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Know-about, know-that, know-how:

A model for moving between theory and design practice

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Abstract

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Everything is designed. From the fork you hold in your hand, to the car you drive, to the public transportation you use, to the mechanisms for justice within a society, to the process of designing itself. Embedded in these designs are the assumptions that underlie the design methods and toolkits used in the design process. In practice, design happens through the application of methods (processes that result in design outcomes), toolkits (materials that support the implementation of methods), and heuristics (the skillful application of methods and toolkits) (Friedman & Hendry, 2019; Hendry, Friedman & Ballard, 2021; Nelson & Stolterman, 2012). Methods and toolkits originate within particular worldviews (Ansari, 2019) and carry with them the assumptions of those worldviews. For example, journey maps, a design method that originated and is used in industry, assume linear time and often ignore the material aspects of the experience at hand. Conversely, traditional methods for making coconut milk developed in Papua New Guinea, outside the dominant Western interpretations of time, allow for spending time together but take longer to enact (Wajcman, 2015). But there are always different ways of doing things, different worldviews, and different assumptions to bring to bear in a design situation. Designers can bring those different assumptions into a design situation by adapting design methods to account for new theoretical constructs. But in what ways does theory inform design methods and toolkits? How can this relationship

be modeled? Can a model of the relationship between theory and design methods and toolkits be used to help translate specific theoretical constructs into established design methods and toolkits? If so, then could this model and the associated skills be taught to novice designers as they adapt design methods?

In this dissertation, to gain traction on these questions, I begin by developing a bi-directional model of knowledge types – *know-about*, *know-that*, *know-how* – in design to describe how theory informs design practice and vice versa. While the model of knowledge types in design is bi-directional, to contain the scope of this dissertation I focus the remaining work on only one direction: from theory to practice. To demonstrate how the model of knowledge types in design could be used to guide the adaptation of design methods, I apply it to eight theoretical constructs (four about materiality and four about temporality) to translate theory-to-practice commitments for each construct and then use those commitments to adapt one established method, journey maps, and one established toolkit, Envisioning Cards. Then, I report on a brief educational case study, demonstrating how novice designers can use the model to adapt established design methods. Then, drawing on the above, I offer heuristics to guide others as they adapt design methods and toolkits. Finally, I reflect on the work of adapting design methods and toolkits as a design process and the flexibility of design methods and toolkits as a lever for incorporating theoretical constructs into design practice. This dissertation makes the following contributions: 1) a bi-directional model of knowledge types in design to describe how theory can inform design practice and vice versa; 2) one adapted design method; 3) one adapted design toolkit; 4) an educational case study exploring the use of the model of knowledge types in design as a tool for teaching method adaptation; and 5) heuristics that novice designers, design researchers, and practitioners can use to adapt other design methods and toolkits.

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Chapter 1: Introduction

Everything is designed. From the fork you hold in your hand, to the car you drive, to the public transportation you use, to the mechanisms for justice within a society, to the process of designing itself. Embedded in these designs are the assumptions that underlie the design methods and toolkits used in the design process. In practice, design happens through the application of methods (processes that result in design outcomes), toolkits (materials that support the implementation of methods), and heuristics (the skillful application of methods and toolkits) (Friedman & Hendry, 2019; Hendry, Friedman & Ballard, 2021; Nelson & Stolterman, 2012). Methods and toolkits originate within particular worldviews (Ansari, 2019) and carry with them the assumptions of those worldviews. For example, journey maps, a design method that originated and is used in industry, assume linear time and often ignore the material aspects of the experience at hand. Conversely, traditional methods for making coconut milk developed in Papua New Guinea, outside the dominant Western interpretations of time, allow for spending time together but take longer to enact (Wajcman, 2015). But there are always different ways of doing things, different worldviews, and different assumptions to bring to bear in a design situation. Designers can bring those different assumptions into a design situation by adapting design methods to account for new theoretical constructs.

But, in what ways does theory inform design methods and toolkits? How can this relationship be modeled? Can a model of the relationship between theory and design methods and toolkits be used to help translate specific theoretical constructs into established design methods and toolkits? If so, then could this model and the associated skills be taught to novice designers as they adapt design methods? To engage these questions, I begin in Chapter 2 by situating this work in design literature, focusing on the relationship between theory and practice as well as work in the field of human-computer interaction focused on the adaptation of methods and toolkits. In Chapter 3, I introduce my research questions and approach. Then, in Chapter 4, I introduce a bi-directional model of knowledge types in design to describe how theory can inform design practice and vice versa. This model, originally developed to describe how design and theory work together in the context of value sensitive design (Hendry, Friedman & Ballard, 2021), is generalized here to describe working between theory and practice in a broader sense. While the model of knowledge types in design is bi-directional, to contain the scope of this dissertation I focus the

remaining work on only one direction: from theory to practice. In Chapter 5, to demonstrate how the model of knowledge types in design is used, I apply it to eight theoretical constructs to translate theory-to-practice commitments for each theoretical construct, and then use those theory-to-practice commitments to adapt one established design method, journey maps, in Chapter 6, and one established design toolkit, Envisioning Cards, in Chapter 7. In Chapter 8, I introduce a brief educational case study, demonstrating how the model can be used by novice designers to adapt established design methods. In Chapter 9, I offer heuristics, based on my experience adapting design methods and insights surfaced during the case study, to guide novice designers, design researchers, and practitioners as they adapt design methods. In Chapter 10, I close with reflections on the relationship between theory and method and a discussion of this work's limitations and open questions.

There are three interests motivating this work. First, I am interested in work that happens in the space between theory and practice. Within design, the precise nature of the relationship between theory and practice is not settled. On the one hand, scholars have long discussed the relationship between theory and practice as a gap (Rein & White, 1981; Rittel & Webber, 1973; Roedl & Stolterman, 2013). Various reasons have been put forward to explain why this gap exists, which are further described in Chapter 2. Other design scholars conceptualize theory and practice as one in the same (Escobar, 2018). However, these articulations of practice and theory as one deny the need for work between theory and practice to be mediated through translation which I argue for in this dissertation. The model of knowledge types in design and the work in this dissertation provides one example of how to work between theory and practice, and the work in Chapters 5-9 provides design and empirical examples for moving from theory to design practice.

Second, the adaptation of design methods and toolkits using theoretical constructs opens space for new insights, new ways of working with theory, and new ways of working within a design situation. By this reasoning, any method or toolkit and any set of theoretical constructs would be interesting for exploring new ideas through adaptation. For example, one could consider the theoretical construct of intersectionality (Crenshaw, 1989) and explore how identity plays a role in a design method like personas (Carroll, 2003). Or one could take up critical race theory (Delgado & Stefancic, 2023) and explore the

ways that race and racism interact with privilege in the context of a design toolkit like the Thing from the Future cards (Candy & Watson, 2018).

Third, conventional design methods and toolkits developed under the dominant logics and mainstream ways of thinking about time and materials have led to a current situation in which our time is increasingly compressed and the material nature of our design work is often overlooked. Modern design, as situated within mainstream assumptions about materials and time, consumer capitalism and technoscientific futurity, has inherited several defining characteristics of these dominant logics such as a linear perspective of time with an orientation toward the future and a focus on novelty, innovation, and progress (Escobar, 2018; Nelson & Stolterman, 2012; Redström, 2017). These assumptions are often implicit features of design projects which seek new and innovative solutions to existential problems. But these logics face a growing number of well-articulated critiques, from the effect on the environment (Puig de la Bellacasa, 2017; Tsing, 2015), to the unsustainable affective pressure of living in constant anticipation of the future (Adams, Murphy & Clarke, 2009). Methods and toolkits originate within certain logics and enact, often implicitly, the foundational assumptions of those logics. By adapting methods and toolkits that originated within the dominant logics to account for new theoretical constructs that challenge our preconceived notions of time and materials, we can open new spaces and new ways of thinking about design from the perspective of temporality and materiality. Specifically, I am interested in how engaging theory in design can challenge the dominant logics related to materiality and temporality. This motivation leads me to choose a set of theoretical constructs related to materiality and temporality with which to do the proof-of-concept work in Chapters 5-9. Throughout, I use this dissertation to explore knowledge in design, the relationship between theory and design, and the adaptation of design methods broadly, doing so using materiality and temporality as conceptual levers with which to do that work.

Given these motivations my dissertation has three main audiences. First, in a broad sense, this dissertation will be of interest to design researchers who are interested in types of knowledge and how to move between them, in particular design researchers who are interested in navigating between theory and design practice. These design researchers will be most interested in the model of knowledge types in design and how it might be applied to theories and practice elements different from those explored in this dissertation. Second, this dissertation will be of interest to design researchers and practitioners engaged

in the work of challenging the status quo in design. These design researchers and practitioners will be most interested in the specific, critical theories I select in Chapter 5 and how I mobilized them in design practice in Chapters 6 and 7. Last, this dissertation will be of interest to novice designers seeking to learn how to apply theory in design practice. Novice designers will be most interested in reading Chapters 5, 6, 7, and 8 as case studies for how to mobilize theory in design practice and the heuristics in Chapter 9 as guidance for how to adapt design methods and toolkits skillfully. All three audiences will find in this dissertation a process for moving between theory and practice by translating theoretical constructs into theory-to-practice commitments with which to design methods and toolkits.

This dissertation makes the following contributions: 1) a bi-directional model of knowledge types in design to describe how theory can inform design practice and vice versa; 2) one adapted design method; 3) one adapted design toolkit; 4) an educational case study exploring the use of the model of knowledge types in design as a tool for teaching method adaptation; and 5) heuristics that novice designers, design researchers, and practitioners can use to adapt other design methods and toolkits.

Chapter 2: Background

This dissertation is primarily focused on navigating between theory and practice by translating theoretical constructs into theory-to-practice commitments with which to adapt design methods and toolkits. To situate this work, I provide a brief overview of 1) the gap between theory and practice and ways of moving between the two; 2) design methods and toolkits, including a brief history, critiques, and the role of methods and toolkits in design education; and 3) previous work to design and adapt design methods and toolkits in the field of human-computer interaction.

2.1 The Gap Between Theory and Practice

The gap between theory and practice has been long discussed in the academic literature of design using a variety of language (Nelson & Stolterman, 2012; Redström, 2017; Rittel & Webber, 1973; Schön, 1987). Sometimes called the theory/practice gap, the science/design gap, or the research/practice gap, scholars have long problematized the perceived distance between theories or theoretical knowledge generated through research in the academy and “real-world” practice. The Oxford English Dictionary (2023) defines the term “theory” as “an explanation of a phenomenon arrived at through examination and contemplation of the relevant facts; a statement of one or more laws or principles which are generally held as describing an essential property of something.” Within the field of human-computer interaction, the term is ill-defined despite being often used, especially in the context of discussing a gap between theory and practice. Building on the Oxford English Dictionary definition, I use the term “theory” to describe the knowledge, often produced in academia, through research for the purpose of explaining complex social and natural phenomena.

Donald Schön took up the relationship between theory and practice in the context of professional education within university settings, problematizing the assumption that research-based knowledge is useful for professional practice. Schön said about this gap that, “In recent years there has been a growing perception that researchers, who are supposed to feed the professional schools with useful knowledge, have less and less to say that practitioners find useful” (1987, p 10). Here, Schön was questioning the role of knowledge produced by research for the practice-based professions such as architecture, law, and education.

Some, such as Rein and White (1981), attribute this gap to the separate agenda and incentive structure developed within academia, which does not prioritize the needs of the professions. Others, like Schön (1987) and Rittel and Webber (1973), attribute the gap to the fundamental task of problem definition. In research and in professional education, problems are clearly articulated and well-bounded. But in practice, problem definition is a much more complex task, full of uncertainty and value tensions, which Schön calls “indeterminate zones of practice” or “the swampy lowland” and which Rittel and Webber called “wicked problems.” As Rittel and Webber describe, in practice there are often “no ‘solutions’ in the sense of definitive and objective answers” (1973, p 155).

