composite made up of water, sand, gravel, crushed stone, and cement. The ingredients are mixed together thoroughly and are poured into a form.</p>
	<p>ELECTRONIC/OPTICAL</p>	<p>Electronic/optical materials are tailored to conduct electricity or light. These materials may be metals, ceramics or polymers. These materials are carefully formulated to control the intensity, scattering, and bending of electrons or photons which pass through them.</p>

	GLASS	Glassy materials are hard, brittle, and non-crystalline. The lack of crystalline grains often results in optical transparency.
	METAL	Metals are comparatively malleable, optically reflective, and electrically conductive. Most metals and alloys are easily shaped by forming.
	METAMATERIALS	A metamaterial is an engineered material specifically designed to exhibit a behaviour that can only occur at specific organisations and sizes of materials. Metamaterials often seem to break the rules of physical behaviour.
	NANOMATERIALS	A nanomaterial is a "material with any external dimension in the nanoscale or having internal structure or surface structure in the nanoscale," with nanoscale defined as the "length range approximately from 1 nm to 100 nm."
	POLYMERS & PLASTICS	Plastics/polymers are made up of millions of repeated links to make long molecules or networks that are tangled or crosslinked together. Almost all polymers use carbon atoms in very long chains.
	SEMICONDUCTORS	Semiconductors are a special case of electronic material that combines two different electrically conductive materials, usually ceramics.

	WOOD	Wood is a composite material made from lignin and cellulose. Wood makes use of a lignin matrix and cellulose fibres to form a polymer composite.
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APPENDIX B: Material Classification Systems

Author(s)/ Organisation	Source	Classification	Comment
Antonelli	<i>Mutant Materials in Contemporary Design</i> (1995)	<ul style="list-style-type: none"> • Plastics • Ceramics • Fibres and composites • Rubber and foam • Glass • Wood • Metals 	This catalogue for an exhibit at MOMA in New York brought advances in material science to the public eye and was inspiring for many designers. A simple taxonomy was used that was accessible to a wide selection of disciplines.
Ashby & Johnson	<i>Materials and Design—The Art and Science of Material Selection in Product Design</i> (2003)	<ul style="list-style-type: none"> • Polymers • Metals • Ceramics • Glass • Fibres • Natural materials • New materials 	A comprehensive textbook aimed at product designers but accessible to other disciplines. It is mainly focused on traditional materials and has a limited classification of new materials.
Ballard Bell & Rand	<i>Materials for Architectural Design</i> (2006)	<ul style="list-style-type: none"> • Glass • Concrete • Wood • Metals • Plastics 	A text that illustrates the relationship of materials to detailed spatial outcomes. The taxonomy used is understandable to practitioners.

Beylerian & Dent	<i>Material ConneXtion</i> (2005) <i>Ultra-Materials</i> (2007)	<ul style="list-style-type: none"> • Carbon-based • Cement-based • Ceramics • Glass • Metals • Naturals • Polymers 	These two books represent a portion of the Material ConneXtion® material library. The taxonomy used is uncomplicated.
Brownell	<i>Transmaterial 1, 2, & 3</i> (2006, 2008, 2010)	<ul style="list-style-type: none"> • Mineral • Concrete • Wood • Metal • Glass • Plastic & rubber • Paint & paper • Fabric • Light • Digital 	Published versions of key materials from website directory of innovative materials. The taxonomy used expands the list of options for designers of different disciplines.
Brownell	<i>Material Strategies—Innovative Applications in Architecture</i> (2012)	<ul style="list-style-type: none"> • Mineral • Concrete • Wood • Metal • Glass • Plastic 	A book that covers case studies in spatial design. It frames the studies on innovation and examines them through a taxonomy that is simple and straightforward.
Van Onna & Frame Magazine	<i>Material World—Innovative Structures and Finishes for Interiors</i> (2003)	<ul style="list-style-type: none"> • Smart technology • No waste • Optical effects • Flexible structures • Sound control • Strong building • Free form • Finishing touch 	An inspiring collection of innovative material that is focused on interior spaces. The taxonomy used is more thematic rather than one

			based on traditional classification systems.
Gessigner	<i>Materials and Innovative Product Development</i> (2009)	<ul style="list-style-type: none"> • Inorganic materials (metals, ceramics, metalloids, amorphous solids and glasses, composites) • Nanomaterials • Organic, bio- and biomimetic materials (Polymers, bio- and biomimetic) • Materials for IT (information technology) (electronic, optical, magnetic) 	A comprehensive study of material innovation that is focused on the business and innovation systems available to product design. The taxonomy used is based on a simple division of organic/inorganic materials, and new technologies related to nanotechnology and information technology.
Lesko	<i>Industrial Design—Materials and Manufacturing Guide</i> (2011)	<ul style="list-style-type: none"> • Metals (ferrous & non-ferrous) • Plastics (thermoset & thermoplastics) • Rubber/elastomers (thermoset & thermoplastics) • Natural engineering materials (carbon, glass, ceramic, refractory hard metals) Natural materials (fibres, wood products) 	A comprehensive textbook of industrial designers that includes materials and manufacturing guides. The taxonomy uses a standard engineering approach to material classification.

McGowan	<i>Specifying Interiors</i> —2 nd edition (2005)	<ul style="list-style-type: none"> • Metals • Wood • Plastics • Glass • Textiles & leather 	A textbook that outlines the process for developing a specification for building an interior space. The taxonomy follows other classifications used in industry.
Moskowitz	<i>Advanced Material Revolution</i> (2009)	<ul style="list-style-type: none"> • Bioengineered materials • Advanced metals • Advanced ceramics and cuperconductors • nanoceramics • Piezoelectric ceramics • Synthetic engineering (nonconducting) polymers • Organic electronic materials (conducting polymers) • Advanced (nonthin) coatings • Thermal barrier coatings • Nanopowders and nanocomposites. • Nanocarbon materials • Nanofibres • Thinfilms • Advanced composites 	A specialised book that examines the technologies and economics that are related to advanced materials. The taxonomy extends the traditional classification to address the advances in material technologies.
Ritter	<i>Smart Materials in Architecture, Interior</i>	<ul style="list-style-type: none"> • shape-changing smart materials (themostrictive & electroactive) 	A specialised book that examines a particular sub-

	<i>Architecture, and Design (2007)</i>	<ul style="list-style-type: none"> • Colour and optically-changing smart materials (photochromatic, thermochromatic & thermotropic, electrochromatic & electrooptic) • Adhesion-changing smart material (photoadhesive) • Light-emitting smart material (photoluminescent, electroluminescent) • Electricity-generating smart material (photoelectric, thermoelectric, piezoelectric) • Energy-exchanging smart material (heat-storing) • Matter-exchanging smart material (gas/water storing) 	category of advanced materials. The taxonomy that is used is focused on performance of the material in the process of change.
Sauer	<i>Made of—New Materials Sourcebook for Architecture and Design (2010)</i>	<ul style="list-style-type: none"> • Light and strong • Material follows form • Coats and covers • Powered surfaces • Re-materialisation 	A creative thematic classification of materials that accompanies innovative case studies. The most important contribution is the classification of re-materialised

			materials. Repurposed and recycled materials are now important to consider.
Wilhide	<i>Materials—A Directory for Home Design</i> (2001)	<ul style="list-style-type: none"> • Wood • Stone • Glass • Metal • Brick & tile • Concrete & plaster • Synthetics, leather & linoleum. 	A standard examination of materials used in spatial design for the home. The taxonomy used includes both interior and exterior materials.

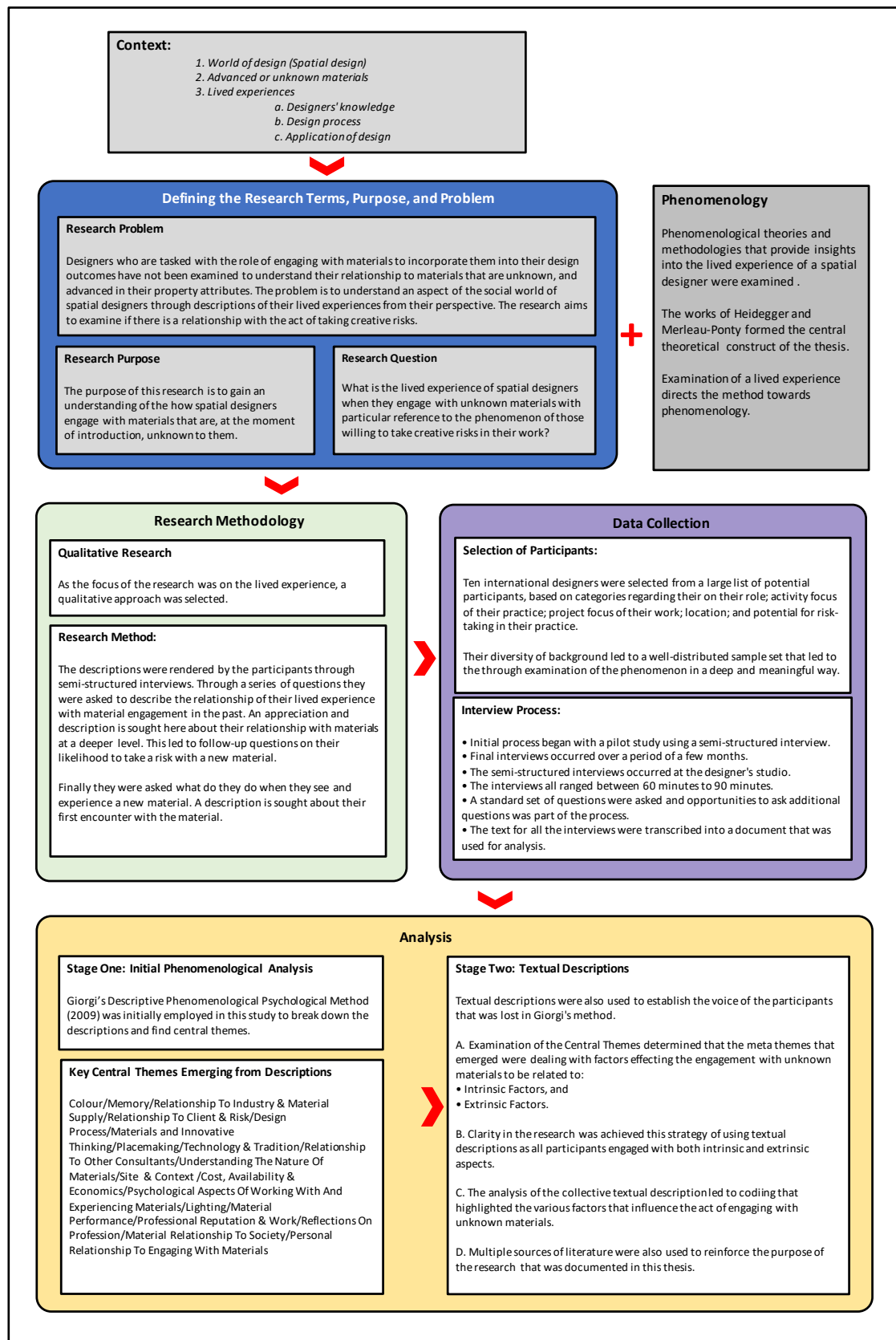
APPENDIX C: Ways of Uncovering Design Knowledge

(After Lawson, 2004, 3-5)

Technique	Description	Comments
1. Simply sit and think about design knowledge.	Examine information that designers are given and make inferences from that material and the design outcomes produced.	Highly successful design often results from minimal external information.
2. Place the designer in a controlled environment.	Observation of the designer in a controlled environment to gather empirical information on how they attain design knowledge.	<ul style="list-style-type: none"> • The artificial setting prevents the designer from engaging in the real world of clients, site, consultants and manufacturers. • Designers are involved with multiple tasks, and knowledge is often gained at times when the design task is not immediately being addressed.
3. Observe the designer in their natural setting.	Observation of designers in their studios.	The design process is often not clearly visible. Visual observations may capture the sources of knowledge but that does not guarantee that this is what is being converted and absorbed by them. If recordings are used, clarity of understanding of what happens in the process of designing is compromised as designers tend to use a visual shorthand that is not picked up with just audio recordings.
4. Simply ask the designers what they know.	A process of interviewing the designer and asking them what they know, or by reading the texts that they have written.	<ul style="list-style-type: none"> • Not all designers are professional writers so there is the possibility of not clearly communicating their thoughts.

		<ul style="list-style-type: none"> • Designers often use text to promote themselves or justify a design outcome to a client. Neither provides the reflective thought necessary to describe their process.
5. Indirectly investigate what designers know by simulating the design process.	Cognitive scientists are developing software to replicate the design process and model design problems to attain solutions.	It is uncertain that the knowledge attained by the software is the same as the knowledge used by the designer.

APPENDIX D: Detailed Flowchart of Research Methodology



APPENDIX E: Participant Profiles

The following list provides a brief description of each participant/co-researcher, with their pseudonyms noted.

Participant/co-researcher 1/Jillian:

A female spatial designer who engages with new and underused materials in installation applications and a research agenda in the USA. Her work is nationally recognised.

[Note: Although this co-researcher/participant was interviewed, her business partner also engaged with the interview process that impacted on having the lived experience of an individual. With very poor acoustics during the interview it was decided not to use the transcription for this research.]

Participant/co-researcher 2/Sandra:

A female spatial designer/maker/architect who has explored materials that are not traditionally used in spatial design to develop a particular design language. She explores materials by looking at innovative manipulation of form driven by the material. Her practice is based in Canada, yet her work is internationally recognised.

Participant/co-researcher 3/Greg:

A male interior designer who is based in Canada and the USA. He is nationally and internationally recognised for a career of exceptional work. His company is one of Canada's most awarded and prolific design firms. His work focuses on materiality as a central tenet, but without any stylistic direction, and constantly explores materials in both traditional and innovative applications.

Participant/co-researcher 4/Lina:

A female interior designer who has explored materials as a core aspect of her professional work with clients. She leads a new creative firm who are willing to challenge the standard way of practising design. She is based in Canada and her work is recognised nationally and internationally.

Participant/co-researcher 5/Preya:

A female spatial designer/maker/manufacturee who is based in Thailand and has a local, national, and international reputation for developing an advanced and novel material from waste. Her work demonstrates an innovative approach to practice through a development of a new material from waste that has many applications within an interior space.

Participant/co-researcher 6/Yoshio:

A male spatial designer/educator who is based in Japan prefecture and has a local, national, and international reputation for being an early adaptor of advanced material in his work. His work crosses many disciplines but is mainly focused on furniture design.

Participant/co-researcher 7/Michael:

A male spatial designer/educator who is based in Canada and has a local reputation for his professional work. His practice is mainly in residential spatial design that explores materials in a sensitive and uncomplicated manner.

Participant/co-researcher 8/Juan:

A male spatial designer who is based in Canada and has a national reputation for his work, which exploits advanced materials for clients who want to push boundaries and increase sales. His work also has theoretical underpinnings that he expands in his teaching activities in spatial design.

Participant/co-researcher 9/Blair:

A male spatial designer who is based in Canada and has a local reputation for exploring materials and form in his professional work.

Participant/co-researcher 10/Fiona:

A female spatial designer and educator based in Canada who has a local and national reputation for exploring advance materials within a theoretical focus.

APPENDIX F: Information Sheet and Consent Form



INFORMATION LETTER for Semi-Structured Interview

PHD RESEARCH PROJECT (Spatial Designers' Lived Experience of Advanced Materials)

Name Concealed

My name is George Verghese and I am a part-time student undertaking my PhD at the Curtin University, Perth, W.A. Australia. I am conducting research into the application of new materials within an interior space and would welcome your assistance. The research would involve a semi-structured, conversational interview technique and should take no more than 2 hours of your time. Its chief aim is to assess your relationship to new and innovative materials in your work. Due to the nature of the questions asked this study will assume to be that of low risk.

I am glad that you have agreed in principle to the interview in your email dated August 31, 2015 and if you are still interested in participating, I would be glad if you would contact me at the details below to confirm the details of time and location most suitable to you.

You are under no obligation to participate in this research, and can withdraw at anytime during the process without any consequences. Information attained in this study will only be used for developing and supporting a theoretical position in my research. This may result in research and conference papers being presented, at which time your identity will be concealed and confidentiality secure. The information will be destroyed after the thesis is completed in approximately 8 years. At all times your confidentiality will be maintained, with my supervisor only viewing these results.

Yours sincerely,

George Verghese
Part-time PhD student at Curtin University, and
CEO of Material Advances and Practice
3235 West 41st Avenue, Vancouver, BC, V6N 3E3
+1 604 218 3971 <george.verghese@map-design.ca>

NOTE:

This research interview process has been approved by Curtin University Human Research Ethics Committee (**APPROVAL #5368**). If you have any complaints or reservations about any aspect of your participation in this research which you cannot resolve with the researcher, you may contact the Human Research Ethics Committee through the Secretary (ph: +61 8 9266 9223 / hrec@curtin.edu.au, or Associate Professor Dr. Dianne Smith (dianne.smith@curtin.edu.au). Any complaint you make will be treated in confidence and investigated fully and you will be informed of the outcome.

Ethics Application: July 2010 /Amended March 2015

Information Letter_2015.docx

CONSENT FORM for Semi-Structured Interview

I _____ (participant's name) agree to participate in this interview for the research project: **PHD RESEARCH PROJECT (Spatial Designers' Lived Experience of Advanced Materials)**. This research is being conducted by George Verghese, CEO of Material Advances and Practice, 3235 West 41st Avenue, Vancouver, BC, V6N 3E3 (tel:+1 604 218 3971) who is also a student of Curtin University undertaking his Doctor of Philosophy in Architecture and Interior Architecture degree.

I understand that the aim of this research is to find the relationship that the individual designer has with the application of advanced materials within the built environment. The questions in this research will be about both the approach you take in your design practice and the relationship that you have with advanced materials.

I understand that my participation in this research will involve a very low risk as the questions are focused on how I design in relationship to materiality. I also understand that the semi-structured conversational interview methodology will be used and will take up to a maximum of two hours.

I am aware that I can contact George Verghese, or his supervisor, Associate Professor, Dr. Dianne Smith, if I have any concerns about the research. I also will be given opportunities to ask questions during the interview process. I fully understand that I am free to withdraw my participation from this research project at any time I wish, without consequences, and without giving a reason.

I agree that George Verghese has answered all my questions fully and clearly.

I agree that the research data gathered from this project may be published and/or be used in a form that does not identify me in any way.

Signature (participant)

____/____/____

Signature (researcher or delegate)

____/____/____

NOTE:

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APPENDIX G: Interview Questions

Questions about their work:

1. I would like to ask you about three significant works that you have completed that best describe your approach to materials.
2. Can you show me the work in terms of images and drawings to help me understand this relationship you have to materials?

Follow-on:

- (a) Is it still evident in your current work?
- (b) Has it evolved in the same direction?
- (c) Has it devolved and taken on more of a traditional direction?

Questions about influences on their work:

3. Who and/or what are the influences upon you in terms of your material choices, and where do you attain knowledge of new materials?

Follow-on:

- (a) Are these influences still there or are there always new influences?

Questions about the challenges they face:

4. What are the challenges faced by you when you design in terms of materiality?
5. What are the challenges you face when considering materials, particularly materials that are new?

Questions about their work in terms of being traditional or innovative:

6. Considering your approach to your work, where would you locate it on an axis between traditional and innovative?
7. Are projects that are more traditional, in terms of materials, a consequence of:
 - (a) a strategic approach?
 - (b) a different philosophical or theoretical approach?
 - (c) a more practical need?

Follow on questions about engaging with an unknown material:

Follow-on

- (a) Do you recognise when innovative use of materials is allowed, or is there more often traditional use of materials that govern the design?
- (b) How important is a consideration of risk when selecting new materials?

APPENDIX H: Example of Giorgi's Methodology Matrix

(Extract from Participant 7: Michael)

PARTICIPANT	NATURAL UNIT	KEY ISSUES	ANALYSED THEME: Key Issues distilled down towards an Analysed Theme revealing similar issues.	CENTRAL THEME: Key Issues expressed as a Central Theme revealing a core Structure (What it tells me about the meaning of the lived experience with advanced materials)
interviewer:	It's February 14th, 2012. Interview questions with Participant 7 (P7) in Vancouver.			
interviewer:	P7 first of all I'd like to take you back to a time when you were beginning your journey into design. Particularly focus on the exploration of materials and how it relates to your journey. This is giving you a context, not necessarily where you are right now but merely where you were when you were back then.			
Question: Who or what are the influences upon you in terms of your material choices when you started your journey?				
interviewer:	Who or what are the influences upon you in terms of your material choices when you started your journey?			
P7:	I think when you start it's almost in naivete about just discovering materials. I think certainly learn from experience and in many cases trial and error. I mean obviously you observe what's around you. I think originally when I started practicing I wasn't thinking that materials had the same potential as they do now. I didn't feel that they were probably quite as integral to a design as I do now. I think I felt them more as a means to the end.	<ul style="list-style-type: none"> • P7 reflected on the naivete about the importance of materials in design, the lack of knowledge in early days, and lack of appreciation of the importance of materials to the overall design. 	P7's lack of independent knowledge led to a lack of critical material thinking in a project.	A spatial designers lived experience of advanced materials is dependent on an independent and holistic knowledge of materials.
interviewer:	Was that, when we're going back? How far back was this when you're talking about?			
P7:	We're talking the late '80s so '87, '89 time frame.	P7 gives the context of the decades in which his education occurred.		
interviewer:	In terms of where were you in your journey? Were you in university? Were you just starting practice?			
P7:	I was just starting practice at that point, yeah. I found even in education, although of course, you're taught materials but at that point in time it was taught as an isolated thing. You need a floor material, you need a wall material, you need ceiling materials. It wasn't, I guess, instilled, perhaps, that that's the integral aspect of the design is the material. The way I approach it now.	<ul style="list-style-type: none"> • P7 reflected on education and that materials are taught in isolation and only later do you understand that integral aspect of materials. 	Lack of holistic nature of material knowledge is considered a key issue for P7.	A spatial designers lived experience of advanced materials is dependent on an independent and holistic knowledge of materials.
interviewer:	We'll unwrap this as we go through these questions. There's a series of questions that I have here, some may be asked of some other designers as well, the same series of questions. Some may lead to additional questions as we go through it this semi-structured interview. How do you see, this part of the larger picture of design, how do you see materials being part of a larger picture of design and the path you have chosen? You may have answered that a little bit.			
P7:	How do I see it now?			
interviewer:	Yeah. When you started your journey you had certain influences. You felt there was a naivete about it. Was there influences in your choice materials?			

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P7:	I think retrospectively, back in that late '80s era I think design was at such a different place. It was very much the middle to end of postmodernism and to me that was so much about superficiality of applying the decoration, of applying the finished appearance of things	<ul style="list-style-type: none"> Relationship of an era, 1980's, as being superficial and only about applied decoration in terms of materials is stated by P7 as different from now. 	P7 reflects on an era that lacked the holistic knowledge of the nature of materials, and was concerned with only superficial decoration.	A spatial designers lived experience of advanced materials is dependent on an independent and holistic knowledge of materials.
P7:	that I think as I evolved to as a designer really understand now the materials have to be true and honest ...	<ul style="list-style-type: none"> P7 states a view that a designer needs to know understand material properties to be able to represent the honesty and true nature of a material. 	P7's comment captures the lack of holistic nature of material knowledge	A spatial designers lived experience of advanced materials is dependent on an independent and holistic knowledge of materials.
P7	and integral and speak to the intent, the user, the program, all of those things.	<ul style="list-style-type: none"> P7 states that the integrity of the whole project is reflected in the selection and use of a material that speaks to the intent, the user, and the program. 	P7's comment captures the lack of holistic nature of material knowledge	A spatial designers lived experience of advanced materials is dependent on an independent and holistic knowledge of materials.
interviewer:	How do you see your relationship, this is part of the second question where I asked, how do you see this part as a larger picture of design in the path you have chosen? What I'm getting at there is your relationship to materials, how do you see that as a part of this pathway? Is it about the discovery of integrity of materials? Is that what you were saying earlier?			
P7:	Yeah, I think you really look at a project or you start a project and now I imagine well, what will these materials be? It's almost like I approach the material as the starting point and then let the design follow knowing what the thresholds and limitations of the materials might be ...	<ul style="list-style-type: none"> P7 starts a project with materials in mind and let the design flow from that point whilst understanding the thresholds and limitations of the material. 	P7's comments illustrate that material thinking and considerations are the catalyst for the rest of the project.	A spatial designers lived experience of advanced materials leads to them to consider it as a primary element of design.
P7	or how the materials might convey form, obviously. Might convey color, might express tension, might create relaxation and of course, filling pragmatic requirements as well. I think I'm also really intrigued by the transparency or translucency of materials. Exploring light on materials because, again, without light, materials don't really exist if they can't be seen.	<ul style="list-style-type: none"> P7 understands that materials convey form through colour and its relationship to light—transparent or translucent. This leads to the comprehension of a material through visual senses. 	P7 recognizes the sensory nature of materials	A spatial designers lived experience of advanced materials leads them to explore the boundaries of user experiences when applying it to their work.
interviewer:	Okay, so this is aspects of your growth in this understanding of materials through maturity aspect of developing your profession.			
Question: Where do you attain knowledge of new materials in the past and presently?				
interviewer:	Where do you attain knowledge of new materials in the past and presently? This is when I ask you a question about the past you have to think about where you were in that past.			
P7:	Yeah.			
interviewer:	Which is the difficult part.			
P7:	I think in the past as a junior designer, emerging designer, you really you relied upon magazines, obviously.	<ul style="list-style-type: none"> P7 reflects that material knowledge coming from external sources such as magazines and suppliers was what junior designers relied on. 	P7's comments indicate a key issue of access to new knowledge of materials.	A spatial designers lived experience of advanced materials is dependent on an independent and holistic knowledge of materials.