In my own home discipline of human-computer interaction, some researchers similarly problematize the theory/practice gap. Historically, it has been challenging to apply basic research in solving classic human-computer interaction challenges (Rogers, 2004). More recently, there are claims that design research produced in academia does not consistently meet the needs of the design practitioners identified as the audience (Rogers, 2004; Stolterman, 2008; Roedl & Stolterman, 2013). In an analysis of research papers at a large human-computer interaction conference, Roedl and Stolterman (2013) found that researchers tend to overgeneralize design practice and lack consideration of the practical challenges of design practice.

Still others question the articulation of the theory/practice gap as a problem to be solved. Beck and Ekbja (2018) reposition the theory/practice gap as a generative metaphor, in itself a problem framing that directs researcher attention toward specific solutions and not others. Beck and Ekbja argue that by taking the theory/practice gap as an obvious problem, researchers instinctively adopt a problem-solving approach. But, by exploring other metaphors for the relationship between theory and practice we can arrive at different conclusions, like “practice is a kind of theorizing” (Beck & Ekbja, 2018, p 9).

Gap or no gap, I am interested in working between theory and practice, two distinct types of knowing and doing. In the following section I describe different ways of moving between theory and practice.

2.1.1 Moving Between Theory and Practice in Design

There are several different ways of working between theory and practice in design. Redström, in his book *Making Design Theory* (2017), describes three main tactics for how theory and design currently work

together – *parallels*, *sequencing*, and *intermediaries* – and introduces a new way of conceptualizing design as a theory-building endeavor which he calls *programs*. Here, I draw on Redström’s language about theory in design to articulate ways of moving between the two and outline how I intend to do so in this dissertation.

Parallels describe the relationship between theory and design where the two are distinct ways of knowing and doing, operating alongside each other independently. Sometimes, bridges are built across the gap, when designers use theory to reflect on design work after the fact. As an example, Redström offers the work of Maarit Mäkelä (2006) who took a retroactive approach, using theory as a lens through which to reflect on, analyze, and critique her own artistic work. Mäkelä first put together a portfolio of artistic work and then reflected on that work using feminist theories. Here, the design work and the theory work are held separately, operating in parallel. In this dissertation, while I do conceptualize theory and practice as distinct ways of doing and knowing, I do not use the parallels approach as Redström has articulated.

Sequencing describes the relationship between theory and practice where theory informs and is used to modify design. As an example, Redström offers the Home Research Institute in Sweden, which, drawing on theories from medical and behavioral sciences as well as political efforts to change society through design, transformed Sweden’s standard of living from among the lowest in Europe to the highest. Redström contends that it is rare that the work of design in sequenced arrangements influences the theories which are used, but I argue that this is more a relic of disciplinary divisions and practices and not because sequenced design work is not a theory-building exercise. Indeed, Redström’s characterization of sequencing overlooks work in human-computer interaction which already engages in theory building, as there are approaches within human-computer interaction which take a sequenced approach in that they draw on theory from outside of the field, while also doing deeply theoretical work through design. One example of this material speculation (Wakkary et al., 2015), which draws on theories from analytical philosophy and literary theory to create counterfactual artifacts. In their work on the tilting bowl, Wakkary and colleagues (Wakkary, Oogjes & Behzad, 2022; Wakkary et al., 2018) use the tilting bowl as a counterfactual artifact to explore the relationship between humans and artifacts as they mutually shape

each other through mediation. This work, while it does engage in sequencing, is also focused on building theory by exploring a design situation using design artifacts.

Intermediaries are design “theories” which sit between the universal and the particular (Nelson & Stolterman, 2012). They are able to generalize across multiple design situations (and so one level above the particular) but they are not generalizable across all design situations (so one level below the universal). As an example, Redström offers the work of Rune Monö in industrial design (1997), which Redström argues is a form-language, or an intermediate level of theoretical abstract in design. I argue that design methods are a type of intermediary, something that is generalized across multiple design situations though not necessarily across all of design.

Programs are Redström’s way forward for thinking of design as a theory-building endeavor. Programs, Redström argues, can allow designers to work with “a diverse set of inherently unstable and transitional worldviews.” Here, Redström is trying to reconcile the nature of theory in other disciplines – which is stable and striving toward universality – with the nature of design – which needs to account for changing contexts over time and is more concerned with the particular. As an example of a design program, Redström offers his work with Lars Hallnäs on slow technology. In their work on slow technology, Hallnäs and Redström (2001) began with an initial articulation of the design space – the program – and began a series of design experiments to explore the problem space followed by reflection on the results to reformulate the design program.

To extend Redström’s language, I argue that sequencing can take place at multiple levels: in the particular, such as in the example of the Swedish Home Research Institute above, or at the intermediate level. In this dissertation I engage in a form of sequencing at the intermediate level, using theory to influence the adaptation of design methods and toolkits which can be applied across design situations.

2.2 Design Methods and Toolkits

Elements of design practice include design methods and toolkits which are the primary focus of this dissertation (Hendry, Friedman & Ballard, 2021). Design methods, as defined by Grant (1979), are “step-by-step, teachable/learnable, repeatable and communicable procedures to aid the designer in the course of designing” (p 1). Design toolkits are a collection of resources (digital or physical) that support design

investigations or the execution of design methods (Hendry, Friedman & Ballard, 2021). In this section I give a brief history of design methods and toolkits, outline some critiques of design methods and toolkits, and discuss the role of methods and toolkits in design education.

2.2.1 A Brief History of Design Methods and Toolkits

While design predates human history, design methods and toolkits are relatively new phenomena. For concise, early histories of design methods see Cross (1980) and Cross (1993), which I summarize here.

After World War II and during the second industrial revolution, there was a strong desire to rationalize or “scientize” design. This is the approach taken by Herbert Simon in his work to create a “science of design” (Simon, 1969). Throughout the 1960’s and 1970’s a series of conferences convened with the goal of systematizing design using logical, rational techniques. Leading proponents of this movement, including Christopher Alexander and John Christopher Jones, argued that design problems were becoming too complex for the limitations of intuitive design methods and traditional craft techniques. Thus, the need for design methods was articulated and early design methods were created. The first wave of design methods of the 1960’s and 1970’s focused on systematic or logical approaches to design, for example, Alexander’s problem decomposition method (Alexander, 1964). Later, both Alexander and Jones would disassociate themselves from the design methods movement, with Jones going so far as to say that he disliked the “continual attempt to fix the whole of life into a logical framework” (Jones, 1977).

In response to shifting attitudes about equity, and the lack of success of systematic design methods from the first wave, design methodologists shifted to more participatory methods, emphasizing the designer’s role as “midwife” who facilitates the design work of other stakeholders in the design situation. While these methods took root in architecture and urban planning, they did not initially take root in engineering or industrial design. Eventually, participatory methods were taken up in human-computer interaction in the United States, following decades of use in Scandinavian contexts (Ehn, 1993). Today, design methods are created by a wide variety of designers both within academia and industry and are an active area of research within the field of human-computer interaction (Daalhuizen, 2014).

Design toolkits have evolved alongside design methods, as mechanisms for designers to distribute design knowledge across contexts. As defined by Mattern (2021), a toolkit is a “collection of tools and materials designed to script a particular process, aimed to serve a particular purpose.” Toolkits,

as Petterson and colleagues (2023) argue, are a way for creators to “efficiently distribute knowledge from a position of authority” (p 5). In human-computer interaction, toolkits take a variety of forms, both digital and physical, and card-based toolkits are a popular medium for design toolkits. Some of the earliest examples include the House of Cards (Eames & Eames, 1952) and the Meta Cards (Crickmay & Jones, 1972). More recent examples of popular card-based toolkits include the value sensitive design Envisioning Cards (Friedman & Hendry, 2012), the IDEO Method Cards (IDEO, 2003), and the Tarot Cards of Tech (Artefact, 2017). (For an excellent overview and analysis of card-based toolkits see Hsieh et al., 2023.) Despite their foothold in the human-computer interaction field, there are critiques of both methods and toolkits, which I outline below.

2.2.2 Critiques of Design Methods and Toolkits

Here I describe two main critiques of methods and toolkits: that they are not useful in practice, and that they encode, without reflection, the worldviews and assumptions of their originators.

Challenges to uptake. Seemingly, from the earliest days of the design methods movement, some have asserted that design methods are not useful in design practice. After a brief foray into the world of systematic design methods, Christopher Alexander (1971) said, “There is so little in what is called ‘design methods’ that has anything useful to say about how to design buildings that I never even read the literature anymore.” Even though Alexander distanced himself from approaches focused on rational or systematic design methods, Alexander (Alexander et al., 1977) would later go on to develop his famous pattern language approach to design. More recently, others have made similar arguments about the practical applicability of methods and toolkits developed within human-computer interaction. Daalhuizen (2014) argues that one factor contributing to lack of uptake of design methods is that they are developed with a primary focus on method as process and outcome, as opposed to focusing on the flexible nature of design practice or centering the designer as method user. More recently, Hsieh and colleagues (2023) surveyed design practitioners in Taiwan and found that one of the main barriers to use of card-based design toolkits is that generally card-based toolkits do not match the requirements of practical design work or provide utility for completing tasks. At the same time, other evidence indicates that some methods are productively applied in practice. In 2004, Rogers surveyed practitioners in the United Kingdom and United States and found that they used a wide variety of methods including scenarios, storyboards,

sketching, prototypes, and field studies. More recently, Harrison and Tatar (2011) argued that many of the least frequently taught and researched methods in human-computer interaction (e.g., personas, affinity diagrams, and card sorting) are some of the most widely used methods in industry design practice.

Worldview. A more damning critique of methods and toolkits, best articulated by Ansari (2019), is that because they originate within specific worldviews, they embed cultural assumptions even while being positioned as universal solutions that can be used by anyone, anywhere. Efforts to reach cultures outside of the first-world, English-speaking countries where methods and toolkits are frequently developed tend to be limited to translation of existing content, as opposed to deeper engagement with other cultures' perspectives of design. Ansari argues that as design methods and toolkits, and indeed the larger project of design thinking, are exported to other cultures they crowd out existing voices in design practice that offer alternative framings of design, thus erasing the very voices they aim to empower through design.

Despite these challenges and critiques, methods and toolkits continue to be developed by researchers and practitioners alike and incorporated in curricula for undergraduate and graduate design courses.

2.2.3 The Role of Design Methods and Toolkits in Design Education

An interesting feature of Grant's (1979) definition of design methods is that they are teachable/learnable, an early articulation of the connection between methods and design education. Indeed, others have argued that methods are a core way we transmit design knowledge across contexts and through domains (Daalhuizen, 2014). It is no surprise, then, that design methods and toolkits have a strong foothold in human-computer interaction education. Wilcox and colleagues (2019) surveyed human-computer interaction educators and found that 80% of educators stated that design methods were a top learning goal for students. An important part of learning design is not just the downloading of design methods, but the learning of the method mindset (Andreasen, 2003), which consists of both mastering the proper use of method and the ability to judge the appropriateness of using one method over others. One approach to teaching the method mindset is the "It's just a method!" pedagogy from Harrison, Back, and Tatar (2006) in which students learn and apply a large number of methods, and, critically, reflect on the application of methods to the design situation. The result, Harrison, Back, and Tatar argue, is that students come away

from the course with the ability to reflect on the process of designing and how method choice affects design outcomes.

Another component of teaching the method mindset, and the approach explored in this dissertation, is to teach method adaptation. Harrison and Tatar argue that “To train good and great designers, we must make students aware of their design situation and give them permission to make and remake methods as needed” (2011, p 11). Others have argued that learning to adapt methods for needs in a specific design situation or context is a core element of professional design practice (Gray, 2016). In the educational case study reported in Chapter 8, I explore the use of theory related to materiality and temporality as an input in teaching the adaptation of design methods to novice designers.