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P7	Working in an office you were dependent on the suppliers coming to you,	• P7 remembered that as a young designer you were dependent on others supplying information to you.	P7's comment addresses the lack of independent access to knowledge of new materials.	A spatial designers lived experience of advanced materials is dependent on an independent and holistic knowledge of materials.
P7	especially in the small city like Winnipeg. We didn't have the resources of design centers or manufacturer showrooms per se.	• P7 recognized that there was a sense of isolation due to location that led to limited material information.	Access to new knowledge of materials is addressed in P7's comment.	A spatial designers lived experience of advanced materials is dependent on an independent and holistic knowledge of materials.
P7	It was really limited in terms of what was in the marketplace and that particular region in that particular time and what the market would bear in terms of cost or availability.	• P7 noted that the exploration of materials was limited by what the market could bear in terms of cost and availability.	P7's comment highlights how economic forces can affect the flow of information about new materials.	A spatial designers lived experience of advanced materials is impacted by market availability and economic factors.
P7	I think there was a very limited vocabulary in many respects.	• P7 felt that this led to a limited material vocabulary in the region.	P7 comment addresses the issue of isolation leading to limited material knowledge and vocabulary.	A spatial designers lived experience of advanced materials is impacted by market availability and economic factors.
interviewer:	Limited vocabulary from the suppliers or the design?			
P7:	Well from suppliers and I think it then trickles down then to the design community because if they only feel that there are only X number of materials available ...	• P7 comments on how the lack of availability of materials from suppliers—based on market forces—dictated the material vocabulary.	P7's comments highlights a key issue of the lack of independent access to knowledge of new materials to market demand and economics.	A spatial designers lived experience of advanced materials is impacted by market availability and economic factors.
P7	that's what they work with rather than seeking out ones that aren't just common or emerging.	• P7 reflects that the material availability dictated their use, knowledge, and the designer's approach to materials., resulting in a limited design vocabulary within the design community.	Isolation leads to limited market and available knowledge resulting in limiting the design language and use of new materials	A spatial designers lived experience of advanced materials is impacted by market availability and economic factors.
interviewer:	Now you look back and you say it's a limited vocabulary. When you were a young designer did you find it limited?			
P7:	Yeah, I did. I did because you would see in magazines or books you would see the interiors of very interesting materials and it seemed why weren't they available in the local marketplace?	• P7 reflected on being educated in an isolated community and recognised the lack of material information and access to interesting new materials through access to international design journals and books. This created a sense of frustration because of the lack of availability.	The key issue of a lack of independent access to knowledge of new materials is reflected in P7.	A spatial designers lived experience of advanced materials is dependent on an independent and holistic knowledge of materials.
P7	Why are were trades people not be willing to work with them? That was always a limiting factor too is the trades reluctance or being afraid of trying new materials or exploring new materials.	• P7 commented on the lack of new materials led to a lack of knowledge about working with them which led to a reluctance of trades wanting to use these materials. Possibly a sense of being afraid of a change in practice because of a new material.	P7's comments highlight the issue of isolation that leads to limited market and available knowledge resulting in reluctance from trades to try new materials and techniques.	A spatial designers lived experience of advanced materials is impacted by market availability and economic factors.
interviewer:	You saw it out there as a young designer but you couldn't have access to it.			
P7:	To a certain degree.	• P7 agrees with the comment that access was denied.	P7 agrees with the issue existing of a lack of independent access to knowledge of new materials.	A spatial designers lived experience of advanced materials is dependent on an independent and holistic knowledge of materials.

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interviewer:	Was that, when we're going back? How far back was this when you're talking about?			
P7:	We're talking the late '80s so '87, '89 time frame.	<i>P7 gives the context of the decades in which his education occurred.</i>		
interviewer:	In terms of where were you in your journey? Were you in university? Were you just starting practice?			
P7:	I was just starting practice at that point, yeah. I found even in education, although of course, you're taught materials but at that point in time it was taught as an isolated thing. You need a floor material, you need a wall material, you need ceiling materials. It wasn't, I guess, instilled, perhaps, that that's the integral aspect of the design is the material. The way I approach it now.	<ul style="list-style-type: none"> • P7 reflected on education and that materials are taught in isolation and only later do you understand that integral aspect of materials. 	<i>Lack of holistic nature of material knowledge is considered a key issue for P7.</i>	A spatial designers lived experience of advanced materials is dependent on an independent and holistic knowledge of materials.
interviewer:	We'll unwrap this as we go through these questions. There's a series of questions that I have here, some may be asked of some other designers as well, the same series of questions. Some may lead to additional questions as we go through it this semi-structure interview. How do you see, this part of the larger picture of design, how do you see materials being part of a larger picture of design and the path you have chosen? You may have answered that a little bit.			
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APPENDIX I: Participants' Quotes on Intrinsic and Extrinsic Factors

The following quotes come from the participants on related issues outlined in Chapters 4 and 5. They represent highlights of comments from the interviews that directly relate to the issues of intrinsic and extrinsic factors that impact the lived experience of these spatial designers with their engagement with unknown materials.

Intrinsic Factors: Part A—Material Memory

I think ... probably I'm one of the more seasoned persons here that you're interviewing compared to the others, but I found that I had been relying a lot on memory and lost memory. (Greg's Transcript)

A love of tactility would definitely be childhood. You'd be like playing in the mud in the Bay of Fundy. There's a big clay beach that I used to make rabbits from. (Sandra's Transcript)

I used to watch him and help him. I still have that sense, smells and strong senses, sensory load on memory. I still remember planning away or pulling. You pull the Japanese saw and even the shavings on his plane were just like needle flakes. He did them so perfectly. I used to collect them. Curls of it. They're just perfect. I was just fascinated by it. I used to just go down and watch and smell. (Greg's Transcript)

I loved finding out how things are put together and loved that my grandfather had the first auto body shop and auto wrecker shop in Canada, in Toronto. I used to go when I was little, and I loved to see how cars were put together. I was always fascinated with how the metal met plastic. (Lina's Transcript)

For years, he did nothing but cast little concrete chairs, little concrete figures, concrete teaspoons, concrete hats, concrete pipes. That was one of the jobs I did for him, as a student, was preparing concrete casts. I used to pour lots of concrete in school. Super playful approach. (Blair's Transcript)

...but he even made his own mud bricks. So maybe I had that kind of tinkering with materials from even when I was very young... I remember like playing with mud a lot if that's another, you know. And then I was interested in like, uh, traditional embroidery and stuff. So, I tinkered with a lot of yarns and strings and, um, you know, the sort of patterns, uh, embroideries and stuff. (Fiona's Transcript)

We were looking around for what could inspire us culturally there because we were making a cultural building in a new country, so it both felt appropriate and an opportunity for us to look and learn. We needed it sitting on the ocean and it's going to have to stand up to a lot too so it's got to be something very durable or it's not going to work. That kind of thinking is so counterpoint to the ephemerality of these paper lanterns that the building's made for. (Sandra's Transcript)

Sometimes you get inspired by going to a quarry in Italy. I think, "Oh, my God. That would be so cool." That ... a century ago they actually used slab, a stone, as room partitions. They probably did in some places or in a washroom or just around the bathtub. Probably the walls are like stones, so I thought, why don't we do bathroom partitions in a restaurant that are just thick slabs as rooms, or the toilet rooms, and depending on our budget of course. (Greg's Transcript)

It's taking this image, and it looks like when you're just sitting on old leather chair and you scratch your name into it, or you scratch your nails until it has that warmth to it. I said, "We're doing a whole wall in that." I said, "Whether it becomes the whole wall or whether it becomes ... if this is a plaster finish but has that unpretentiousness to it, that it's not pristine and it's already..." (Lina's Transcript)

I don't know if that's a modernist approach, but it's—God, it's like the days where there was quality. Nothing was artifice veneer. It was the real deal. Solid stone. There's a lot of my memories based in this. I can't get to that. If I can't obtain that because of budget constraints or whatever, just let it go. Yeah, don't even try to fake it. ... I long for the past, that sense of holiday in old craftsmanship. I don't ... I'm not

always able to do it, because of primarily price, and get somebody to do it. (Greg's Transcript)

I remember having a flashback making the [product name] of when I was really little living in the barn and I cut out paper apple trees and attached them to the sides of the kitchen we weren't using because my dad had built two for no particular good reason, but it made this narrow space. I made the apple trees join and stuff, and I made this room out of paper apple trees and I just completely had a flashback to it when I was definitely the early paper [product name], I realized this is what I've wanted to do my whole life. I'm compelled to do this. There's something about it that I feel is one hundred percent myself right now for some reason. (Sandra's Transcript)

I hated going there. I hated being dragged to the ... because I had disdain for just thinking about that, going into a fabric department and that, all that. I guess all the textiles in bolts seemed to suck all the moisture out of the air. I don't know, when I was a kid and I used to go in there, and I used to almost wince and I was going to die. Ten seconds I'm going to die, because of this dryness and I couldn't breathe. ... The only thing is colour. I was attracted to colour, yeah. ...The world, especially in that time in Toronto before mass immigration, it is a very dreary place. It's all browns, and some greys and black that people wore. Work blue collar uniforms, navy. (Greg's Transcript)

...I didn't realise, but I think my father was a boat builder, a builder of wood, fishing vessels for the Japanese fishing industry on the West Coast decades ago. I remember his Japanese tools and he made these perfect wood parts. Wood components for the boat, there are such beautiful objects. All done by hand. I think that made a huge impression on me. Probably more than I realised. (Greg's Transcript)

I had many opportunities to go to the factories. A wooden factory, and a urethane factory, chair factory Then, I, how can I say, faced many different materials in the manufacturing processes. And that's the kind of first part I guess when I think of material very seriously. (Yoshio's Transcript)

It's conscious, like it was definitely conscious. I love taking something that people are familiar with but using it in a new way. They touch it and they're like, "Oh, my God! I wouldn't have thought that this was this product. What is this?" I just think it's really interesting. (Lina's Transcript)

... and it's taking a tin ceiling that is so old world and applying it to the wall. All of a sudden, you're applying it in a different way that people aren't used to, but they're used to that material. (Lina's Transcript)

We're researching material right now. I'm trying to find an old mason jar so that we can make it into something else... (Lina's Transcript)

So, you know, when we were kids, there were things we, gold paper cards ... you know, those little game cards or whatever. You just wiggle to see different images. So they're called lenticular images. And so sometimes what I do is, because the material is supposed to change with the element and it's very hard to capture that in regular photography media, so, I just do four to five images and print it as lenticular films. So, when you move around the photography, you can see that it's changing. So, like again lenticular prints have been around for 30–40—whatever, 50 years. So, it's just, within the context of my work. It makes perfect sense, that medium. (Fiona's Transcript)

... I used that material to create the effect on a building. So, quite often, there may be some existing materials that I kind of change and the person I dealt with at 3M said, "Oh, that was never used in that manner before." (Fiona's Transcript)

I mean, I'm learning constantly from traditional materials but, yeah. Changing it towards innovative.... But, as I said, like I can't start with a new material, right, that you'll always start tinkering with existing or traditional materials. (Fiona's Transcript)

Now we understand the micro to the macro concepts and the micro detail to the macro concepts. Then we take all that in and almost forget about it for a second and then walk through the space or listen to the way that the footsteps sound in that hallway or the way that

people are sitting down interacting or not interacting or looking at the openings through structures or walls or façades or glazings. (Juan's Transcript)

Future past, yeah. This is where materials become the fabric of what we know, of where materials ... I mean they become the connection and it's reflexive this way. We see material, we project ourselves onto it and then we're left with this imprint, not of our material onto the material but the imprint of the material onto us and how it affected our experience. Our experiences are what makes us who we are, through the collective idea of what that feeling of that space or that environment in that time was like. (Juan's Transcript)

Even smells. I was just actually commenting this morning, I remember walking in that hospital hall this morning actually with my wife and I said, "That smell. I remember that from some workplace somewhere," because it was like a cleaner and some solution. There's something that immediately threw me back to this time and place. Yeah, I mean if, say 20 years down the road, I encounter this material again there could be that anamnesis that occurs or recurrence of that memory or maybe that smell or something like that, but it becomes us. Materials are our memory and it has an imprint. (Juan's Transcript)

As I told you that, the ... We learn how to appreciate the beauty of the sculpture, of texture, of colours. I think this is the way that we appreciate things in our lives. When you see things, and you see materials, and you see that's how you can create beauty out of some certain material. How to make them more beautiful for you to use it. Make the best out of one. Whether that material is worth for you to explore or not, you can decide that you like it or not. You want to explore, you don't want to, or you have a future in that or not. Asking whether you take this or not. You have to try. (Preya's Transcript)

***Intrinsic Factors: Part B—Material Experience Chapter one
(Personal Design Experience/Educational and Inspirational Experience)***

*I would say, we went to the World Fair in 2000 in Frankfurt. No, in Hanover, sorry. The whole premise of this Expo was the innovation of architecture. I've never been blown away like I was there. It was just like the Japanese Pavilion was made of cardboard tubing that was...
(Lina's Transcript)*

Expo 67 in Montreal, it was super pivotal, pivotal, pivotal. In that I knew I wanted to become an architect, designer or sculptor. As a designer, I was un-molded. I was un-molded. That was amazing, and I was blown away. I can remember every detail. So many details of the interiors of those pavilions that are long gone. Travelling on the little monorail to the Buckminster Fuller dome. I also went through the Ontario Pavilion with these huge, big, big rocks that were evoking the Canadian shield. Cut these square blocks of granite, stack them, and that was the edge, onto the lagoon, and they just put this canopy. This fiberglass canopy over it, or Frei Otto's tent—the precursor of the Olympics stadium, and I was mesmerised by these curves and the ... The structure of the steel net, steel net. Yeah. I was, "This is what the future's going to be," I thought. (Greg's Transcript)

And the stuff of the special effects of the 2001, and the Gerry Anderson's UFO stuff are always the same. And I was a primary school student at the time. About eight years old. Something like that. And I was pretty inspired by those future designs. (Yoshio's Transcript)

Absolutely encouraged. Yes. I think that's the really important thing, and people who have parents who are artists are more likely to look at a child's drawing and see something in it to encourage them. (Sandra's Transcript)

My mother was a seamstress tailor, highly trained. A tailor. She was a perfectionist. I remember her thinking, her brain moving. You can almost smell the smoke as you try to resolve this coat detail or how do you get rid of the buckling. How do you make this drape smoother?

Drape better. Just figuring out different details and that is probably thanks to my mother too. (Greg's Transcript)

Well, growing up with a Dad and Mom that are artists and always making things. We lived in a barn that was in constant renovation for quite a few years. Absolutely probably affected me in a really good way, I think, but just always having a sense that things are made, not bought in a shop, whereas a lot of people don't grow up that way. Things come from stores, not necessarily being made. Then just always being encouraged that way. (Sandra's Transcript)

Yeah. I think in terms of the framework of design I've inherited or in other words has been passed onto me. I think there's a bit more tradition, more than I can give recognition toward through my family, because my father's father was a blacksmith who also created his own tools. I remember my father showing me some of his tools that he had created. (Juan's Transcript)

Strong sense of quality that they [parents] instil too and helping to put together. (Greg's Transcript)

He would certainly influence my thinking, maybe not specifically about materials in the sense that it's not like he would you say, "Oh, check out this particular type of glass or this edge of glass," or something, but he certainly opened my eyes to what detail consists of. If you took the care to think about perhaps the spaces in between or the subtle contrast of tone on tone or the same tone on tone, in his work that's what he focused on. Right down to, in his days as a graphic typesetter he would space out things to one sixty-fourth of an inch. With that attention to detail, I think, it was almost impossible to escape from when thinking about when I looked at objects in the world itself. Perhaps it's a little OCD. (Juan's Transcript)

Even when I was sitting on the desks that were old. I went to [X] Collegiate. I went to [X] Collegiate in high school, and at the time they were just still transitioning over from the old desks that were all ganged, cast iron at the tops with the ink well. Then in front—the front

panel of your desk, modesty panel, was actually the back of a person in front of you. I'm not allowed. I'm bored out of this thing too, history or whatever, and then trying to sink the ink well, and ergonomics. Playing with it. (Greg's Transcript)

I remember during my masters, I took at this Jewish community centre, they had a good course where they were teaching how to make sculpture or using, um, like there's a cement that you can brush on. So, you know, like stuff like that. I, early on, I mean less so now, because once you're in academia, you make less stuff. I, I hire students to make stuff but I don't make them anymore. But early on, I was always interested in making stuff myself. (Fiona's Transcript)

I found even in education, although of course, you're taught materials but at that point in time it was taught as an isolated thing. You need a floor material, you need a wall material, you need ceiling materials. It wasn't, I guess, instilled, perhaps, that the integral aspect of the design is the material. The way I approach it now. (Michael's Transcript)

Yeah. I think, as you say, there are two waves of changes in my life. The first one is my furniture company days in the development section, and after that, [name of college]. That's kind of one first wave over facing the material and thinking of a new way of using materials. And the second wave is IDEO. And when it was IDEO, I had a good opportunity to see new materials, innovative materials. And Material Connexion® created lots of interesting software books. Those inspire me a lot. (Yoshio's Transcript)

I just have a vision of my mom taking me to church with her, not wanting to be there and sitting there, and her asking me halfway through like, "Are you okay?" or asking me something. I say, "Well, I'm trying to figure out how they've hung that cross." My mom was like, "That's what you're thinking about?" I'm like ... It's always been a real curiosity. (Lina's Transcript)

Yeah, I believe in that. I believe in studying trades and traditions and that there's a human history of that type of learning that's happened

that's really interesting. On the West Coast, here it's looking at the way indigenous people really understood cedar. Every inch and fibre of a cedar tree, they understood it and how it could be used in different ways. (Sandra's Transcript)

It's fascinating the history of this company, right? It's a small town in Pennsylvania and they are over 100 years old as a company. They've been making nothing but paper decorations for over 100 years. Some guy brought back literally a tissue paper palm tree from Germany to his small town in Pennsylvania and said, "Isn't this cool?" He started a cottage industry. (Sandra's Transcript)

We were like wow, there's something to this. This is a whole world of things, I've never actually seen anything else made of flexible honeycomb other than paper decorations. Yet the first paper decorations, honeycomb ones, were well over a thousand years ago in China. Yet in all that time no one's really made anything else other than, well... in its flexible state but of honeycomb. (Sandra's Transcript)

Yeah so you could take the brick or the tile and think, like do, that kind of analogy There's an incredible system of Catalonian construction made from curved ceramic tiles where they're laminated to create structure. Is the tile material, or is the clay the material in it? Where does the product begin and the material end, or is it still a building material, which a lot of people would conclude. (Sandra's Transcript)

I use that particular example because that's been one of my, one of those key turning point, case studies, where I've said: "Yes, these people had something. They figured something out." The Guastavino Tile Company were Italian immigrants to New York and they bought clay quarries in upstate New York and made the tile. They had the construction crews. They had end-to-end control and they were architects. They were pulling the clay out of the ground, owned the trucks that moved it, end-to-end. They could control that full system which the most valuable part of it at the time, well, one of the valuables, the things that made it successful, was that it became

economically viable because they had so much control. They had control over who marked up what, because they were the only ones marking up and could be as competitive as they wanted to be with other forms of construction. They were able to introduce formed construction single-handedly into North America and build a ton of buildings, so that they really owned an era of construction in a way in North America, which is like a family. Like Grand Central Station, ... great American landmark buildings that McKim, Mead and White made that were done in all Guastavino tile. It was also fireproof at the time and that became important. (Sandra's Transcript)

I will say like, of course ... there's always new work coming. But people who have been working in the area of materiality, material innovations, they are consistent. ... architects, interior designers, industrial designers, or engineers who have been publishing regularly... (Fiona's Transcript)

Yeah, because they not stopping me from doing things. I dress whatever I want to. At that time, I'm just like everybody along just very fashionable things. I do something different. I always do something different from others. (Preya's Transcript)

I know exactly what I want to do. I want to do something this way. A formal kind of thing, I look ... I make my clothes out of my mother's skirt, but I made it into a blouse. I use the ... It's pleated and it's very stiff, so I use the end of the skirt, and I put it here. It's so nice, the pleat. Yeah. I use it as my blouse, so I sew it together and slightly cut it. Then the skirt here, the end of my blouse. I make something. (Preya's Transcript)

My mother let me do it. I wanted to do my own clothes since I was young. I wanted to make trousers and I just cut it. One leg is red, another leg is green. I think it's so beautiful when I do it. I don't know how to do it, but I just cut it and sew it, and show it to my mother. "I can't do it. I can't. It looks like this." My mother just laughed. She [was] not teaching me. (Preya's Transcript)

Now I've been able to have the luxury of travelling and experiencing those different types of spaces. You bring that back and go, "Well, yes but it's maybe not exactly what I would have expected that experience to have been, or that's a great experience, but I want to use it over here for something else." (Michael's Transcript)

Well, I'm always exploring. Whenever I go to a trade show or I travel ... I'm always looking at new materials and how they're utilised. For me, it's seeing the material in the marketplace, but then thinking about, "Well, what else could I use that for?" (Michael's Transcript)

I think in the past as a junior designer, emerging designer, you really relied upon magazines, obviously. Working in an office you were dependent on the suppliers coming to you, especially in the small city like Winnipeg. We didn't have the resources of design centres or manufacturer showrooms per se. It was really limited in terms of what was in the marketplace and that particular region in that particular time, and what the market would bear in terms of cost or availability. I think there was a very limited vocabulary in many respects. (Michael's Transcript)

I think when you start it's almost in naïveté about just discovering materials. I think certainly I learn from experience and in many cases trial and error. I mean obviously you observe what's around you. I think originally when I started practising, I wasn't thinking that materials had the same potential as they do now. I didn't feel that they were probably quite as integral to a design as I do now. I think I felt them more as a means to the end. (Michael's Transcript)

We have to live on what we can build. I guess that's just a reflection of a practice. I guess that's always the lens that I bring to new materials, is how will it interact with people? I don't mean the end-user. I mean, what's the process of getting it on the wall or building the wall from it, and who are the people that are going to do that? (Blair's Transcript)

Spatial, and then through the spatial, materials come up. Yeah. Spatial and then site in a situation, and then I think material. (Greg's Transcript)

Well, I think it's maturity. I think it's when you're an emerging designer you somewhat fixated on what's new, what's happening and what's the hottest trend? What's "in" in interior design this month sort of thing. I think when you've gained life experience, you've travelled. You've experienced different environments and places... that you really start to appreciate that it's not necessarily whatever is brand new or whatever is hot or whatever so-and-so is using but it's, how can that influence? What difference does that make in a space? (Michael's Transcript)

I think I evolved to, as a designer, really understanding now [that] the materials have to be true and honest. (Michael's Transcript)

I think the essence of experimenting will always be there, and that thing that I admire in the example of an indigenous people studying the use of cedar, there's something timeless in what I admire about that. It's something that can be very contemporary. (Sandra's Transcript)

I just enjoy doing whatever. If it is something new and challenging, I think I'm going to do it. (Preya's Transcript)

Yeah, you have to take risks. Because you think that you can do it, you can win it. The risk that you.... Not really like, risk your life or anything. Probably, it's challenging because you can fail it. If you have your will, strong will, and you enjoy doing it, any way you can find a way to win the situation. (Preya's Transcript)

When I started it, I just ... Told you before that I tried in many different kind of techniques, to get different kinds of texture. That's the way I evolve with one material. So, you explore them in many different ways. Which results do you prefer? Which direction that you can ... use it for real? (Preya's Transcript)

I just enjoy doing whatever. If it is something new and challenging, I think I'm going to do it. I always do something like this, such as other than the water hyacinth, a friend comes asking me He got this project to do a shuttle boat for the Shangri-La Hotel. A shuttle boat! Asked that I design something. (Preya's Transcript)

I think partly, I like solving problems. It comes together. You can solve something that I ... normally do, ... for the interior design work, it's also a challenge as well when you can do something different. You can do something new, you can do something in different angle, or in different way, and it comes out good and you're proud of it, and you enjoy doing it. I think it's the same way when you're involved with something. You want to achieve the best out of it, and you try to find solutions around the plot. (Preya's Transcript)

For me, I've come from a place where I was so unconfident in myself. Is it one thing? It's been a whole lot of things that have kind of pushed me. I wouldn't say it was more material but more of who I was that made me comfortable with who I am, that has allowed me to say I have the confidence to answer to what I'm doing. You know what I mean? I think that ... I think I'm afraid of heights. I was afraid of heights and I had nightmares about it all the time. My thing is like, "Okay, let's go to the Grand Canyon," and I climbed out onto one of those structures that stand free. Now, looking back, it was stupid because I could have killed myself, but it's like, "Okay, I did that. Now I can do this." It's like I was terrified to talk in front of people, so I was like, "Okay, well, let's ..." I was asked to speak in Vegas in front of 200 people and I'm like, "Okay, so I'll do that, and then talking to 10 people will be fine." (Greg's Transcript)

Intrinsic Factors: Part C—Material Ideas (Conceptual and Theoretical)

...so, again, that experimentation was going towards sort of building, and having poetry—poetry appearing with rain. ... Yes. So, again, a lot of the questions because prototypes, as you know are not final. They are just conceptual building prototypes. So, I'm trying to push the work further. (Fiona's Transcript)

Yeah, well something you recognise and don't recognise, that's familiar. There's familiar like taking something familiar, and then also taking something and then being taken by surprise at the same time, is combined in that. Just that epitomises how we want to make sure we walk around the world. We want to make sure we stay curious enough to learn about everything around us. That's what kids do. That's what I know I love about living. Make sure I never lose that. (Sandra's Transcript)

It has many layers, because that's my need. That's my need, to feel that I'm relevant on an innovative level. I will find out about what can I do by laminating glass. What happens if [you] laminate ... Dot matrix, a real white gold, a palladium onto a glass, instead of aluminum, blah, blah, blah. It's my need or maybe partly insecurity that I have to have some element in my work that's more exploratory. (Greg's Transcript)

Nadine always says to me my famous line is, "What if?" because I always like to explore the other option of it ... (Lina's Transcript)

I think because I'm an interior designer, I have the chance to see lots of things around. I'm always looking for something new to create something different. Material is very important to make your differentiation. When you design, you make things different from others. If you have something like the first time that we do this, I think nobody have it. (Preya's Transcript)

I have always maintained that I am happiest when I am completely lost, that I feel the most comfortable when I have no idea what we're doing, like when we did the gathering place and we proposed something that we didn't know how to build. Up to that point in my career, I had built quite a lot of things, but they were predictable concrete structures with infill and all that kind of stuff. I was really liberated and I was really ready, at that point in my life, to scrap all of the stuff that I knew and try to take risks. Here was a manageable risk. It was just something inside. It wasn't going to hold up a building. I had no idea how to construct the form that I had put forward. To their

credit, the client group, they were supportive and I'm thankful. (Blair's Transcript)

When we're actually working and enjoying the mode of working, we just feel a sense of freedom with surrounding ourselves with more abstract inspiration like nature and just materials, raw materials. ... Just to really be able to immerse ourselves in our exploration, be more inward and focused about it. We're just focused, I guess, and less apt to just do what we see happening beside us, because there's nothing happening beside us. (Sandra's Transcript)

It's more fun thinking of something that way and how to make use of the things that nobody cares [about] and is useless. ... I think it's more fun for me, doing something like that, this way. It's to prove that if you have train[ing] in design, or you work with this skill, or you try something in this skill, you can use your imagination or your creativity to create something new, or fun, or ... Sometimes help the world get rid of this used thing. (Preya's Transcript)

Yeah. That freedom that it will get to unfold into something, but we don't know what. (Sandra's Transcript)