2.3 Designing and Adapting Design Methods and Toolkits

Adapting existing design methods and toolkits or creating new ones is of great interest to the human-computer interaction community, both from a design research and practitioner perspective as discussed in Section 2.2.1 and from an educational perspective as discussed in Section 2.2.3. While many have raised the critique that methods are not taken up in practice, the work of creating or adapting methods and toolkits within the design research community continues apace (Daalhuizen, 2014). Recent examples of methodological innovation include sensory probes (Gayler, Sas & Kalnikaitė, 2021), the future ripples methods (Epp et al., 2022), and situated participatory design (Stegner, Senft & Mutlu, 2023). Recently developed toolkits include the Building Utopia Toolkit (Bray et al., 2022), the Work Kit of Design Fiction (Near Future Laboratory, 2023), the Responsible & Inclusive Cards (Elsayed-Ali et al., 2023) and the Human AI eXperience (HAX) Toolkit (Amershi et al., 2019).

Within my home field of value sensitive design, the creation or adaptation of methods to enact theory in design is of central focus, and I situate this dissertation work in the context of methodological development within value sensitive design. Value sensitive design is a field of study within human-computer interaction focused on the foregrounding of human values in the technical design process (Friedman & Hendry, 2019). Over the three decades of work of value sensitive design across a variety of different technologies, researchers developed or adapted several design methods and toolkits. In 2017, Friedman and colleagues published the first collection of value sensitive design methods, reflecting on the

work of previous projects and articulating the specific methods which were developed or adapted as a contribution to the design field. Value sensitive design methods offer guidance on how to engage in value sensitive research and design, enact the theoretical constructs of value sensitive design, and are intended to be integrated into existing design practices (Friedman, Hendry & Borning, 2017). Value sensitive design methods include value scenarios (Nathan, Klasnja & Friedman, 2007; Yoo et al., 2013), value sketches (Friedman et al., 2002; Woelfer et al., 2011), and stakeholder tokens (Yoo, 2017). Value sensitive design toolkits include the Envisioning Cards (Friedman & Hendry, 2012), the Multi-Lifespan Envisioning Cards (Yoo et al., 2022), and Judgment Call (Ballard, Chappell & Kennedy, 2019). In this dissertation, I build on the previous work of adapting design methods and toolkits in the tradition of value sensitive design, bringing theories of materiality and temporality into focus.

Chapter 3: Research Questions and Approach

3.1 Research Questions

In this dissertation, I take up four research questions: (R1) In what ways does theory inform design methods and toolkits? How can this relationship be modeled? (R2) Can a model of the relationship between theory and design methods and toolkits be used to help translate specific theoretical constructs into established design methods and toolkits? (R3) If R2 can be answered in the affirmative, then could this model and the associated skills be taught to novice designers as they adapt design methods? (R4) What heuristics can be employed when adapting design methods and toolkits to better account for new theoretical constructs? In the following sections, I outline my approach to engaging with these questions.

3.2 Research Approach

Engaging these research questions requires a tripartite approach: conceptual, design, and empirical investigations. In response to R1 and to begin addressing R2, a conceptual approach is needed to develop a bi-directional model of how theory can inform design methods and toolkits and to translate theory-to-practice commitments from a set of theoretical constructs. I take a design approach to answering R2 and R4, using the theory-to-practice commitments to adapt one design method and one design toolkit and to synthesize heuristics to guide method adaptation more generally. And in response to R3, an empirical approach is needed to provide evidence that the model of knowledge types in design can be used by novice designers to adapt design methods. Together, the three investigations provide a view of the research questions that the approaches in isolation could not offer (Friedman & Hendry, 2019).

So, in what ways does theory inform design methods and toolkits? How can this relationship be modeled? I engage R1 by generalizing a conceptual model of knowledge types in design in Chapter 4. This model, previously published by Hendry, Friedman, and Ballard (2021) to describe how design and theory work together in the context of value sensitive design, provides a structure to describe one way that theory can inform design practice and vice versa. While the model is bi-directional – describing how theory can inform design practice and vice versa – to contain the scope of the dissertation the work of

Chapters 5-9 explores the model's use in one direction – that from theory to practice. To demonstrate how the model of knowledge types in design can be used, in Chapter 5, I show how theoretical constructs can be translated to theory-to-practice commitments. Specifically, I chose to work with eight theoretical constructs that challenge mainstream perspectives on materiality and temporality. To select these constructs, I identified candidate pieces of literature related to materiality or temporality (or both) and which fit into a framework to describe human relationships with materiality and temporality at different levels of abstraction (individual, institutional, societal, and global). I then chose two pieces of literature at each level of abstraction (one for materiality and one for temporality) by 1) identifying which pieces were “sticky;” 2) engaged with critique of the mainstream perspectives on materials and time; and 3) were accessible to a broad audience. I identified a theoretical construct from each of the eight selected pieces, then I used the model of knowledge types in design to translate theory-to-practice commitments for each theoretical construct. This work provides a bi-directional model of knowledge types in design establishing a way to conceptualize relationship between theory and design method and toolkits in relation to R1 and demonstrates its application to theoretical constructs in order to translate theory-to-practice commitments, laying the groundwork for R2.

With this conceptual framing, both the model and the specific theory-to-practice commitments translated using the model, I then turn to the substance of R2: can a model of the relationship between theory and design methods and toolkits be used to help translate specific theoretical constructs into established design methods and toolkits? To engage this question, I took a design approach, using the theory-to-practice commitments from Chapter 5 to adapt an existing design method: journey maps (Chapter 6) and an existing design toolkit: Envisioning Cards (Chapter 7). Approaching this issue from the level of method and toolkit is compelling for several reasons. First, methods and toolkits are developed from specific cultural points of view (Ansari, 2019) and reflect and embed the assumptions of the logics in which they are developed. Thus, adapting methods and toolkits in response to theory-to-practice commitments that challenge mainstream ways of thinking about materials and time is one way to engage the dominant logics in the context of design practice. Second, methods, as a set of processes for practicing design, and toolkits, as materials that support the implementation of methods, are easily reconfigurable and often adapted for new contexts and purposes. In this work, I harness the adaptability

of methods and toolkits and their usefulness as vehicles for attention to inspect, reflect on, and adjust how we do design work by engaging new theoretical constructs. Any number of methods and toolkits could have led to interesting outcomes, and some of the options considered include experience prototyping (Buchenau & Suri, 2000), personas (Carroll, 2003), cultural probes (Gaver, Dunne & Pacenti, 1999) and the Thing from the Future toolkit (Candy & Watson, 2018). I chose to adapt journey maps because while, as timelines, they have an explicit engagement with temporality, there are still assumptions about materiality and temporality which are interesting to explore using the theory-to-practice commitments centered in this dissertation. Similarly, I chose to adapt Envisioning Cards because the toolkit has an existing commitment to materiality and temporality, which could be expanded upon using the theory-to-practice commitments as a guide. Adapting just one method or toolkit would be enough to establish that the model of knowledge types in design can be used for this purpose, but, taken together, the adaptation of a design method and a design toolkit demonstrates a more comprehensive reach for the model.

After establishing that the model of knowledge types in design can be used to adapt design methods, I turn to R3: Could this model and the associated skills be taught to novice designers as they adapt design methods? In Chapter 8, I offer a brief, empirical, educational case study, demonstrating how the model was used by novice designers to explore adapting established design methods. Specifically, I taught an undergraduate course on design and introduced students to the model of knowledge types in design through in-class design activities. In design studios, they first practiced bringing new theoretical constructs into design practice by applying the adapted Envisioning Cards from Chapter 7, then practiced using the model of knowledge types in design directly by adapting journey maps and finally demonstrated promising mastery by using the model of knowledge types in design to adapt a method of their choosing. My analysis of their design work and reflections provides early evidence that the model facilitates talking, thinking, and designing with theory in the method adaptation process.

Finally, I turn to R4: What heuristics can be employed when adapting design methods and toolkits to better account for new theoretical constructs? Reflecting on my experience adapting the design method and toolkit in Chapters 6 and 7, I developed a set of seven heuristics. I used these seven heuristics to guide participants in the educational case study, reported in Chapter 8, as they adapted

design methods. Drawing on insights from participants in the case study and further reflection on the adaptation of design methods and toolkits, I revised and expanded the original set of seven heuristics to the set of ten presented in the last section Chapter 9.

3.3 The Role of Incremental Change

Working within the current framework of design, given the critiques of the dominant logics, has its limitations. A different way to respond to the critiques of the dominant logics is to overhaul the way we do design, starting fresh from a radically different set of logics (Escobar, 2018). Another way to respond, and the approach I take here, is to make incremental steps toward alternative logics, starting from where we are within the dominant logics (Tonkinwise, 2014). I am working within the dominant logics, starting from design as currently practiced and situating this project within a specific academic discourse. This work will not, nor does it aim to, radically transform design (as desirable as that outcome may be). Instead, this work aims to open the widening cracks in design as practiced today in hopes of moving closer to alternative ways of practicing design. This will likely be unsatisfactory to proponents of a radical overhaul of design, and I accept that for now.

One valid critique someone might bring against the incremental change approach is that working within the dominant logics – even with the good intentions of thinking beyond them – might cause more harm than good in that it perpetuates the existing harms of the logics and distracts from the deep changes that need to be made. It is important to acknowledge “the hypocrisy that comes from being a change agent toward a new system from within the old system” (Tonkinwise, 2014). Indeed, this dissertation, situated within academic discourse, is constrained by some of the very logics it is trying to resist. This project alone is not enough to bring about the kinds of changes needed for design to resist the dominant logics, and my aim is not to “solve” for the critiques I have outlined here.

Often small, incremental changes enable bigger, flash points of change that people tend to see as the “moment” change (Papacharissi, 2015; Williams, 2001; Yoo, 2018). These flash moments of big change rely on the consensus of a broad range of stakeholders who see alternatives as desirable and necessary. To build consensus around the necessity of change, we need a variety of approaches, both inside and beyond the dominant logics, if we are to arrive at a place where design enables many ways of

being. My aim is for this dissertation work to be one of the many small steps moving toward alternative logics in design.

3.4 Researcher Stance

I am a design researcher at a large public research university in the Pacific Northwest of the United States. I have never fully lived outside the dominant logics of the Western hemisphere, the Global North, the United States, the late 20th and early 21st century, and being white and an English speaker in a cultural context where those are dominant traits. In the context of the empirical data collected for this dissertation (see Chapter 8), I was the instructor of an undergraduate course. Prior to teaching the course I completed several internships with a large software company and since teaching the course (and while completing this dissertation) I have been employed full-time at that same software company. Almost all my research starts from the assumption that we must consider a wide range of stakeholders in our work, both human and non-human, because we are all bound together. My dissertation has a critical relationship to the dominant logics of consumer capitalism and technoscientific futurity, in large part because of the uneven arrangements of those logics for interconnected stakeholders. In doing this work, I assume, as many others do, that different configurations are possible.

Chapter 4: Model of Knowledge Types in Design

Ideally in design, theory and method inform each other (Nelson & Stolterman, 2012; Redström, 2017). Yet how to make the move between the two is not always straightforward or clear (Rogers, 2004; Stolterman, 2008; Yoo et al., 2022). Difficulties arise from the gap between how problems are defined and knowledge produced in academia and how problems arise in practice (Rittel & Webber, 1973; Schön, 1987); the difficulty in making abstract concepts concrete (Yoo et al., 2022); the lack of usefulness of theoretical contributions to practitioners (Rogers, 2004; Stolterman, 2008); and the novelty in academia of design as a theory making endeavor (Redström, 2017). To make progress on this challenge, I generalize a bi-directional model of knowledge types in design and their interrelationships, originally developed in the context of value sensitive design and published in Hendry, Friedman, and Ballard (2021).¹ This model offers a framing of theory, practice, and translating knowledge between the two. The model of knowledge types in design was originally articulated to describe knowledge types and their interrelationships in value sensitive design. In value sensitive design, designers bring together conceptual, empirical, and technical investigations with a value framing to achieve project goals in a way that foregrounds human values. The tripartite approach of value sensitive design involves translating theory into practice (e.g., mobilizing theoretical constructs in practice elements like methods) as well as practice into theory (e.g., advancing theoretical constructs within value sensitive design in response to findings from empirical and technical design practice). In this dissertation, I generalize the model of knowledge types in design so it can be applied to theoretical constructs that do not originate within value sensitive design or even the field of design. While the model of knowledge types in design is not new, its broader articulation and use outside of value sensitive design is novel. I explicate the model below using an example from value sensitive design.