Oh, no, definitely. I mean it's always fluid. I mean you'd never reach the end. Yeah, it is what I thought it would be but I'm not even midway. I'm not at the end. I'm always looking to the future, what's gonna be? How are things gonna change? How is our profession gonna change? How do we fit into the big picture of technology? All sorts of environmental issues. All sorts of things. (Michael's Transcript)

Basically, instilling in me that anything is possible. Just think if you can design it, you can create it with that material, and you can find materials to create. (Michael's Transcript)

Yeah. You see something you want to make happen sometimes, which is the opposite end of just the experiment, which we love. We love not having any particular pressure about what it's going to be or when it's going to be, but then there's also, sometimes, you know, you want to get somewhere and it takes time and trial and error to get there. For

us, we were always looking for the Holy Grail of materials where we can have all the properties of strength and fire retardancy and water resistance and all of these things. At the same time, something that's responsible to the planet and can be harvested and made in a way that feels good, right? (Sandra's Transcript)

Then I also believe that we can continue to contribute. We haven't figured out the whole planet and understood materials. There's still more learning to be done as a whole and then also just more [of an] artistic idiosyncratic level in the way, a subjective way that an individual might come up with once they understand the material. (Sandra's Transcript)

Some projects require more exploration and further exploration, and more I guess pushing for more innovation. And other times, it's the reinterpretation of... (Greg's Transcript)

As you know, my expertise is in material innovation, so I always take that tangent versus just find the material and apply it. (Fiona's Transcript)

Yeah, it's actually involving all kind of senses. When you do ... The design for the space, it requires all kind of senses. Include functional things. (Preya's Transcript)

We're interested in both in practical and impractical things. They were definitely a learning point, very, because I'd always understood felting in one way but had never picked something up that was as hard as a rock and still felt. It made me think, what is felt? What are these things? If you pick something up that feels like a river-rock but it's been made for a machine. How does that, what's happening here, and how does that happen? (Sandra's Transcript)

Since leaving that firm to start my own, it sounds like I've thrown in the towel, but it doesn't [mean that]. I try really hard to start from ... I don't want to stay at first principles, but I try to start at the bottom. What are the inevitable materials that are going to be considered here? Concrete block for a public washroom; steel with timber for a bus

stop; or, in-situ concrete for a robust public enclosure. Because you pick your battles when you do this stuff. You've got to try to land on something in the project that will be firm, that is a decision, that is not going to get undermined or eroded when you are fifty percent through the design, and you've got to rethink what you're doing, and you've lost all of that conceptual foundation, or just the foundation, in your process. (Blair's Transcript)

I think it's such a fine balance between it being unsuccessful and being successful. It's just knowing that balance and kind of trusting your gut and saying, "This is going to be okay." (Lina's Transcript)

To me ... innovation is taking risks. In anything, really. Because if it hasn't been tried and proven, then... (Michael's Transcript)

I think you always have to take risks with new materials, absolutely. It's not taking risk for risk's sake. In doing so you're learning. It's more about learning your own limits of thinking during the process. (Juan's Transcript)

Risk is important from a couple of different standpoints, to ask personally like the whole thing we're talking about is actually, really, we value the lessons of not being afraid to fail and just accepting it sometimes; yeah, you will but it's worth it just to try things. Sometimes the things that fail actually lead to something way better than what you were trying to do anyway and all that stuff. Risk is valuable. (Sandra's Transcript)

Yeah. You do have to take measured risks. Like, I don't know, it's prudent to be responsible as well. (Sandra's Transcript)

The word innovation is used a lot. Not the word risk as much, but the ephemerality of the paper, I think, is something that is a similar mindset to people thinking of it as risky or less predictable. (Sandra's Transcript)

Yeah. I still take risks. I still do it. ... Yeah, you have to do it anyway, because it's the way to achieve something different. If you don't take

risks, you just ... It's ordinary kind of people, or company, and nobody [is] interested in that. You can't survive. If you don't think of something new, or take risks, and you're always on the safe side, how can you create something different? Just waiting for somebody who can produce something for you. (Preya's Transcript)

It's like, from my experience, the space that we've got, you have to design something particular that will go there. We can do like, hundreds of designs out of that one space. ... I say, "Why don't we do it differently?" Just flipping and doing a different way. (Preya's Transcript)

What drives me to do that? Probably want to win the situation. Yeah. I want this, and how can I get it? I find a way to get around it. Okay, how can I do it? Even, I have to do this and ... I have to do it myself to achieve what I want. (Preya's Transcript)

... but like the not being afraid to fail is a really important thing. (Sandra's Transcript)

I've always been like that. As a kid, I was never afraid to do the assignment that wasn't asked for. I always made things in my basement. I always ... I probably felt a lot more like myself in university, because in an architecture school, it's a lot like being in kindergarten in a way. ... Maybe first year architecture school, if there was a moment where I realised as an adult. (Sandra's Transcript)

I think there's value, that's where most of the learning comes from, when we start to see the breakdown of materials and when things fail. Sometimes there's a beauty in the failing too, I find. (Juan's Transcript)

Yeah. And that time to play a little bit and let something morph. If you're in a big hurry to get paid to be, you're not even going to see what happens in between, or [you're] just too busy, too distracted. That's what happens in between either. (Sandra's Transcript)

I shouldn't speak to the digital world as much, but it's definitely something I understand, and I appreciate the physical world by

actually playing with something rather than preconceiving what you're going to do in your brain, inside your head, inside a notebook. That it's evolving in front of you. (Sandra's Transcript)

Sketches, I sketch with my paper and sketch with material. ... Make models. I weave, myself. I got very small machine, I weave myself. I think of something, I have to do it by hand. I stitch it, I plate it. I plate with material myself. When we want something different you have to do it by yourself. ... I'm very low-tech. I'm very good in drawing. It's so fast, you don't have to open it. This white, plain piece of paper and sketch it. It's not technically ... It's like sending interior material or whatever. I just sketch the idea. (Preya's Transcript)

Yeah, yeah. I like drawing. Love drawing and I know that I want to be ... First, I want to be an architect, and end up to be interior designer. (Preya's Transcript)

I think a sense of place is to me, becomes more tantalising. (Greg's Transcript)

I always have this nostalgic recall to whatever we do... I may not use that information or what I distilled in the past, but it's still in my brain. (Greg's Transcript)

Illusions are an enhancement of an existing character that the material possesses. (Greg's Transcript)

I've been researching store, department store, luxury stores for a client once, and one of the things that came up was I said, "I want ... that Barneys air." Meaning not the actual thing that's inside Barneys, the store in New York. Just that feeling when you walk in, you feel like you're in Barneys. (Greg's Transcript)

Colours, or light, nothing. You just know. I just want the feeling when I come in, and one of them said, "I wanted it to feel like you're in [CLIENT X]." I don't know whether I ignored that, or what, but it's that feeling that ... Yeah, that sense of place. (Greg's Transcript)

I don't think place can be quantified through space. I think place has much more to do with the time we spend in an environment on a social level as well as the physicality of materials, the physicality not just tactile but acoustically. It could be atmospheric or atmospheric pressure. (Juan's Transcript)

Yes, so sense of place comes, therefore comes in exploration of materiality, in its locality for sure. (Greg's Transcript)

Yes... One, it intrigues me. More than anything it intrigues me. Number two, I felt somewhat a responsibility to explore that locally and in a sense for very simple reason. A practical reason and it's, why would I ship all this stuff, material, to another country? (Greg's Transcript)

That's important, sense of place. I think especially now with the marginalisation and commoditisation of ... a sector I'm most familiar with right now, so the luxury retailing sector is just everywhere. (Greg's Transcript)

Actually, for interior design work, we have to deal with the function of the space first. You can do the layout in many different ways, different angles, and you'll find ... Materials have to be involved anyway. You find something for special, for your project. You have to do something differently. Whatever you can, different texture for the wall. How can you make it more interesting with a texture, or a design that [has a] different angle, or whatever? You have to ... When you look into more detail, the space, you look at the space and then more details. How can you make that space more interesting, or the whole thing more interesting? Using many, many ways of thinking. Colour, texture, lighting, whatever. It's kind of thinking of many, many things at the same time to get the results. (Preya's Transcript)

It was taking the philosophy of what the company is, and they're very well-rooted and they have a great clientele following and they're really well-known. It's taking what are those properties of how people see them and taking what material represents that. It's looking at a limestone that has that longevity in the... It's saying, "Okay, well, who is

this company?" If we have to capture this in architecture, then what are these elements? It's looking at—okay, so it's this limestone. It's their traditional casing, and it's all stone, ... but they're also a very forward-thinking company. They have now over 1,000 employees. It's taking that philosophy that they have, as well as [being] very forward-thinking and pushing themselves, which is where the aluminium structure came from, and saying it's that juxtaposition against being well-rooted and forward-thinking. Let's have it lit from within because it represents their company. (Lina's Transcript)

I'm all about interaction. I think, for me, the most important things of my life happened in the interaction. (Lina's Transcript)

I imagined who it is more than anything. I think that we always design for the who, like who is it going to be in this space? What is it that they wear? What is their life like? What is it that they're going to expect when they come here? When I look at doing, as an example, the [PROJECT A], and I was saying to [CLIENT A], who's the owner, and I said, "What car do they drive? What car was it that they drove when you first opened?" He said, "Well, the first day that this space opened was the first day of World War II." I was like, "Okay. What was happening at the time? What was the entertainment? What was the family life like?" (Lina's Transcript)

It's so important because I always say we always design for the who, we never design for the what. Because it's like you can design a chair, but who's sitting in that chair? You can design a table, but who's sitting at that table? It could be a six-year old kid, is it very different then if it's like a forty-year old man? (Lina's Transcript)

I then did an installation of having that being projected onto translucent screens in a space where people could walk around and behind and in front. As well as having cameras on the actors or the bodies that are moving in space being projected onto the walls themselves. It's this interplay of the body within space, the body creating a space, being projected, recorded, and projected in real time on the surroundings. (Juan's Transcript)

[An] experience we never had, like even playing with these things in scale models, we realised that wow, this is actually a tremendous thing. We grabbed wedding bells from the Dollar Store. We were cutting them up and doing things with it. It all started, we were talking to a friend that's an audiophile and talking about how to make speaker columns. Just thinking about well, how can you make a three-dimensional curved object? What are different ways to make three-dimensionally curved objects? I thought of a wedding bell. That's something where you start, you manufacture in two dimensions and get compound complex three-dimensional curves. (Sandra's Transcript)

We deconstructed a soccer ball, which is based on Buckminster Fuller's 'bucky-ball'. That's just a strategy for flat pieces stitched together to make spherical objects. It's actually, when you look at it and you start to think about it, it's not too unlike taking flat CMUs [concrete masonry units] and lacing them together with steel rebar. The two simple principles of putting these things together ended up talking to each other in rather unexpected ways. It's a very modest building, but right now I consider it a material tour de force for me. I'm pretty happy with it. (Blair's Transcript)

How you approach materials. How you ... yeah. It's the editing and composition and limiting the amount that you use. It's how you judiciously use it. (Greg's Transcript)

Because material concerns [in] our thinking was the kind of first part in the design process. (Yoshio's Transcript)

Materials sometimes become a kind of key factor for the new design language. (Yoshio's Transcript)

I think, for furniture design, I see material more kind of as a physical material. And for the design ideation, I see material more like an image source. (Yoshio's Transcript)

... going through architecture and interior design, you think materials are something we apply, right? So you, well, because it's still practised

as such that you just order materials and then typically, it's either its surface qualities or colour or reflection or it's all the surface visual qualities of the materials that guides the decision making. Versus in other fields, it's not just the visual it's about how the material performs. (Fiona's Transcript)

Yeah, I think you really look at a project or you start a project and now I imagine well, what will these materials be? It's almost like I approach the material as the starting point and then let the design follow knowing what the thresholds and limitations of the materials might be... (Michael's Transcript)

I think it's more of when I'm starting to think about what the design is. It's going online, like we just finished doing [Project 4B], so it's looking at how does the ... what is Canadian? It's looking at green housing, okay, if we're going to redo [Project 4B], the whole premise of the design is Canadian design. It's looking at what is the stone? We're using soapstone. Then it's looking at a resin... (Lina's Transcript)

That's been a conscious thing where we've given ourselves a project several times to try and use only one material on something. The gravitating towards ephemerality is both conscious and unconscious. It's just something that we now understand about ourselves that we do. (Sandra's Transcript)

I try to stick into this material until this day. From one material, we can create hundreds and hundreds of designs. We make it different. (Preya's Transcript)

Other materials that I did recently ... It's used newspaper. I show it at the beginning of this year in Singapore, IGFF. You see by yourself. It look different and you don't know it's newspaper. It's become a furniture. (Preya's Transcript)

I want to do something different and I want to explore. Making use of this in different way. Try to see how far I can go with that. In everything that I'm involved with new material, that is old material

and how can I make use this material to ... Whatever I can do about it. How far I can go with that. (Preya's Transcript)

Yeah, even that. Because it's appropriate for ... It's an appropriate material. It's trying to solve... it's problem solving in the most traditional way. It's not just aesthetics. Because I like carbon fibre. (Greg's Transcript)

I would be taking that material and perhaps, we would perhaps... use the same material, but I am using it in a microcosm. I'm using it in a way that's very usable. I'm not using it as an architecture. I'm using it to define a space, interior space. (Greg's Transcript)

They were quite fascinated that we came up with some new materials and some old materials. Some old materials were manipulated in a new way, such as laser cutting or something like that, but obviously very traditional materials such as wood or sheet metal. Then, of course, new composites and they're never seen before, like natural materials, but re-broken down into particles and put back together again in a more interesting and more cementitious material. (Greg's Transcript)

Yeah. We're still ... I mean I still love to use innovative components in our work, but not 100%, the whole ... Let's say if doing an installation out of a timber and bamboo or whatever. It's a great art object as architecture, but it's only built for ... You know it's going to be ignored. It's such a big boom, big flame, big press, big attention. The bigger the flame, the faster the flame out. (Greg's Transcript)

What I do? I ... I try to see the form. The shape and form that I can make out of this. If I were a fashion designer, I think probably I think, "Should be which part of the dress? Or should it be just like bag?" For me, for interior designer, probably thinking of something I can make use out of this. (Preya's Transcript)

... how the materials might convey form, obviously. Might convey colour, might express tension, might create relaxation, and of course, filling pragmatic requirements as well. I think I'm also really intrigued by the transparency or translucency of materials. Exploring light on

materials because, again, without light, materials don't really exist if they can't be seen. ... What does it create to the environment? Does it make illuminance? Does it create tension? Does it add colour? How does it make a person feel in the space?

*Because I think so much of the how you feel in a space, the psychology of when you're in that space is dependent upon the materials.
(Michael's Transcript)*

The premise behind that was it was for an exhibit at a design show and the premise was, rethink design using materials that were environmentally friendly. Each designer could interpret that in their own way. (Lina's Transcript)

It was our approach... looking at the space that we did for the interior design show, because it was to be environmentally friendly. It was looking at how can we use something to create a structure and then not throw that product away. It was using something that we could give back. [Supplier 4B] is a huge lumber supplier here and they'd lent us all the wood. (Lina's Transcript)

So, 90% of our product actually went back, so our whole booth was constructed of these 2 by 10s and everything, like shelving, everything was friction fit. Shelving all fitted into it, huge cabinets all slid into here, and so it was all fitted off the shelves so it contained the structure and supported everything. (Lina's Transcript)

Just starting with white because we love the colours of the sun and that changes white throughout a day in architectures. Just something I've always loved, a white wall. Then the next natural progression from that is a black wall, right? Especially in a material that's translucent. There's the opacity of the black wall and the translucence of the white one, seems to be the two counterpoints that are interesting. (Lina's Transcript)

Different opacities that would allow at certain times light to stop and at certain times allow the light to come through the glass. (Michael's Transcript)

Yeah. As mortals, I think there's something that is very appealing to looking at the physical world around us and just relating to it and how it might age. That age can be graceful. You don't always just throw something out because it changed from age. (Sandra's Transcript)

So suddenly, you know, oil, gas and what it does to, and given that in the last 30-40 years like everything is petroleum product and where we are now. So, I think it's energy related, and I think the next material direction is very much like how we can generate, or how we can use less energy. (Fiona's Transcript)

Once I laid it out, I thought I was done but at that point I then started to incorporate colour to it, and at the time I was reading a little bit about Wittgenstein's theory of colour. It went into the philosophy of how we see things and how also how we can interpret things in different ways, whether they actually exist or not in reality, of whatever may constitute reality is a different story. What we contrive to be reality can certainly be subjective, which is just of a real experience as an objective of reality. If we feel it and we see it then it becomes a part of us. I started to think about how that could be translated through colour in this poem. Then I started to think about using the colours of CMYK as light projections, how that would change our perceptions and how it would change the readings. (Juan's Transcript)

Yeah. I continue to move on, I believe. I start to look toward, I'm starting to look at materials less about the physical properties of materials but more about the philosophy and the theoretical situations that occur with materials. That comes through the academic aspects or the research that I'm doing where I start to look at, I'm going back into that movement of, say, the dematerialised aspects of art in the '60s with the Fluxus movement, and looking at some theorists about social art or art in the public by Rosalyn Deutsche or Rosalyn Croust too. Elizabeth Grosz from her Architecture from the Outside in the '90s. I was more recently introduced to [this] which is also starting to seep into my thinking about materials and how that affects our social

relationships with private and public entities in space. (Juan's Transcript)

My father was a craftsman, a woodworker and boat builder for fishermen on the west coast of Canada. He made a wooden bath in the basement for all eight of us in the family for a steaming hot scrub-down and soak. There were hand tools he'd brought from Japan and, one day, he was working on a wooden bowl with a strange looking saw. He explained it was better design than western ones, because when you cut wood with it, you pull the saw—it's more accurate; when you push a saw, it tends to wobble, not when you pull it. That was the moment. (Greg, cited by Clancy 2017, 41)

Extrinsic Factors: Part A—Material Properties (Personal Design Experience/Educational and Inspirational Experience)

One thing I should say just while I'm thinking about it is ... it's definitely not just the intrigue of mystery, but there's a deep belief that by truly learning about a material we'll be able to make something better than we would have been able to make otherwise. (Sandra's Transcript)

That it will be possible to really understand the material and craft it in a way where there's a level of elegance that it gets because you're paying attention to the nature of the material itself and able to respond to it. (Sandra's Transcript)

You can't design anything until you know what it is that you're using. It's like you can have an idea of what it is that you want, but if the product doesn't work with the properties, if it won't work with your design, then you can't really use it. It's different thicknesses of it, so you can't design something until you know exactly what it is that you're using. (Lina's Transcript)

I guess the unknowns of their tolerances, their capabilities, thresholds—the longevity, is it going to last. (Michael's Transcript)

Well, when I look at a piece of joinery with wood, just using that as an example, ... [we need to] understand that wood expands, contracts. Join those pieces in a way that that material can actually live and breathe and work because the person who made it knows that wood expands and contracts and that it does it a negligible amount in one direction and a lot in another direction and a minimal amount in the third direction. (Sandra's Transcript)

To use the word better, but it's something I believe in because I do believe in craft. It's biased and that can be subjective, but I believe in craftsmanship in general. I take a lot of joy in it if I see something really well made. I always have. It was one of the reasons I stopped architecture two years in. I'm like, I want to actually know what a piece of wood really is. I want to get it. I want to know what I should do with a piece of wood. I've seen lots of wood furniture my whole life, but I want to actually know ... (Sandra's Transcript)

Let's just say it is a panel of wood. It could be ranged or articulated on different angles or cuts and grains and all shapes and sizes. Then of course the voids in between and the connections in between. It's at that point then I start to think about how the material... At what point, I start to ask myself, at what point does that material start to transform into a different formation than I originally had thought of or had thought of as the limits of that material? At what point does it become, say more plastic, if I start to say think about bending that wood? (Juan's Transcript)

INTERVIEWER: Okay. You look at potentiality?

Lina: Oh, absolutely.

INTERVIEWER: Not only of material but of functions, do you prescribe function? When you prescribe those functions, in your mind you start stretching and pulling it and twisting it and squishing it and holding it up to the light, do you envision some of the things you mentioned earlier about the personal space or the place that you think would be in the whole sort of lighting and the ambiance and the ...?

Lina: Well, I imagine someone sitting here and someone else being able to touch it. (Lina's Transcript)

Yeah. I get people to touch them because that's what sold it, I think. Like if you want to stick your fingers on the back of it. (Lina's Transcript)

You know, everything possible with the material. I saw it floating around. I haven't seen it, the real one. I don't know. What does it look like when it's ... The stem? Because I saw the green one and it flowers. Started from that and got the material, and just wondered, "How can I make use of this fibre, in a way that we can sell it as well?" Make it into a cottage industry. You have to use hands, because you have to give this to the villagers to work. (Preya's Transcript)

The project in Alaska is definitely one where we were building with primarily snow and a little bit of ice. No other materials at all. That one, I think, because we put ourselves in a position where we would end up having no choice but to improvise and try to understand the material on its own terms and how it was going to be that day and under that temperature, and how does it bond and how does it work? Realizing that snow can be many different materials in a way, depending on the temperature conditions that it was formed under and whether it's been tossed around. The crystals have their little tines broken off. (Sandra's Transcript)

That epitomises, again, we've given ourselves the project several times of taking one material only and seeing what you can do with it. If you have one material, a piece of paper, a snowflake; how does it join to itself? Particularly, if you can get away with not bringing even binders or anything in it becomes particularly interesting to us. Felting, or working with snow, where you can understand how something bonds to itself when you're given conditions. It appeals to us on several levels. There's a purity to it that's a psychological level. It's also to recognise [it is] very practical because it allows for easy recyclability in things. (Sandra's Transcript)

Well... we, at one point, decided that the teapot is a good example of deciding, how do you make something out of one material? Glass or borosilicate glass is a fantastic material to use in that way because you can weld it to itself. There's so many different ways to manipulate it. It has negligible coefficient of expansion so it's exceptionally forgiving in terms of how you work with it. You can heat up one spot till it melts and the other one could be sticking in ice and it's not going to fracture from a difference in thermal expansion. (Sandra's Transcript)

It's handmade paper and it's left over in the factory. He knows the owner of the factory and got the leftover of the paper from its pineapples. Pineapple paper. From pineapple. Leftovers. (Preya's Transcript)

How can I push it? It depends on the nature of the material, itself. (Preya's Transcript)

It's property. Property. It depends on the material. I can't say. But, for example, it's a translucency, or a type of sense, or smell, or how can I say it, rigidity, or colour, those defined properties. (Yoshio's Transcript)

Yeah [I am manipulating it], which is to learn physically from it ... What qualities does it have? There's nothing in particular to look at, you just start feeling it, and then what it is it is. (Sandra's Transcript)

Probably, naturally. It's a little unfair because it says the word Gecko right on it, which immediately biases you to grass. I read that, and I started thinking about the natural grippiness of a thing. (Sandra's Transcript)

Try to figure out how to use it. Because it's so appealing, tactile. Its profile, shadow, and the highlights, and the shadows, little bumps. This is very thorough. The light hits it. What's the practicality of it? What's it made out of? It's primary, one of the primary properties is its elasticity, so why not take advantage of it. For instance, why bother making it into a wall mass. It should be ... You should manipulate its properties to its maximum. There's no point in doing that. It has to be

moulded onto something or is the material itself, and can it support you? Interesting. (Greg's Transcript)

We don't know its physical properties, the practicality. How will it evolve, or something with a particular finish change colour, over the years? Change, finish? We don't know. (Greg's Transcript)

I don't like to use it because it's sexy to use. Its appropriateness is really important in the work. How will this look 10 years from now? Will my client be happy in this? ... Physical properties we don't know. They are not time-tested. (Greg's Transcript)

I'll use moulded fiberglass in a measured way that I know 100% that it's responsible, it's doing what it's supposed to do. (Greg's Transcript)

... so, it's just like, what could you do with this? Why was this? ... It makes me stick my fingers in the back of this and makes me think of ... Can you stretch it? Does it become a seat of a chair? Does it become a wall? It has these little holes in it. Do you backlight it? That's the little thing. It's looking at what is it made up of and it's almost like a wetsuit material, covered in ... It's cool. It's just like it excites me. (Lina's Transcript)

I think, if it's a new material, I think the challenge is how has it been used before and what of the properties of it, so you can understand the structure of the material or how is it fabricated. Or, if you're going to use it in a different way, making sure that whoever's fabricated it is okay with using it in this way. (Lina's Transcript)

What I do? I ... I try to see the form. The shape and form that I can make out of this. If I were a fashion designer, I think probably I [would] think, "Should be which part of the dress? Or should it be just like bag? For me, for interior designer, probably thinking of something I can make use out of this. (Preya's Transcript)

Interviewer: And when you were doing that, what were you thinking? Not just feeling. Were you projecting?

Yoshio: Yes. Thinking of kind of possibilities.

Interviewer: Yeah. Because you said: Was it used as a chair? So right away you were thinking furniture.

Yoshio: Yes. (Yoshio's Transcript)

Wow. Do they add elastomers to it? That's wild. It appears to be solid though, isn't it? (Michael's Transcript)

I see, does it deflect? Can you see light through it? Is it going to be strong or is it going to be flexible? Tactile, yeah. I have to touch it, yeah.