In the model there are three knowledge types, *know-about*, *know-that*, and *know-how*, which map to theory, translation, and practice respectively. Theoretical constructs, the components of theory, are what we *know-about* the world or design situation; methods and heuristics are the *know-how*. We transition from *knowing-about* (theory) to *knowing-how* (practice) through theory-to-practice commitments,

¹ This chapter draws heavily from this publication and, in some places, with only light edits.

knowing-that we must act on something we *know-about* the world. We can expand what we *know-about* the world using knowledge gained via practice through practice-to-theory commitments. Table 1 shows the knowledge elements, their definitions, and provides the following example. Consider the theoretical construct of stakeholders in value sensitive design. This theoretical construct holds that direct and indirect stakeholders are affected by the design of technology – we *know* this *about* the world. In making a theory-to-practice commitment, we *know-that* stakeholder concerns must be considered in the design of technology. We enact this theoretical construct in practice – *know-how* – through methods, toolkits, and heuristics that consider stakeholder perspectives in design. In our empirical work with stakeholders in value sensitive design, we have discovered that “individual or community identity” is as important as “role” for stakeholders, and we can use that practice-to-theory commitment to expand the way stakeholders are conceptualized in value sensitive design. In this model, the translation elements facilitate and make explicit the transfer of knowledge from theory to practice and vice versa.

Table 1. The model of knowledge types in design (Hendry, Friedman & Ballard, 2021).

	Knowledge Element	Definition of Element	Knowledge Type	Example
Theory	Theoretical construct	Abstractions, propositions, or perspectives, carefully defined and explicated.	Know-about	Direct and indirect stakeholders are impacted by technology.
Translation	Theory-to-practice commitment	Declarative statements that translate the theoretical constructs into actionable project steps or design processes.	Know-that	Interests of direct and indirect stakeholders must be addressed in the design of technology.
	Practice-to-theory commitment	Delineated empirical accounts from practice that translate into specific refinements, extensions or additions to the theoretical constructs and directs innovation in theory.	Know-that	Stakeholders who hold to individual or community identity provide empirical insights and reasons to broaden the theoretical construct of stakeholders to account for identity in addition to role.
Practice	Method	Focused activity intended to uncover or develop particular kinds of design insights or directions.	Know-how	- Direct and indirect stakeholder analysis. - Stakeholder tokens.
	Toolkit	Physical and digital materials that support investigations and methods.	Know-how	The “stakeholder” cards in the Envisioning Cards toolkit.
	Heuristic	Guidance for selecting, ordering, and managing design processes.	Know-how	- Conduct stakeholder analysis early. - Prioritize which stakeholders to emphasize and which to set aside given resource constraints.

4.1 Theory: Know-about

The Oxford English Dictionary (2023) defines the term “theory” as “an explanation of a phenomenon arrived at through examination and contemplation of the relevant facts; a statement of one or more laws or principles which are generally held as describing an essential property of something.” Within the field of

human-computer interaction, the term is ill-defined despite being often used, especially in the context of discussing a gap between theory and practice. Building on the Oxford English Dictionary definition, I use the term “theory” to describe the knowledge, often produced in academia, through research for the purpose of explaining complex social and natural phenomena. The building blocks of theories are theoretical constructs – abstractions, propositions, or perspectives, carefully defined and explicated and which indicate something we *know-about* the world. A theoretical construct is a conceptual tool that helps us understand a complex phenomenon. Theoretical constructs are representations of some phenomena that are relevant to our inquiry and can be distilled from philosophical, social science, or technical literature. As an example, one theoretical construct from value sensitive design is that *direct and indirect stakeholders are impacted by technology*. This theoretical construct describes something we *know-about* the world, related specifically to who is impacted by technology, which can apply across design situations. As another example, a theoretical construct about privacy could be that *how people manage their personal information in different contexts or with different technologies varies* (Nissenbaum, 2009). This is a carefully defined statement describing something we *know-about* the world related specifically to how people manage their privacy, which can apply across a variety of design situations.

To be useful in design, theoretical constructs should be abstract enough to apply across a variety of design situations yet specific enough to make a meaningful statement about the phenomena. A less useful theoretical construct could be either too abstract or too specific. When theoretical constructs are too abstract or broad, they make it difficult to gain traction in a design situation. For example, a statement like *privacy is important* is too abstract to be a meaningful theoretical construct, as it is not carefully explicated to provide information about privacy such as a definition or by specifying to whom privacy is important. Conversely, a theoretical construct that is too specific or narrow makes it difficult to apply across design situations. A statement like *users can disable data sharing in the privacy settings* is too specific to be a meaningful theoretical construct because it assumes a specific technology or design solution.

Theoretical constructs can, in theory, come from any field or discipline. In its original articulation to describe how theory and practice work together in value sensitive design, the theoretical constructs used in the model of knowledge types in design came from value sensitive design theory. In this

dissertation, I explore using the model to move from theory to practice with theoretical constructs that originate outside of value sensitive design, specifically in critical theory, media studies, and organizational studies. Sometimes, a theoretical construct is already defined, and the designer is able to pick it up and use it as is. More often, there is conceptual work to define the theoretical construct from a larger body of theory. In Chapter 5, I demonstrate how to articulate theoretical constructs related to materiality and temporality from existing literature.

4.2 Practice: Know-how

Design practice is the process of applying design knowledge in a specific design situation to achieve an intended design outcome (Nelson & Stolterman, 2012). In design practice, designers employ a wide range of tools, key among them methods, toolkits, and heuristics. These three elements of practice in the model are concerned with design action (i.e., taking concrete steps in a design situation). Often, methods are used in combination with toolkits and informed by heuristics, and the same method, toolkit, or heuristic can be used for different purposes or at different times within a design process. Importantly, methods, toolkits, and heuristics are all developed within certain worldviews and carry with them the assumptions of those worldviews. Tensions arise when methods, toolkits, and heuristics are applied outside of the worldview in which they were developed (Ansari, 2019).

Methods are focused activities or processes intended to uncover or develop particular kinds of design insights or directions. Methods can range from general processes (e.g., conducting user interviews or prototyping) to a very specific set of instructions (e.g., journey maps or affinity diagrams) and are often used for transferring design knowledge across design situations and for teaching design (Daalhuizen, 2014). In practice, methods are quite flexible, and when and how to apply a method is informed by heuristics and the designer's own expertise.

While methods are steps or processes, toolkits are a collection of resources (digital or physical) that support design investigations or the execution of design methods. Like methods, toolkits are useful for the sharing of design knowledge across design situations. Unlike methods, toolkits don't necessarily follow a predefined set of steps or instructions. Examples of toolkits include the value sensitive design Envisioning Cards (Friedman & Hendry, 2012), the Human AI eXperience (HAX) Toolkit (Amershi et al.,

2019), Datasheets for Datasets (Gebru et al., 2021), and the Responsible AI Impact Assessment (Microsoft, 2022a).

In practice, having a robust set of methods and toolkits available can lead to questions like, "Which method and/or toolkit to use when? And how best to apply it?" This is where heuristics come in. Heuristics are flexible and adaptable guidelines that can help designers choose and apply appropriate methods and toolkits in different design situations. Heuristics are a valuable tool for transferring design knowledge from one designer to another, across different design contexts. They can help designers plan design engagements or make adjustments to the plan as the design situation is engaged. Heuristics arise from reflections on skillful practice, studies of projects reported in the literature, and conversations with designers. Some heuristics from value sensitive design are 1) it is useful to conduct a stakeholder analysis early in the design project; 2) when conducting a stakeholder analysis, identify as many stakeholders as possible and then prioritize which groups to engage; and 3) to prioritize stakeholders, it is often important to consider who is most impacted by the technology. Another example of a set of heuristics is the Responsible AI Impact Assessment Guide (Microsoft, 2022b), which supports skillful implementation of the Responsible AI Impact Assessment Template (Microsoft, 2022a).

An example of a design artifact to illustrate method, toolkit, and heuristic is Judgment Call (Ballard, Chappell & Kennedy, 2019), a game for industry product teams to surface ethical concerns related to technology using value sensitive design (Friedman & Hendry, 2019) and design fiction (Lindley & Coulton, 2015). In Judgment Call, participants draw cards to create a prompt for writing a review about a technology from the perspective of a specific stakeholder. With each turn, participants take three cards, one for the rating of the review (one, three, or five stars), one for a value to focus on (e.g., accountability, reliability, transparency, inclusion, etc.), and one for the stakeholder (e.g., end user, bystander, parent, etc.). Using these three cards the participants write a review of the technology at hand. For example, the participant may be prompted to write a one-star review about the transparency of facial recognition technology from the perspective of a bystander. For Judgment Call, the steps that users go through to write a review are the method, the cards that support prompt creation and structure of the review are the toolkit, and the tips that appear in the instructions to support skillful practice are the heuristics.

4.3 Translation: Know-that

So far, we've discussed theory (*know-about*) and practice (*know-how*). But how to move between the two? The third knowledge type, translation, serves as a bridge for knowledge transfer between theory and practice in design. There are two knowledge elements to translation, theory-to-practice commitments and practice-to-theory commitments which facilitate moving from theory to practice and vice versa.

Theory-to-practice commitments are statements that guide designers in enacting a particular theoretical construct. They express what designers need to attend to (*know-that*) but not necessarily how to attend to it (*know-how*). Theory-to-practice commitments should be actionable in order to effectively guide design practice. To demonstrate, I'll create a theory-to-practice commitment based on this theoretical construct related to privacy: *how people manage their personal information in different contexts or with different technologies varies*. This theoretical construct tells us a few things about privacy, such as privacy is something that people manage; people may conceptualize privacy differently in different contexts; and people may manage their privacy differently across technologies. One theory-to-practice commitment for this theoretical construct could be that *we must design technologies that enable stakeholders to manage privacy effectively across different contexts*. In this case, the theory-to-practice commitment enables the designer to explore users' context, privacy, and privacy management techniques they may not otherwise have prioritized.

Practice-to-theory commitments acknowledge the insights surfaced in design work and allow for these insights to inform existing theories. In some cases, empirical data or other design work will stretch existing theoretical constructs or problematize them. In such cases, a gap in theory might be exposed which, in turn, offers opportunities for refining or extending existing theoretical constructs or for inventing new ones. For example, the development of new policies, laws, and social norms related to identity have pointed to limitations with stakeholder analyses based solely on roles. As a result, one practice-to-theory commitment relevant to value sensitive design is that, in addition to role, the individual and community identities of stakeholders impact how they are affected by technology. While the model of knowledge types in design is bi-directional and allows for movement between theory to practice and vice versa via the translation elements, the work of Chapters 5-9 explores use of the model in one direction, that from theory to practice.