(Michael's Transcript)

I think one of the first things I'd like to do is see where it breaks. I often do the stress and strain test and looking at, in this case, it might be the weaving or the warping of... Smells of polymer. (Juan's Transcript)

Yeah. I'm always looking for what the threshold is of the breaking point. Second thing I like to do, if it's not opaque material, then I look for how does it react with available lighting, artificial lighting. Then I start to think about uses of external, internal elements. (Juan's Transcript)

It's probably something that might go behind a shingle, or something like that, to keep an airspace. It's not particularly rigid, so I don't know. It might be a landscape mat of some sort. It's the wrong colour for that. Maybe in a green roof, maybe it's an absorptive membrane, possibly. A water retainer, but a sponge. (Blair's Transcript)

What's its suitability for being inside? It has the ability to keep a cell, so, can we use it for anything acoustically? As far as its flame spread, has it got any VOCs, and all that stuff, get that off the list right away. Can it go inside. (Blair's Transcript)

I mean say I'm not searching [for it] myself. It came just in front of me. I would touch it, smell it. This is definitely a, a PVC product of sorts. Smells icky. So, you know, it's kind of like check its physical properties, try to understand how it could have been made... obviously this is something spun. And then see where I can use it... maybe just kind of like a mental note. But if I'm looking [at it] as project specific, then

obviously I would tear it apart a lot more. I would kind of put it through the grinder and burn it... poke it, rip it... Yeah. Smells terrible but looks good. Nice colour (Fiona's Transcript)

Well, what else do you do differently? You have this product, and what sets you apart from the other four companies in the world that take this product that starts off as not a solid and you're forming it into a solid, but you're all forming it to a sheet good. Why are you doing that? Why don't you form it into a different way, and all of a sudden, you're setting yourself apart from your competition. (Lina's Transcript)

You start back at the beginning and you say at the processing stage, "Let's think of our product differently." You're taking this moulding material, you have it. You can form it into anything. Because there was a manufacturer that thought of how to get it to a slab, everyone's going to follow that process. (Lina's Transcript)

It's looking at all the properties that each material has and how do they play together; and making sure that each person that's touching that is aware of all these sensitivities that need to be taken into consideration. (Lina's Transcript)

Primarily our librarian and some of the designers get involved. Right away she goes, "No, no, no. Yes, possibly. Yes, maybe, maybe. Get rid of this. Get rid of those." Sort of, "That's crap." At first, they were taken aback by it and almost offended by that, and now they understand. At [Greg's company] when they like something, they're not wasting their time with the other stuff. We know they're going to use it, so it's interesting. (Greg's Transcript)

A lot of our suppliers they must have first dibs on a lot of new materials, because they think, "You guys can figure out how to use these materials, so you get the first ones to figure out more than these other companies." They sort of test out what you think... It's like a lab here. They come with all this stuff, and a lot of it is crap. 95% is crap, but the five percent is fantastic. (Greg's Transcript)

I think it is important. I think it's challenging and it's relying on your supplier of that new material if they can answer your questions and make you feel confident that you're choosing something that will be backed. If something goes wrong with it, and you're the first testing ground, are you going to have the support that you need? You need to basically give that to your client, to say, "It's new, but here's the research they've done and I'm going to get them to ..." (Lina's Transcript)

Okay, for the bar, what happens if it chips? How durable is it? What happens if it's smashed? What are the properties of this material? ... [The client is] getting it first-hand and I'm not the one... It's not my product, but I'm saying, "I think it's a great product for this, but let's hear together what it is," so he has more of a comfort level as well because he's paying for it. (Lina's Transcript)

Well... Knowledge one, knowledge. Because my knowledge about the material is limited. For example, how can I say, what's the kind of limit of using that material? Like heat. The performance of the material. And also cost. And also, how it's made. Those [pieces of] information, sometimes, not enough. (Yoshio's Transcript)

They took it and did research about these fungi problem and how to dye, how to protect it, and how to treat it right. They used about more than a year to get some conclusion, solution. (Preya's Transcript)

When we got the sample that we want... from the other research and everything. We have the right way to treat these materials. Again, we have to try to see how can we make use out of this water hyacinth. I try many different ways. Weaving, make it flat and sew it together, make into just one flat sheet and you can cut it and do something with that. Weave it with the wood frame, weave it with the rattan. Every way possible, we tried many ways to make use of the water hyacinth. Then, mostly it's furniture because it suits me well. (Preya's Transcript)

Well, we started with the literal tissue paper, the wedding bells. The first full-sized wall was six and a half feet tall and 600 sheets of tissue paper. (Sandra's Transcript)

We found someone that was really interested in experimenting. They were in the opposite position. They were sitting there going, "I have all these tools and people but the things we make are completely disposable. The only thing we can compete against other companies in China that are making wedding bells and turn-keys our cost." So, it's over who's cheapest and that's the only thing anyone cares about in our industry. (Sandra's Transcript)

He really believed in the idea of making something else but with the tools they had. They experimented for two whole years before they got the Tyvek to work. Because we had to get a non-toxic glue that would be compatible with the machines, that wouldn't yellow in sunlight and wouldn't delaminate. The viscosity, everything. It seems all simple at first, that you're just going to switch out the material, but it actually takes a lot of trial and error to get everything humming and working right. (Sandra's Transcript)

Just sort of taking the risk, and then the risk has to be backed by solid research. Researching the characteristics of properties, physical properties of new material that we're using, or the technique that we're using has to stand up. (Greg's Transcript)

How I can say, appearance, and also I know the usage of the materials was a kind of ... a key to that design.... That kind of perforated metal. That is usually used for the heat insulation in the building. Or the sound insulation in the big buildings. And nobody used it for the outside of that fixture. It's usually the kind of back side, popular material. I thought, it's very light and easy to use, so I thought it's good to create a new chair using that material. (Yoshio's Transcript)

... when I get to know new material, I get the sample, and I play with it. And I check the metal kind of properties of that material. And then, I start to think of how I can apply that kind of new... property to the

design, my design. That's kind of the way I think. But at the same time, I feel, I'm more kind of open sense to that, five senses, not only visual but also tactile sense. And also, kind of, how can I say. The way I see material, it's changed. I know it was changing. (Yoshio's Transcript)

INTERVIEWER: Okay. But the idea of playing is the really important thing. And that I've noticed this consistency with others I've talked to. There's a relationship of playing with it. Right?

Yoshio: Yes. Yes.

INTERVIEWER: And when you play with it, you're thinking of the senses. Is that right?

Yoshio: Yes.

(Yoshio's Transcript)

I guess it was partly that it was a naïveté about materials at that point. I certainly would have like to have explored other materials, but I think I knew the restraints of the vocabulary I would be allowed to use in terms of materials, so I tried to manipulate them as far as I could.

(Michael's Transcript)

Completely opaque, yeah. Even though it's the exact same material, the bamboo charcoal ink that we ended up using makes it completely opaque but it's also this beautiful black that allows the lustre, the fibre, to show through, and the combination of the fibre lustre and the quality of the charcoal gave me these silvery sheens in the light. Yeah, deep shadows. (Sandra's Transcript)

If I were to play with this like my set of things, like it's akin to having a scientific method, or something where you would apply a set of things to any particular material or object. One of the things we would do is, how do you attach it to itself if you have no other materials? But you need to attach those to itself, how is that accomplished? I'd look at this and I'd start to think, well, you can probably fuse it to itself. You can probably use heat. Then so you just try that and see if that works. Chemicals probably work too, but obviously heat is easier to work with. Then, can it hold a fold? Are there different ways to crease it and make it fold? (Sandra's Transcript)

I mean it has to go in a 360 [degree] process where I start off on one point. I have to exhaust the 180 turns of where I start to think "Oh, this could be done in a completely different way or with a different material." (Juan's Transcript)

I think I first look at the way that the so-called traditional material is typically seen and articulated. Then once I understand the perceptions of how that material is conveyed or how it's used, I then look at different ways in which that same material can be interpreted. (Juan's Transcript)

Then I'm changing, altering the concepts of what I would call traditional wood, other than wobble board, or something like that. If I'm wanting to create this type of curve or this bend, then it's at that point that I start to think about other materials, what else can express that same form or formation? (Juan's Transcript)

Because folds give structure. Those two things, like how do you attach it and how does it fold, are like something you might take to any material whether it's glass or paper. (Sandra's Transcript)

I said, "I just want this line to read that it's folded, and this it's a flat part of a horizontal plane, which is just so that it defies gravity." Put a lot of weight on it, tons of weight on it. (Greg's Transcript)

So, I knew roughly it was gonna be in an exhibit, and it had to be thick enough so that the sensors and wiring was invisible, but I also thought, given the direction of Integrative Technology's 3D printed fabrics, uh, would be interesting. So, then I did the research, and... I found this sandwich material, 3D printed sandwich fabric from [manufacturer's name] in Germany, and so we got the samples integrated with the wiring. (Fiona's Transcript)

I was prototyping a material that would have hydrophobic and hydrophilic qualities, meaning like it would, portions of it would, absorb water, and portions of, of it would repel water? So, since that material is not available, or right at the proportions that I needed, so we used Scotch Guard. (Fiona's Transcript)

Extrinsic Factors: Part B—Material Project Concerns

I mean, there's so many elements that come into play when you're choosing something because this is a concept that we developed for [Client 4 XX] and it was looking at these limestone walls that reflect that of an old bank. (Lina's Transcript)

We've taken aluminium cladding and had it powder-coated and it's all backlit. The reason that we started doing that was because we were faced with two separate venues that were over a parking garage, so we were restricted with weight. Looking at aluminium as it was the lightest structure that we could have.... I think that it was the powder coating of it, looking at the durability of it in the winter, and the Canadian winters, with the salt, and it was the best product that would withstand the elements. (Lina's Transcript)

...there is a material fit to what you want to do. So, take the example of wind quills. So, we needed something that oscillated with the wind. Well then, you know, we started testing like Mylar, and then Mylar was too thin. It had a beautiful effect but then we moved to sort of thin PVC, like translucent PVC that still oscillated, but it wasn't too rigid to kind of capture that wind movement. (Fiona's Transcript)

There was a chance that because it hasn't been used in that context that it wasn't going to work because you know, most reflective fibres are within eye level, like a light has to hit the material within your vision of cone for you to see it... (Fiona's Transcript)

So, a reflective material suddenly on a building façade is not reflective at all. So, you have to kind of make it work. (Fiona's Transcript)

For this project, the starting point was, I wanted a very light flooring because the ceilings were quite low, so I wanted to maximise the light balance as much as possible... It was about light and the balance and bringing light into the centre of the apartment because there were parts in the centre that we didn't have any light or view. (Michael's Transcript)

It's a building that also works with a veneer of glass that is outside of it that is slightly reflective and gives one ray as one looks at it in elevation, and then one when one is under it, perspectively and experientially. (Blair's Transcript)

Sometimes something new, and it's not necessarily a new material, it's sometimes something new comes of the study because you're cross-fertilising two different thoughts and putting them together. In that case of the wedding bell, the speaker cone, and interest in, we were at the time thinking about urban living, and trying to live in a tiny apartment and doing a lot in it, which happened to be our situation in life at the time, but we were also realising it's an urban condition. (Sandra's Transcript)

We used 2 by 10s and we had them stacked horizontally, and our wall was 12 feet tall. We would have spaces in between, and we used steel threaded rods to clamp this whole structure together. (Lina's Transcript)

The one that floats along in the rivers is a rather short one, but the one in the small canal, it's a longer one because of the water. It's more still, I think. We test... Convincing probably... 5, 6, 7-10 different villagers to train. We go there and collect it. (Preya's Transcript)

I mean this may be a bit of an institutional setback because I don't have a lab where I could test these things... I don't always have a lab setup to just experiment at my heart's content. I have to always put it together, make it happen. It's tough each time... typically, these kinds of labs are given to engineers. It's more like tinkering in a lab setup to see what comes out of some of these experiments. (Fiona's Transcript)

Well there's external challenges and then there's internal challenges, I think. The external challenges are predicated on the framework of where I'm working with and whether it's an institution or whether it's the brief that I'm given from a client. I always look for the loopholes or I always look for the things that aren't stated so that I can try to bring

some new thinking or innovative thinking outside of the brief. (Juan's Transcript)

I think that each client brings something new to the table and pushes your envelope and you say, "Okay, well what can we do with this client?" or, "What is it they want and how can we make them think differently about what they do?" ... Then taking that and saying, "It's part of your job to educate the client and they only know what they see. If it's taking your product and using it differently, or if it's introducing them to using something the way they've never seen," I think that's the excitement of that as well. (Lina's Transcript)

There is one... organization. It's called [name of organization]". The vice-president, it's a woman vice-president of the bank. They have a project helping villagers to get more income. Their marketing people came to see me and asking me whether I'm interested in designing something out of the Water Hyacinth. (Preya's Transcript)

The client, [CLIENT X] asks to reinvent them, and one of the surest ways of reinventing them was to radically change the shopping environment for them, and how people shop, and impart a new, obviously a new look or freshness to the interior design concepts so that we can attract a new crowd of shopper that they've never had... they really latched on to an expression of materials, new materials... (Greg's Transcript)

I think that it was to bridge a gap between an 18-year old and an 80-year old. It's a family restaurant and it's having a material that an elder person would respond to, which is the stone, and yet be attractive to a younger person, which would be the aluminium and backlit. It's that marriage between the two. (Lina's Transcript)

When I understand how people perceive this world, I sometimes find new way of thinking for the material. For example, the visual impaired people, we have several workshops. And after that, I felt the way they perceive the world and the way we perceive the world are different, because we have eyes, and we can see visually. It means that we have X

and Y axis in our brain. Okay. When I see this paper, this does not show X and Y grid. So, we have a grid thinking because of have visuals. But for the visually impaired people, especially born visually impaired people doesn't have that kind of sense. Their sense is basically hands, right, and sounds. If it's about the hands and the sounds, there's no X and Y grid. It starts from one point in the spread. It's a different mentality. (Yoshio's Transcript)

It's being inspired by the client and using something that they're totally not expecting... part of your job is to interpret who it is, like if I was to take something and say, "Okay, well, if I was to apply material to this client, what would that be?" (Lina's Transcript)

[I say] "I've got something that is going to be bulletproof, and you're going to be able to maintain it every day with a can of paint, and I know how to make that material do something that you won't have seen before. It's going to dance. This is how I'm going to do it." That's the way I need to position the beginning of my projects... (Blair's Transcript)

If it's ideation, definitely, I would try. But if it's a commercial work, I need to make sure... Plus, the kind of result [that comes] out of usage, use of that new material. Otherwise, it's very dangerous... The designer should think how the product or material is used. And resolving possible problems. And, if there's a possible problem, then you need to solve that problem. In other words, without thinking of that kind of thing, it's very dangerous [just] to use new materials because it's interesting. (Yoshio's Transcript)

We didn't have a mandate from a client or anyone else telling us, "We need a chair and we need to launch it in spring." Just play. No brief at all and being able. I think that epitomises the way we definitely liked that freedom to maybe even how we might even start in one direction, but the freedom to learn from what we're doing and improvise and maybe take it somewhere that we had no idea we wanted to go [to]. That's the real gift of working with the physical world rather than the digital world. (Sandra's Transcript)