4.4 Stakeholders: The Model in Action in Brief

To demonstrate the model in action, I offer the following scenario:

Harper is a designer at a large consulting firm. Recently, the consulting firm won a contract to redesign the website of a large government agency, which requires them to consider a wide range of stakeholders. Harper is tasked with designing the proposal for how they will engage with stakeholders, but she does not know where to begin. This is where the model comes into play. First, Harper needs to define the theoretical construct to frame their consideration of stakeholders. To do this, she borrows from value sensitive design: *direct and indirect stakeholders are impacted by technology*. Then, in order to make this statement actionable, Harper needs to translate this into a theory-to-practice commitment. She determines that in order to fulfill this contract the theory-to-practice commitment should be: *In this contract, we must engage both direct and indirect stakeholders throughout the design process, and where possible, prioritize solutions that work for all groups*. This theory-to-practice commitment will guide their work on the contract in service of the theoretical construct. Next is practice. Harper identifies several value sensitive design methods they might employ in fulfilling the contract, including a direct and indirect stakeholder analysis and value dams and flows. A requirement of the contract, however, is that Harper's firm must use co-design. Using the theory-to-practice commitment, Harper identifies a gap in their initial conceptualization of co-design – they had planned to co-design the website with only one stakeholder group, website users seeking services from the government agency. This plan excludes other important stakeholder groups like people who use the agency's services but don't have access to the internet and parents of underage users. Harper is able to change their approach, so they engage multiple stakeholder groups in the co-design process as well as incorporate additional methods, like value dams and flows. Harper's proposal is accepted, and the firm begins working on the new website. Using a modified form of co-design to include a broad range of stakeholders and the value dams and flows method, Harper surfaces several important gaps that the

agency's website may be able to fill. But also in this process, Harper discovers that stakeholders who hold to certain individual or community identities raise important concerns about how the website might (not) work for others that belong to those identity groups. Using the model, Harper defines a practice-to-theory commitment to acknowledge these insights: *Unique insights from stakeholders who hold to individual or community identities provide reason to broaden the theoretical construct of stakeholders to account for identity in addition to role.* This practice-to-theory commitment allows Harper to redefine the theoretical construct for stakeholders in their contract: *In this contract, we must engage both direct and indirect stakeholders, across both role and identity, throughout the design process and, where possible, prioritize solutions that work for all groups.*

The model supported Harper through the definition of the theoretical construct to frame stakeholders, the translation of a theory-to-practice commitment to guide the project in service of the theoretical construct, the identification of appropriate methods to engage the theory-to-practice commitment in the project, and the adaptation of an existing method to align it to the theory-to-practice commitment. In practice, Harper identified a gap in the theoretical construct, and here too, the model supported Harper in defining a practice-to-theory commitment and refining the theoretical framing of stakeholders to align with insights from design practice.

4.5 The Relationship Between Theory and Practice and The Nature of Moving Between the Two

As discussed in Chapter 2, the relationship between theory and practice is frequently characterized as a gap. Method, as a form of practice, has a similarly disjointed relationship to theory. Designers frequently invent methods atheoretically, or without strong connections to existing bodies of theoretical work. For example, the journey map method, which is discussed further in Chapter 6, was developed by practitioners, seemingly without a theoretical basis as the original articulation makes no reference to a body of theory (IDEO, n.d.; Kelley and Kelley, 2013). The method originators were acting as practitioners, working to solve a specific problem in service design. And even methods which are developed with

explicit ties to theory are often practiced atheoretically. Take, for example, affordance-based design practices within the field of human-computer interaction. The original theory of affordances, introduced by psychologist J.J. Gibson, described the complex interplay between the properties of an individual and the properties of an object in their perceived environment (Gibson, 1966; Gibson 2014). In introducing the theory of affordances to human-computer interaction, Don Norman rearticulated it to describe only the properties of an object, and now methods, toolkits, and heuristics, which focus on implementing the theory of affordances in design practice do not capture the richness of the original theory as articulated by Gibson (Rogers, 2004). I argue that this gap between theory and practice, and between theory and method as a form of practice, is often observable because the work of theory (to describe the world) and design (to take action to shape the world) are different ways of knowing and doing that require intention to move between.

Even theories of design, which describe practice, are not practice and require translation to enact in design practice. Thinking about taking action and taking action are fundamentally different but related activities, as taking action in the world (practice) is informed by our understanding of the world (theory) (Ingold, 2013). The relationship between theory and practice is what allows us to use theory to analyze methods that may have been developed atheoretically, and, conversely, why we can – to an extent – practice methods atheoretically.

Skillful designers are able to make the shift between theory and practice rather seamlessly, without necessarily making the translation work between theory and practice explicit, but this poses challenges for non-experts attempting to take up theoretical constructs in design practice. Take for example, Tony Fry's theory of defuturing (1999). In his work, Fry uses historical examples to describe how the act of designing limits some future possibilities by making other future possibilities arise through design action. In the final chapters of the book Fry shifts from largely theory building work (using historical examples to build his argument and shape what he means by the term defuturing) to work that attempts to translate Fry's ideas into action by invoking the language of practice (e.g., "demonstrate that this understanding is transferable into an employable sensibility in professional practice" (p 143) and "this theory in translation to practice" (p 184)). Despite Fry's explicit move toward a practice orientation, these final chapters lack concrete, easy to understand guidance for how to apply Fry's ideas in design practice.

Even in describing defuturing as a method, Fry describes an analytical approach, and not a design approach. Seeming to acknowledge the challenges of taking up defuturing in practice, Fry revisits approaches for design action in a separate book *Design Futuring: Sustainability, Ethics and New Practice* (2008). In this practice focused book, Fry offers actionable methods and heuristics for enacting some of his theoretical work and its existence is evidence that often intentional work is needed to translate theory into practice.

The translation elements of the model – theory-to-practice commitments and practice-to-theory commitments – are one way to navigate between theory and method, but navigating between theory and method through explicit translation may not always be necessary nor can translation fully transfer the insights derived in theory to method and vice versa. At times, connected ideas emerge in theory and in method simultaneously, exploring shared concepts through different epistemological perspectives. One example of this is slow technology (Hallnäs & Redström, 2001). In developing the approach, Hallnäs and Redström simultaneously explored the theoretical constructs underlying slow technology (e.g., designing for presence instead of use) and the methodological approaches to slow technology (e.g., designing for form and function) simultaneously, with ideas and insights from both theory and practice informing each other and providing a richer view of slow technology, all without an explicit translation step. This example implies that explicit translation is not always required to move between theory and practice. Of course, like all models, the model of knowledge types in design has limitations. The model is not exhaustive and describes just one of many possible ways to conceptualize the relationship between theory and practice. The example above, of how theory and practice were performed together in the project of slow technology, offers just one alternative model for the relationship between theory and practice that does not necessitate explicit translation.

In this chapter, I generalized a bi-directional model of knowledge types in design and described their interrelationships to characterize the relationship between theory and practice. In the following chapter, I apply the model to demonstrate its usefulness as a tool for translating theoretical constructs to theory-to-practice commitments which are used in the subsequent chapters for the adaptation of a design method and toolkit.

Chapter 5: From Theoretical Construct to Theory-to-Practice Commitment: Eight Constructs Related to Materiality and Temporality

This dissertation takes up two challenges. First, demonstrating how the model can be applied to theoretical constructs and used to adapt existing methods and toolkits, and second, challenging the dominant logics through critical engagement with materiality and temporality. The first step in any adaptation process in the direction from theory to practice entails identifying appropriate sources for theoretical constructs and then creating concise and explicit theoretical constructs. Next, is translating theory-to-practice commitments from those theoretical constructs. As this dissertation engages with theoretical constructs that challenge the dominant logics by engaging critical themes around materiality and temporality, I sought to identify theoretical constructs related to materiality and temporality with which to adapt an existing design method and toolkit.

5.1 Overview of Method

My goal in this chapter is to move from theoretical construct to theory-to-practice commitment using theoretical constructs that challenge the dominant logics related to materiality and temporality. But where should those theoretical constructs come from? To identify the theoretical constructs I work with in the remaining chapters, I first created a framework to guide the selection of candidate literature, with concepts that address different levels of abstraction of human experiences of temporality and materiality. Next, I surfaced candidate literature to populate the framework. Then, I chose one piece of literature for each cell of the framework. Finally, I distilled a theoretical construct from each piece of literature and then translated that theoretical construct into a theory-to-practice commitment.

As discussed in Chapter 4, theoretical constructs can be distilled from academic literature. To identify a set of robust yet contained theoretical constructs related to materiality and temporality, I first needed to surface related academic literature. In order to work with a variety of ideas in this space, I created a framework that addresses materiality and temporality at different levels of abstraction. Drawing on the Levels of Human Experience (Friedman & Hendry, 2019, p 9) and the order of civilization (Brand, 2000, p :37) (see Appendix A), I created a structure that encompasses different levels of experiences of

materials and time: individual, institutional, societal, and global. These specific terms – individual, institutional, societal, and global – simplify but evoke the categories from Friedman & Hendry and Brand respectively. These categories serve to describe different levels at which we experience materials and time, ordered from those which, according to Brand, change more quickly (Individual) to those which change more slowly (Global).

Table 2. The level of experience from the selection framework mapped to the level from each source which it evokes.

Level of Experience in the Selection Framework	Mapping to Levels of Human Experience (Friedman & Hendry, 2019)	Mapping to the Order of Civilization (Brand, 2000)
Individual	Individual	Fashion
Institutional	Small Group, Organization	Commerce, Infrastructure
Societal	Public Space, Social Policy	Governance, Culture
Global	Global	Nature

With the framework in place, I surfaced literature related to materiality and temporality to serve as candidates for each cell. The goal of surfacing candidate literature was to be intentional, but not necessarily comprehensive. The works do not represent all critical scholarship, nor all materiality or temporality literature. My criteria for identifying candidate literature were that pieces must 1) be related to materiality or temporality or both and 2) fit into one of the eight cells across four different levels of experience (individual, institutional, societal, and global). To generate options for the selection cells, I used two simultaneous approaches, citation tracking and conversation with experts in the field. Using these two approaches, I collected two to three candidates for each cell that met criteria one (related to materiality or temporality or both) and two (covered different levels of abstraction). In this work, I limited candidates to written text (books, book chapters, and articles), but it may be possible to source theoretical constructs from other formats as well (e.g., art).

Surfacing candidate literature was straightforward, but selecting just one piece for each cell posed a challenge. How could I anticipate if a candidate would lead to interesting design outcomes? In many ways this question is difficult to answer a priori – there is no way to tell if a design project will succeed without having started the work and at the same time designers develop an intuition about how

to take action in a design space. That intuition showed up for me in the literature selection process as a quality of “stickiness” – after reading a piece I would notice whether or not I was drawn to it. The phenomenon of stickiness goes beyond thinking an idea is interesting. When a piece was sticky, I would have a sense of being able to *do* something with it. For example, when I first read “It’s about time: An enacted view of time in organizations” by Orlikowski and Yates (1999) I was drawn to the theme in the piece that time is objective when we enact existing temporal structures and subjective when we change temporal structures. Before taking any design action, I felt like I could *do something interesting* with that idea. While that feeling is no guarantee, this piece was sticky enough that I chose it for the cell and ultimately used a theme related to the objectivity and subjectivity of time as the theoretical construct from the piece.

In addition to stickiness, I introduced two criteria to reduce the number of options and select one piece for each cell: 2) engagement with critique and 3) accessibility. In order to fulfill my motivation to challenge the dominant logics, I specifically chose pieces that engage or facilitate engagement in critique of the dominant worldviews or ways of thinking about materials and time. Also, I knew that I would be conducting an educational case study and so I considered whether pieces might be accessible to an audience with potentially no exposure to the underlying body of work. Using the three criteria, I selected one piece from the two to three candidates for each cell. When I was selecting the piece for each cell, I did not consider how the pieces would work together as a whole – each piece was selected individually. Table 3 below shows the eight selected pieces.

Table 3. The selected work for each cell showing which level of abstraction it addresses and whether it's related primarily to materiality or temporality. Titles of books are italicized and journal articles and book chapters are in quotes.

Level of Experience	Materiality	Temporality
Individual	"Material intelligence" (Adamson, 2018)	<i>How to Do Nothing: Resisting the Attention Economy</i> (Odell, 2019)
Institutional	"The 'invisible' materiality of information technology" (Borning, Friedman & Logler, 2020)	"It's about time: An enacted view of time in organizations" (Orlikowski & Yates, 1999)
Societal	"Rethinking repair" (Jackson, 2014)	<i>In the Meantime: Temporality and Cultural Politics</i> (Sharma, 2014)
Global	<i>When Things Fall Apart: Heart Advice for Difficult Times</i> (Chödrön, 2000)	<i>Matters of Care: Speculative Ethics in More Than Human Worlds</i> (Puig de la Bellacasa, 2017)

5.2 Literature Selection

5.2.1 Individual Level

At the individual level our relationships to materials and time are shaped by our personal experiences, perspectives, and cultural influences. The scope of my reasoning at the individual level can vary for both time and space from quite narrow (e.g., my experience with a particular technology in a single context like my home) to quite broad (e.g., my experience with a material artifact like a family heirloom over my lifespan), but is firmly rooted in individualized experience. Here, I selected Adamson's 2018 article "Material intelligence" and Odell's 2019 book *How to Do Nothing: Resisting the Attention Economy*. Other literature considered at this level includes critical making (Ratto, 2011), slow technology (Hallnäs & Redström, 2001), and anticipation (Adams, Murphy & Clarke, 2009).

For materiality, I chose "Material intelligence" because I find Adamson's (2018) call to "recover our literacy in the ways of the physical world" a compelling lever for this project and a way to engage the logic of consumer capitalism. In writing on material intelligence, Adamson argues that we've lost our connection between material, maker, and consumer. He encourages us to consider the chair we're sitting on – do we know what it's made from? Where it was made, and by whom? Do we know how the materials used were extracted from the earth? This knowledge, and more importantly, the appreciation of the materiality of our everyday objects are what Adamson calls *material intelligence*. For Adamson, material

intelligence isn't just about knowing where our objects and materials come from, but it's also the aesthetic and kinesthetic experience of an object.

For temporality, I chose *How to Do Nothing: Resisting the Attention Economy* (Odell, 2019) because Odell's call for individual refusal to participate as a way of resisting the dominant logics echoes sentiments in this dissertation. Responding to society's current obsession with productivity, Odell argues for resistance in the form of attention practices focused on listening, contemplation, and connecting with our natural surroundings. For Odell, the shifting of attention from technologies of distraction to our natural surroundings begins with an individual, and eventually a collective, refusal to participate in the attention economy. While Odell is responding to institutional or societal enactments of time, her approach focuses on individual responses to these pressures, hence its inclusion at the individual level. And while Odell is talking about refusing to participate as a consumer, it is compelling to explore the idea of refusal as a designer – both in terms of how designers work (refusing to work quickly) and in terms of what is designed (refusing to design certain kinds of experiences).

5.2.2 Institutional Level

At the institutional level, our relationships to materials and time are codified, and governed by rules and established practices. At the institutional level, I focus on specific institutional practices in the short to medium term (e.g., three to five years) and confined material domains (e.g., sectors like agriculture, textile manufacturing, and healthcare). To fill the cells at this level, I selected Borning, Friedman, and Logler's 2020 article "The 'invisible' materiality of information technology" and Orlikowski and Yates's 1999 article "It's about time: An enacted view of time in organizations." Other options considered at this level include "Ending the depression through planned obsolescence" (London, 1932) and *The Political Value of Time: Citizenship, Duration, and Democratic Justice* (Cohen, 2018).

I chose "The 'invisible' materiality of information technology" because it describes five institutional pressures that minimize the materiality of information technology, and addressing any one of these could be a compelling lever to engage the dominant logics. As Borning, Friedman, and Logler point out, there are significant material costs to modern information technology, however, these are often hidden or invisible costs. From the extraction of materials used to build devices to the energy used to ultimately dispose of them, materials are implicated at every point in the lifecycle of information technology devices.

Borning, Friedman, and Logler highlight five forces that work to minimize the visibility of the materiality of information technology including the disciplinary norms of computer science and practices such as abstraction, metaphors (like cloud computing), utopian visions, the visibility of hardware, and market forces. Borning, Friedman, and Logler argue that these forces work together to make the material impacts of information technology invisible, the impacts of which are not shared equitably.

I chose “It’s about time: An enacted view of time in organizations” because it describes an essential concept for any other work in this space – temporal reflexivity. Before we can change any ingrained practices related to temporality, we must first become aware that those practices are changeable. As Orlikowski and Yates argue, temporalities are not imposed, they are enacted. Thus, an important starting place to begin working outside the dominant ways of thinking about temporality is the social construction of time. Orlikowski and Yates, studying temporal practices in organizational contexts, theorize that time is socially enacted through everyday temporal practices. These temporal practices – such as regular meetings, academic calendars, or seasonal vacations – give rhythm and form to our social practices. Applying this enacted view of time to two case studies (one on the project to develop the computer language Common LISP and one with a Japanese product research and development team), Orlikowski and Yates recast the temporal oppositions (e.g., clock-based versus event-based, cyclical versus linear, etc.) discussed in the empirical literature on time as dualities. Temporal structures are both objective and subjective, they enable and constrain action. Within temporal structures, time is both universal and particular; clock-based and event-based; cyclical and linear; closed and open-ended. The social construction of time indicates that we can construct other ways of being in time if we choose to do so.

5.2.3 Societal Level

At the societal level, our relationships to materials and time are tacit, deeply ingrained in social practices, reified by shared expectations, and go mostly unquestioned in the day-to-day. At the societal level I consider time scales in the medium term (e.g., decades) and practices contained within cultural boundaries, even if those boundaries are quite large (e.g., the valuation of time and labor within western capitalist society). To fill the cells at this level, I selected Jackson’s 2014 book chapter “Rethinking repair” and Sharma’s 2014 book *In the Meantime: Temporality and Cultural Politics*. Other options considered at

this level include *How It Is: The Native American Philosophy of V.F. Cordova* (Cordova, 2007), *The American Indian Mind in a Linear World: American Indian Studies and Traditional Knowledge* (Fixico, 2013), and *The Dance of Life: The Other Dimension of Time* (Hall, 1984).

I chose “Rethinking repair” because it is an interesting ontological shift away from the focus on innovation and newness within the dominant logics. In “Rethinking repair”, Jackson moves the focus away from innovation toward maintenance and repair by introducing the concept of *broken world thinking* which contends that “breakdown, dissolution, and change, rather than innovation, development, or design as conventionally practiced and thought about are the key themes and problems facing new media and technology scholarship today” (Jackson, 2014, p 222). Jackson argues that we live in a centrifugal world, always on the verge of coming apart, and always being reconfigured and held together through acts of maintenance and repair. This work of maintenance and repair, so integral to keeping our technology, infrastructure, and social systems working, is often invisible. Jackson argues that the productivist bias of the new media and technology fields – but also of our dominant logics – belie the imagination and artfulness of repair work. That is, our focus on creating new and innovative solutions distracts from the creativity needed to keep current systems running.

I chose *In the Meantime: Temporality and Cultural Politics* because it lays bare the temporal inequalities that emerge under global capitalism. This is a compelling place from which to challenge the dominant logics related to temporality in design. Sharma accounts for the lived experience of time within global capitalism, asserting that our individual relationships with time are entwined and deeply uneven. Sharma unpacks a set of uneven temporalities through interviews with frequent business travelers, taxi drivers, corporate yoga instructors, and those involved in the slow food movement. Sharma argues that labor is valued differently in a capitalist market, and capital invests in supporting certain labors and not others. Sharma’s concept of power chronography describes this inequality through a lens of temporality demonstrating how capitalism perpetuates temporal inequalities – how people can experience shared time differently based on how their labor is valued in a capitalist system – as well as income inequalities. The temporality of highest value in the market is the frequent business traveler; all other temporalities must align to and serve the dominant temporality. Power chronography explains how we all experience

time differently, as time is lived at “the intersecting range of social differences that include class, gender, race, immigration status, and labor” (Sharma, 2014, p 138).

5.2.4 Global Level

At the global² level, our relationships to materials and time are intergenerational, interspecies, and difficult to conceptualize or act upon in everyday life. At this level I consider the largest scales both in time (e.g., hundreds or thousands of years or more) and in space (e.g., biospheres) and for both (e.g., physical geological change over millennia). At this level, the boundaries between materiality and temporality are most fluid. The term global reflects that, at this level, time and materials can be human (i.e., intergenerational) and natural (i.e., interspecies or geological) phenomena. Change happens more slowly compared to other levels of experience. To fill the cells at this level, I chose Puig de la Bellacasa’s 2017 book *Matters of Care: Speculative Ethics in More Than Human Worlds* and Pema Chödrön’s 2000 book *When Things Fall Apart: Heart Advice for Difficult Times*. Other options considered at this level include *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins* (Tsing, 2015), *Braiding Sweetgrass* (Kimmerer, 2013), *What Time is This Place?* (Lynch, 1972), and *Timefulness: How Thinking Like a Geologist Can Help Save the World* (Bjornerud, 2020).

I chose *Matters of Care: Speculative Ethics in More Than Human Worlds* because its emphasis on making time for care expands the present and blurs the boundary between materials and time in a compelling way. Also, the emphasis on interspecies and intermaterial care challenges how we think about interrelations from both temporal and material perspectives. Puig de la Bellacasa challenges the conventional understanding of care as a human-centered and moralistic concept and proposes a new way of thinking about care as a speculative and relational practice that involves more than human worlds of technoscience and naturecultures. The work draws on feminist, postcolonial, and ecological theories, as well as on empirical case studies of soil communities, permaculture, and alternative technologies, to

² It is challenging to find a term that accurately reflects what I mean for this most expansive level of the framework. Other terms I considered include geological, ecological, planetary, interspecies, and systemic. Part of the challenge stems from the long time horizon possible in this level, from hundreds to thousands of years or more – as a society, we are not practiced in thinking and talking about periods of time so vast. Another challenge stems from the variety of stakeholders experiencing these large time horizons, not just everything that is here today but things that may be here or not here in the next hundreds or thousands of years or more. In the absence of a perfect term to accurately reflect this level, I use the term global – relating to the whole world, where both “whole” and “world” are interpreted in the broadest sense.

explore how care can be reimagined as a situated and committed form of speculation that both sustains and transforms the world we live in. While making time for care is a material practice, it's rooted in temporal desires: expanding the present.

I chose *When Things Fall Apart: Heart Advice for Difficult Times* because Chödrön's idea of impermanence challenges the tension within the dominant logics between short-term disposability (planned obsolescence) and a desire for long-term permanence (push to make the uncertain more certain). Chödrön writes about the concept of impermanence and how it can be applied to daily life. She discusses the idea that everything in life is constantly changing and that this change is inevitable and natural. Chödrön suggests that rather than trying to resist change or hold onto things as they are, it is more helpful to learn to accept and work with impermanence. She writes about the idea of "leaning into the sharp points" of life or facing difficult experiences and emotions with courage and openness, as a way of developing resilience and finding peace. Impermanence is about how (or not) things (especially here, materials) exist over time.

5.3 Translation: From Theoretical Construct to Theory-to-Practice Commitment

The first step in working with these eight pieces is to move from the larger work to a specific, well-articulated theoretical construct (what the selected piece tells us we *know-about* the world). This involves isolating a key idea that will become the focus going forward. After identifying the theoretical construct, the next step is to articulate a theory-to-practice commitment (what we *know-that* we should attend to in the design process). The process of translating theoretical constructs to theory-to-practice commitments is more art than science. It requires a deep understanding of the theoretical construct in order to do rigorously, and some theories are more difficult to translate than others.

To distill theoretical constructs from the eight pieces and translate them into theory-to-practice commitments, I used the following process:

1. **Read the work and identify key themes.** In this step, I read each work carefully, focusing on key terms, themes, and ideas. The key terms, themes, and ideas are the building blocks of theoretical constructs.