Now as an independent designer, you weigh the risks with the rewards and you hopefully engage with the right type of client who's willing to try some innovative things. It can be very challenging to convince a client to try something that's not tested or proven. Yeah. You need very liberal clients. (Michael's Transcript)

Well, you're more matured and experienced. People trust you. They respect your experience. When you're a junior designer, people will give you chances, but there isn't a trust account there. (Michael's Transcript)

We don't make it a vanity project, because we wouldn't last very long. That's part of our longevity, I think... We're dealing a lot with entrepreneurs, which, they're innovative and creative in their own way. You're using that money out of their pocket. (Greg's Transcript)

As an architect, you don't have the money, you don't control the capital. You are doing something on somebody else's pay check. I've had buildings that have just been gutted right before they go for tender. There's nothing more crushing and soul-destroying. I actually start from a position that is more conservative than it used to be. (Blair's Transcript)

... very tight budget. Client that was open to some innovations and ideas but really didn't have a lot of money to spend. How I approached this particular project from materials' point of view was to use fairly rudimentary materials like plastic laminates and just inexpensive carpets, and things like that. But really utilised them to manipulate forms and create forms and used the colour and the material to express the forms to give the energy and the excitement of the space. (Michael's Transcript)

Nothing was expensive. Nothing was hard to get. Nothing was unconventional or experimental. (Michael's Transcript)

... it is a humble little public washroom building that is a low-budget, low-nonsense kind of project. Very much a durable building, and low-budget, and all that kind of stuff. We started that project with the

lowest common denominator material, one that I have avoided working with my whole life, concrete block. It's a \$2 material. We started that, and we decided to make ourselves love this material. (Blair's Transcript)

... also a very small experimental project for us. It's a simple outdoor pavilion and rain cover. For that, we used self-consolidating concrete and conventional concrete, and worked very hard on the concrete formwork technology. Through designing the way that the formwork would be constructed and using CNC tools to cut the formwork in precise ways, we found geometries that were both orthogonal and conventional and related to the context and geometries which were non-orthogonal, non-parallel... (Blair's Transcript)

This was quite a generous budget, yeah, which allowed obviously for the expression of the materials as well as the detailing and connections and things like that. (Michael's Transcript)

Cost and... Sometimes now it's availability. All of a sudden you realise material like stone comes out of the ground, but that particular vein. You're not going to find again, or not to say I'll never find again, but you may not find it again. You're certainly not going to ask the crew to start rooting around just to find that. (Greg's Transcript)

It's the fact that there's a global movement and pressure towards consumers wanting recycled things that makes them available. Because otherwise a small company, like, we pay more for the recycled paper than we'd pay for virgin paper and that kind of thing. That's just the reality of it. Any company making things right now is in the same kind of boat, often that where the recycled one is going to be more expensive in some ways. (Sandra's Transcript)

Oh, I mean it's so much easier now I mean with access to the internet, you can find any material that really intrigues you or interests you. Living in a larger city you have greater resources and local representation of materials. (Michael's Transcript)

It's a bit of a hybrid. In the end, it's a standard white glazed brick, which is important at [client's name]. White glazed brick is their backbone vocabulary. Then, the coloured bricks that are within it, in the end, are grey and a dark grey. We had hoped that during the process... One of the researchers has a rapid prototype room. We thought we could actually get some custom-made bricks in various metals that they used... we didn't end up following through. It is, in the end, an off-the-shelf brick. (Blair's Transcript)

They were all for it and so for two years neither of us made any money from the collaboration and the time we were putting in to trying to get the stuff to work together. Now we are the biggest part of their business, by far. (Sandra's Transcript)

... practical side of what we do has changed, in other words, the money spent on materials versus labour is reversed. In other words, we spend, try to spend less on labour here in the developed world, more on materials. Material costs are so high with the unions and all these add-ons. Over in places like India or China, there's so much labour to use, so you can do some intricate work, handwork, but you can't ... You have to use local materials as much as possible, because the cost and import duties... It has changed our design, what we insert into interiors. (Greg's Transcript)

That's the main concept of this organisation. The villagers gain more income. Normally, they do... It's like, they work, go to the rice fields. They have lots of spare time, so use their spare time to do some handy work for sale. (Preya's Transcript)

You see that it's our advantage of handicrafts work. You don't have to invest in the machine. If you have machine, you have to stick with something you have to do with the machine, but in handicraft, you can do whatever. You can do thousands of samples and you don't have to invest anything out of that. Only your time... and time consuming, and people don't understand why it's so expensive. (Preya's Transcript)

From water hyacinth, I've learned that if you want to create something new, it takes lots of your time and energy. If you have to build up the business with this as well—not as a researcher that you can create some material... but only [with a] material that... can't find a market—you can't really use it. (Preya's Transcript)

So, there was no cost involved, because we hadn't paid for everything, so there was no cost involved. Basically, they lent it to us, and then we fabricated it and took it all down and shipped it back to them. There was no waste. (Lina's Transcript)

I would say it's practicality. I mean, once again, it goes back to the budget and time aspects too. I think it ultimately needs to perform at a base level of practicality. (Juan's Transcript)

There are certainly challenges with a lower budget but sometimes you have to be more creative... there comes innovation with that. I would say that it's a two-part thing with budget and time. Budget and time, if you have the two on your side, and innovation, I think that's a sandbox I love to play in. Of course, we don't always have that luxury. There are certain limitations that to come into play for sure. It sometimes is quite direct, where a client will say, "I want this. This is what has worked. This is what we would like to do." There's always the role that I feel that I need to play, or I need to bring about, where I like to push them to say, "Well, we can also do this." Then we try to explain the value of doing things differently and still meeting their target. (Juan's Transcript)

Extrinsic Factors: Part C—Material Community Consultation

I think the misuse of materials is super important. Of course, you do your due diligence, and figure out why somebody made this, what are the flame spread ratings, and what's its intended use, and all that business. Then, what can you use it for? What can you do with it? You take it apart, and you destroy it, and try to figure out what it might be. How long does it last? (Blair's Transcript)

It's probably going inside. You get your due diligence on the environmental safety and fire stuff. Then, what can it do? What does it look like from a distance? Can I put that in a ceiling? It's probably going to droop. How would I retain it? If you fire holes through it or pins through it with good washers, that would be interesting, because it will have some acoustic absorption. Is there any STC rating? (Blair's Transcript)

Has anybody done any testing on it? Usually you come up against that right away. Has anybody tested it for anything, and am I going to be on the hook for trying to get somebody to use it and pay for the testing? You want to know all of that stuff right away. (Blair's Transcript)

Yeah because I mean we have liabilities. We have responsibilities so yeah, but I don't let that deter me from trying something new or attempting to try something new. (Michael's Transcript)

They are old materials that we won't use or avoid using. I love to use, I love to use nickel plate. To get the impact, that warm, metallic, white metallic finish, but it's highly toxic. The whole process. (Greg's Transcript)

There's no building codes, no railings, it's made out of snow. Nobody cared but it's a public room. If you made a public room out of anything but snow, somebody—in a North American city—somebody would be after you to make sure the railings were there if the kids were running around and platforms ten feet in the air... because it was made of snow and everything on this entire project even though it was a very public project and planned well in advance, the only building material is snow... that's outside of people's preconceived notions of what a building inspector would pay attention to... (Sandra's Transcript)

What I'm experimenting with really is just in lab context and then conceptual exhibition or experimental space concept that I'm able to exhibit. To date, I can't really build anything in real life because it hasn't gone through the life span of developing it, testing it, further research, tested some more. (Fiona's Transcript)

"I can't believe how many hours have gone into it." It's like, well, no one's ever done it before. If you want to take a leap of faith and you're wanting something that is completely unique, then you have to understand that hours have to go into it to research if this can be done. (Lina's Transcript)

... patenting as well, because some of these ideas were really interesting and people approach me, like businesses approach me, to turn it into an idea but I have no background in patenting... So, I went the academic route [in] which you publish and then you lose all your IP... in order to turn into a product or work with a company, you have to keep your IP rights. You can't, you can't talk about it up until the patent is resolved. (Fiona's Transcript)

I started to think about what is the availability and what are the normal sizes of materials? That eventually was a great service to me because then I started to think about budgets as well. (Juan's Transcript)

When you look around at the built environment, when you look at downtown [name of city], so much of the quality of the environment is defined by the systems that the architects used. The systems that the architects used, especially not in that scale building, you're building a contemporary city, they're going to be almost predetermined. Everybody's using the same thing over and over again. They're only going to experiment or do anything outside of the box in a really marginalised way. (Sandra's Transcript)

It's also at that point in the building process if you're making a building and you have two trades meeting, it's that the spot between two materials is the one where everybody is pointing past each other going, "That's not my problem." It can often, that spot between two materials usually adds cost to a project, can cause problems in detailing, different things like that. (Sandra's Transcript)

There're different types of cross-fertilisation. We might make a new material with these guys out at [local university], right? That's the idea. (Sandra's Transcript)

They're friendly and all and they made us our wall but as soon as it came to experimenting and trying to ... We wanted to use the Tyvek straight away. We wanted to try that. They'd give it one shot, or whatever, and then it didn't work out. Because the laminations weren't holding, and it just wasn't working. They weren't willing to keep trying because they already had a business, it just wasn't their interest. (Sandra's Transcript)

There's such a long tradition, particularly in glass in Europe. This is something that men who are craftsmen do. They make the glass. They don't design what's made with it, almost never, but it's a highly skilled profession. It's done by men and the design is done by somebody else. There's a lot of boundaries around it that have been there for hundreds of years since Moreno when no one was allowed off the island ... (Sandra's Transcript)

Well from suppliers and I think it then trickles down then to the design community because if they only feel that there are only X number of materials available... that's what they work with rather than seeking out ones that aren't just common or emerging. (Michael's Transcript)

Why were tradespeople not willing to work with them? That was always a limiting factor, as is the trade's reluctance or being afraid of trying new materials or exploring new materials. (Michael's Transcript)

Working for someone years ago, you're limited to the limitations that they place upon you. Saying, "Oh, well that'll never work. That's too expensive. It's not gonna stand up. It's not gonna be durable." All sorts of things. (Michael's Transcript)

I would suggest a particular material such as break bent steels that could be powder coated or something like that, but it still needed to perform with lightweight characteristics, had to be modular, had to

withstand extreme temperatures through transportation. Then they came back with a couple of options... which... really sparked this secondary level of dialogue that was now transcending the initial form. Because we started to come to a solution of this lightweight material that could break apart but be reinforced. It ended up being this laminated corrugated cardboard, which was perfect, especially for transportation purposes and very economical in that way for that purpose. (Juan's Transcript)

It's a chess game. You are, as I said earlier, you're trying to maintain control... However, if I'm not really careful about how I script and manage that conversation, I know that individual has the ability to make a conversation about a material all about economics, buildability, schedule, and so on, and maybe not at all about poetry, longevity, legibility, what's the building saying. (Blair's Transcript)

He's really important for my work, because he makes our materials come alive. He's a... I call him a lighting painter, because he paints... our materials and brings the best out of them or makes other parts recede that are not important. He works the material... More successfully, if I come with materials with me. Explain what I'm trying to... what those materials are trying to do. He brings up the best of it. (Greg's Transcript)

That's one of the things I think that we've figured out. How to best use these, the crafts, the crafts people there. How do you use whatever they're good at, and use that technique in a different option, instead of on the screen, maybe on a piece of furniture? (Greg's Transcript)

It's hard to get floor to ceiling height slabs of stone and [get them] installed, because unions would refuse to do it in North America. Anyway, I don't know about Europe or other Western countries, but they won't touch them. Can't get them. You have to cut it down to a smaller size. Because of the danger, health and safety matter. In India you see these walls, bathrooms full-on, thick walls, book matched. (Greg's Transcript)

... we have put a fireplace around the structural column and calling people and saying, "We have this idea," and people are saying, "No. We don't want to do it," because everyone's afraid of it. My thing is like, "Okay, we're going to have it built and you are going to be sorry that you weren't the one doing it." (Lina's Transcript)

Beyond their vision of what they could do with their materials... because I think that each of us get caught in what it is that we're doing in life. If no one questions that or doesn't ask anything different from you, then you'll continue doing the same thing. (Lina's Transcript)

I think if we have lots of collaboration between material researcher and a designer, you can achieve something. (Preya's Transcript)

The black took a long time because we weren't happy with any of the first test and samples we got back when we asked our manufacturer to make a black version. (Sandra's Transcript)

It's funny, because [industrial designer's name] is more like that which is a classic industrial designer. He doesn't understand the sensuality component, the romance component. He'll only go so far into the tactility of the material but doesn't understand what happens when you reduce or increase the radius of the leg. (Greg's Transcript)

... there are a couple of people I enjoy working with but not everybody has the time and energy to invest in some of these conceptual prototypes. (Fiona's Transcript)

I came back thinking, I will never take no for an answer anymore, and I haven't. I always want to know why. It was everyday it affects me. When we looked at the structure for Oakville and sitting around at the table with 20 people and everyone's saying, "No, you can't do it because it's over a parking garage." We'll be saying, "Well, why?" Then, "Well, the square footage of the pounds per square foot will not allow that." I'm like, "Okay, well what are the pounds per square foot?" It's just keep asking and asking and asking until you've exhausted it. If the answer is no, then you know you've at least tried. (Lina's Transcript)

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