2. **Select and define** the theoretical construct of interest.
 - a. **Select.** When there is more than one key theme in a piece, I selected one to work with. Choosing a specific theme to focus on from each piece was, again, more art than science. I focused on “sticky” ideas that I felt would be interesting to explore from a design perspective, or that I could reasonably translate into an action-oriented statement in step three, translation. Questions I asked myself when selecting key themes include: What is most compelling about this piece? What theme provides an interesting lever with which to think critically about materiality or temporality or both? If I could only keep one theme from this piece, what would that be? These questions helped me to narrow down from a wide range of themes in a piece to the theme that would anchor or serve as the theoretical construct for each piece.
 - b. **Define.** After selecting the key theme, I defined a specific theoretical construct – a statement, carefully articulated to describe something *we know-about* the world. The focus here was on creating a short one to two-sentence statement that captures the key theme at an appropriate level of abstraction and in a way that can be applied across design situations. Guiding questions here include, what does this key theme tell us about the world? What does this key theme say about us? These questions helped me to refine themes into the theoretical constructs that appear in Table 4.
3. **Translation.** To make the jump from theoretical construct to theory-to-practice commitment is to make the jump from a broad generalization about the world (*know-about*) to a concrete action aligned with that generalization (*know-that*). Following the model, I found it helpful to use the sentence structure below to create the declarative statement which is an actionable step for mobilizing the theoretical construct. In completing the sentence, the designer crafts the theory-to-practice commitment.
 - a. *[Theoretical construct] is something we know-about the world. In order to account for this in design, we know we must [theory-to-practice commitment].*

For some pieces, this process was easier than for others. For example, the concept of power chronography from Sharma's *In the Meantime: Temporality and Cultural Politics* (2014) was a theoretical construct I had been thinking with for several years before engaging in this dissertation work and it was a natural choice to take up here. Likewise, for the theoretical constructs surfaced from "Material intelligence" (Adamson, 2018), "Rethinking repair" (Jackson, 2014), "It's about time: An enacted view of time in organizations" (Orlikowski & Yates, 1999), "The 'invisible' materiality of information technology" (Borning, Friedman & Logler, 2020), and *When Things Fall Apart: Heart Advice for Difficult Times* (Chödrön, 2000) – each of these pieces has a clear theoretical construct I was familiar with and keen to apply in this design context and their subsequent theory-to-practice commitments were relatively straightforward to translate.

In *Matters of Care: Speculative Ethics in More Than Human Worlds* (Puig de la Bellacasa, 2017) there are a number of different theoretical constructs one could choose, each emphasizing a different aspect of the work. For example, the relational or speculative aspects of care would have been valid theoretical constructs to surface from this work and might have led to very different design outcomes. For this piece in particular, the difficulty was in identifying which theoretical construct to focus on. In the end, I chose a theme from this work related to non-human stakeholders which we in value sensitive design have been discussing for some time (Friedman & Hendry, 2019). From there, the theory-to-practice commitment was easy to articulate.

In working with *How to Do Nothing: Resisting the Attention Economy* (Odell, 2019), I had the opposite challenge. The compelling theoretical construct I wanted to work with was clear enough, but translating that into an actionable, declarative statement in the form of a theory-to-practice commitment was challenging. In reflecting on this process, I believe this was because of the nature of the theoretical construct at hand – it is inherently about *not* doing. Said another way, there is a challenge in making productive a theoretical construct rooted in resisting productivity. To navigate this challenge, I created a theory-to-practice commitment which creates space to consider the concept of refusal in the design space, both for the recipients of design as well as for designers.

Table 4 details the theoretical constructs and theory-to-practice commitments from each of the eight pieces. The first column identifies one of the eight selected pieces, the second column contains the

theoretical construct distilled from the piece, and the third column contains the theory-to-practice commitment translated from the theoretical construct.

Table 4. Theoretical constructs and theory-to-practice commitments for each of the eight selected pieces.

Selected piece	Theoretical construct (<i>know-about</i>)	Theory-to-practice commitment (<i>know-that</i>)
“Material intelligence” (Adamson, 2018)	We are increasingly disconnected from the material realities of our daily lives.	The designer must support the connection the user has with the materiality of the artifact, not just the experience, but also the experience of the artifact itself.
<i>How to Do Nothing: Resisting the Attention Economy</i> (Odell, 2019)	Our attention and therefore our time is fragmented in our current capitalist online environment. In order to regain control of our attention, we must practice the art of refusal.	The designer must create opportunities for refusal. In addition, as designers, we ourselves can refuse to design experiences that contribute to the attention economy.
“The ‘invisible’ materiality of information technology” (Borning, Friedman & Logler, 2020)	Five forces work to minimize the visibility of the materiality of information technology and the material impacts of information technology: the disciplinary norms of computer science and practices such as abstraction, metaphors, utopian visions, the visibility of hardware, and market forces.	To surface materiality in the design of information technology, the designer must engage with the forces working to minimize it.
“It’s about time: An enacted view of time in organizations” (Orlikowski & Yates, 1999)	Time is socially enacted through everyday temporal structures like regular meetings, quarterly reports, and academic calendars. These temporal structures seem immutable but can in fact be changed.	The designer must highlight our ability to change temporal practices.
“Rethinking repair” (Jackson, 2014)	We live in a centrifugal world, always on the verge of coming apart, and always being reconfigured and held together through acts of maintenance and repair. This work, while often invisible, is a site of creativity, imagination, and artfulness.	The designer must foreground breakdown, maintenance, and repair as essential to the story of technology and of innovation.
<i>In the Meantime: Temporality and Cultural Politics</i> (Sharma, 2014)	Under global capitalism, we experience time differently based on our intersectional identities and how markets value our labor.	The designer must consider whose time is implicated in design and how equitably.
<i>When Things Fall Apart: Heart Advice for Difficult Times</i> (Chödrön, 2000)	Impermanence is the essence of reality, yet too often we resist impermanence by creating things with the hope that they will last forever.	The designer must accept that all things must come to an end and be intentional about that ending.
<i>Matters of Care: Speculative Ethics in More Than Human Worlds</i> (Puig de la Bellacasa, 2017)	Thinking with care in more than human worlds involves decentering humanness, de-objectifying non-humans (living and nonliving), understanding interconnected webs, and disrupting technoscientific futurity as the dominating temporality.	In order to think with care in more than human worlds, the designer must legitimize and de-objectify non-human stakeholders.

Stepping back, in this chapter I've demonstrated how the model can be used to effectively translate theoretical constructs into theory-to-practice commitments for theories that originate outside of value sensitive design. In the chapters that follow, I take up the next step in the translation process – enacting theory-to-practice commitments in the elements of design practice. Specifically, I explore enacting the theory-to-practice commitments from Table 4 by adapting the journey map method in Chapter 6 and adapting the Envisioning Cards toolkit in Chapter 7.

Chapter 6: Translation: From Theory-to-Practice Commitment to Method

There are many methods that designers use in design practice to achieve specific design outcomes, including interviews, scenarios, sketching, and prototyping (Carroll, 2003; Friedman, Hendry & Borning, 2017; Greenberg et al., 2011; Martin, 2012; Nelson & Stolterman, 2012; Sanders & Stappers, 2014). Many of these methods are prime candidates for adaptation using theory-to-practice commitments (and indeed, several of these methods are explored by participants in Chapter 8). To demonstrate the process of adapting design methods using theory-to-practice commitments, in this chapter, I adapt a design method called *journey maps* (Cramer, 2022; Howard, 2014) to enact the theory-to-practice commitments translated in Chapter 5.

I chose the journey map method to adapt because, while the method has an explicit commitment to temporality, there are several dimensions to explore in relation to both materiality and temporality. First, the temporality of journey maps is artificially bound. Designers developing journey maps typically do not disclose why a particular time period is highlighted and not others. Second, journey maps infrequently describe the material aspects of the objects included in the map. Often, some of the material considerations may be more invisible a la Borning, Friedman, and Logler (2020), but, other times, the journey maps are about physical objects such as the cell phone buying example shown below (see Figure 2). Even when the journey maps explicitly include physical objects, the materiality of objects is often underexplored. Third, journey maps frequently describe experiences with a product from “start to finish,” but they rarely, if ever, depict a period of time long enough to describe late-stage use such as obsolescence, disposal, or decomposition even when they involve material artifacts guaranteed to pass through those phases. By adapting journey maps in this chapter, I aim to broaden the method guided by the theory-to-practice commitments translated in Chapter 5.

6.1 Journey Maps: Description and Examples

Journey maps, also called user journey maps (Mears, 2013) or customer journey maps (Cramer, 2022), are designer created timelines that illustrate “the entire journey of the user along all touchpoints with a product or service” (Usability.de, n.d.). Journey maps present a series of points in time (typically moving

linearly from left to right or top to bottom) where the user has predefined interactions with the product or service being explored. At each touchpoint, the map might describe the user's emotions, goals, and/or actions. Designers can create journey maps for a range of topics, from physical experiences (like navigating an airport) to a digital experience (like creating an account and purchasing something from a website), and the aim is typically for the designer to use the journey map to surface insights and improve the user's experience. Depending on their goals, designers can create journey maps using several different approaches; for example, designers can create journey maps based on their understanding of an experience, based on user data, or in collaboration with users. When creating a journey map, designers can leverage a variety of tools, which range from those specifically designed to create journey maps, such as Smaply (Smaply, n.d.), to templates to support the creation of journey maps on popular design platforms like Miro (Miro, n.d.) and Figma (Figma, n.d.).

The journey map method, as described by IDEO, a design and consulting firm, (IDEO, n.d.) and also found in Kelley and Kelley (2013), involves the designer taking the following steps:

1. "Choose a process or journey that you want to map.
2. Write down the steps. Make sure to include even small steps that may seem trivial. The goal is to get you to consider the nuances of the experience that you may normally overlook.
3. Organize the steps into a map. Usually we display the steps sequentially in a timeline. Your map may include branches to show alternative paths in the customer journey. You could also use a series of pictures or whatever method fits your data.
4. Look for insights. What patterns emerge? Anything surprising or strange? Question why certain steps occur, the order they occur in, and so forth. Ask yourself how you might innovate each step.
5. If possible, show the map to people familiar with the journey and ask them what you've overlooked or gotten out of sequence."

Given that there are a variety of ways to refer to the elements of a journey map, I will use the following terms for consistency throughout the analysis and adaptation in this chapter. A *user* refers to the person or persona navigating the process depicted in the journey map – the person or people moving along the timeline. An *experience* refers to the subject of the journey map – the software, process, or experience the user is participating in within the journey map, such as buying a car. A *touchpoint* refers to a specific stop along a journey map. Journey maps typically follow a user moving through a specific process, as opposed to the process itself; that is, journey maps are typically user-centric and not process-

centric. The focus is on the user's journey through the process, their steps, needs, and reactions to the process they are experiencing in the journey map.

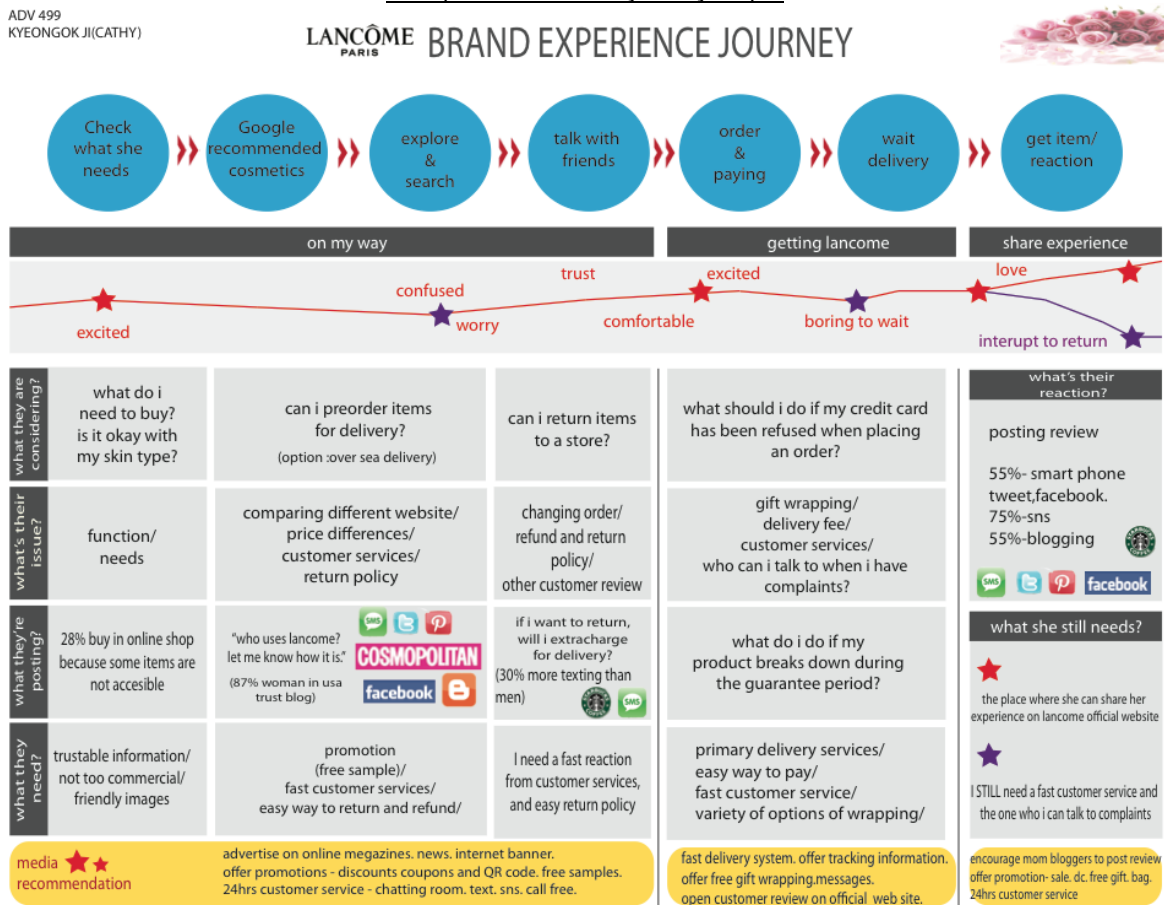
As previously mentioned, there are several ways that journey maps already have explicit and implicit commitments to time. Time in a journey map is represented by a timeline, and the touchpoints along a journey map represent steps in a process sequentially from start to finish. Depending on the experience being mapped, steps may be clock-based – occurring at specific times of the day or year, such as on April 14th annually (Orlikowski & Yates, 1999); event-based – occurring in relation to other events, such as at an annual reunion (Orlikowski & Yates, 1999); or situational – occurring when the appropriate circumstances are in place, such as when the ground thaws in spring (Taylor et al., 2017). Typically, a journey map is scoped to the period of time that is required for the user to navigate the experience, and the touchpoints are primarily from the user's perspective. Often, time in journey maps is linear, progressing forward in one direction, and touchpoints are presented as discrete moments along the timeline.

It is less common for journey maps to engage with ideas related to materiality. However, we know from Borning, Friedman, and Logler (2020) that all information technology has material implications, even when those implications are invisible. Looking at the steps of the method as articulated by IDEO, no part of the method directs the designer to consider materiality explicitly. So, while journey maps don't often explicitly engage materiality in the process of the method, materiality is an implicit part of a journey map, as every experience, even completely digital ones, will have material implications. Despite the lack of explicit inclusion of materiality in the journey map method, there are specific examples that often consider at least some aspects of materiality, and one such example (Figure 1) is discussed below.

Figure 1 and Figure 2 below show two example journey maps. In Figure 1 the user is not particularly well defined, but we can gather from the details of the journey map that the user (she/her) is someone who is interested in Lancôme products and is seeking information about the brand. The experience is the user's process of searching for and acquiring Lancôme products and the touchpoints include getting advice about Lancôme products from friends, making a purchase, waiting for the purchase to arrive, and reacting to the item when it arrives. In this example, time is more or less linear, progressing forward along a straight path. There is no point at which the user decides not to purchase Lancôme

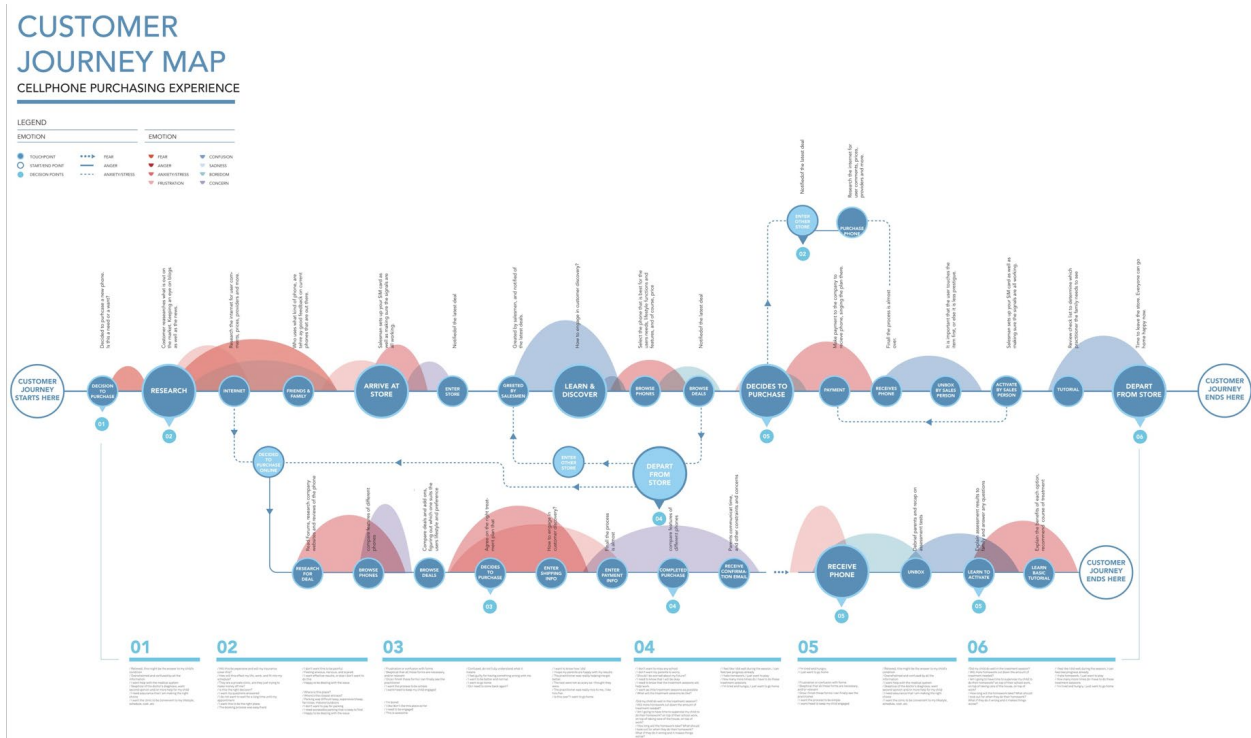
products, nor do they repeat any of the steps in the process (returning, for example, to an internet search after speaking with friends). There is one interesting moment at the end of the journey map where the designer has acknowledged that the user may wish to return the product, but that experience is left unexplored. This journey map does include one explicit reference to material considerations, acknowledging that the product may break down during the warranty period, but it is framed through the lens of quickly replacing the defective item. There are other aspects of materiality implicit in this example which are not explored, including the materiality of online shopping, shipping and returns, and product packaging. Overall, Figure 1 is a compelling example because, despite its relatively simple approach, there is a lot of information related to both materiality and temporality, while still leaving room to explore additional considerations.

Figure 1. A journey map describing a user's experience with the beauty brand Lancôme. Interestingly, this example includes a reference to breakdown (Jackson, 2014), noting that the user might have questions about what happens if their product breaks down during a guarantee period. Image credit: <https://uxeria.com/en/10-most-interesting-examples-of-customer-journey-maps/>.



In Figure 2, the user is someone who is purchasing a new cell phone, the experience is their journey of purchasing the cell phone, and the touchpoints include arriving at the store, entering the store, and being greeted by a salesperson. In this example, several different timelines are explored simultaneously, the two main branches being the decision to purchase a cell phone online or in a store, and even after deciding to purchase in a store, the journey map provides that some users may change their minds and decide to purchase online. This example is much more temporally rich, but lacks any consideration of materiality, despite ample opportunity. In this journey map the materiality of online shopping, traveling to and from various stores, shipping, and of cell phones themselves is not made explicit. Throughout this chapter, I use these two example journey maps to demonstrate the process of adapting an existing design method.

Figure 2. A journey map describing a user's experience purchasing a cell phone. While this example does not explicitly engage materiality, there are several different timelines presented simultaneously. Image credit: <https://www.ux-republic.com/en/experience-map-8-inspiring-models/>.



6.2 Surfacing Assumptions and Laying the Foundation for Method Adaptation

When adapting design methods or toolkits using theory-to-practice commitments, a productive place to start is by understanding the assumptions embedded within the existing method or toolkit. To both surface the underlying assumptions of journey maps and begin the adaptation process, I examined the two example journey maps systematically in terms of each theory-to-practice commitment (see Table 4 in Chapter 5). Specifically, I used the theory-to-practice commitments to ask, how does or doesn't the example journey map capture this theory-to-practice commitment? If the method doesn't capture the theory-to-practice commitment, what does this say about the assumptions that underlie journey maps? And how could the journey map method be adapted to enact this theory-to-practice commitment? The eight theory-to-practice commitments surfaced several assumptions of journey maps that can be grouped into three categories: assumptions about materials, assumptions about time, and other assumptions.

6.2.1 Assumptions about Materials

Several of the theory-to-practice commitments brought to the fore journey maps' lack of consideration for the materiality of an experience.

Material Intelligence. Within journey maps, it would seem that the user's connection to or experience of the materials in the way conceptualized by Adamson's (2018) writing on material intelligence is not salient. Indeed, there is nothing inherent about the method itself that foregrounds materiality or the user's experience(s) of it. In the examples above (see Figure 1 and Figure 2), materials are secondary to the user's experience and even to temporal considerations. When materials were considered in the Lancôme example (Figure 1), it was in the context of replacing a defective product. In Figure 2, there was no mention of materiality despite opportunities for exploration.

Maintenance and repair. A second assumption about materiality present in the journey maps is that the repairability, maintenance, or what happens to the materials after the period of time mapped is not relevant (Jackson, 2014). In the Lancôme example (Figure 1) there is a reference to breakdown or faulty products, but there is no mention of what happens to those products (or products that are simply returned or exchanged for personal reasons) following their return or disposal. In the cell phone example

(Figure 2), there is no consideration of whether the user is replacing an old cell phone, whether an old cell phone could have been repaired, or what happens to the new cell phone over time (whether it can be maintained or repaired in the future).

These assumptions indicate that there is ample room to foreground materiality within the journey map method. For example, the method could be adapted by including steps in the process which specifically ask the designer to consider materiality; extending the journey map to include stages of breakdown and decomposition; or creating object-focused journey maps which center material artifacts' journeys through their material lifecycle. Specific adaptations to the method are proposed in Section 6.3.

6.2.2 Assumptions about Time

Several of the theory-to-practice commitments surfaced assumptions embedded in the journey maps related specifically to temporality.

Enacted view of time. First, an enacted view of time as articulated by Orlikowski and Yates (1999) suggests the temporality of a journey map is objective. Per Orlikowski and Yates, temporal structures are subjective until we agree to work within them, and once agreed upon, they become objective. For example, time is subjective when we are in the process of negotiating deadlines, but objective once deadlines are agreed upon and upheld. For journey maps, it's very likely that the designers considered many different options for conveying time (different periods of time, different ways of moving through a given time period) but viewers of a completed journey map see the temporality of the journey map as objective.

Refusal. Second, there is an assumption that the temporality of the journey map is non-negotiable by the user. While some journey maps (like Figure 2) have multiple routes, there is little consideration for the user's ability to negotiate the specifics of the journey map or to refuse to participate (Odell, 2019). Within the journey map, the assumption is that the user will progress along the timeline, constantly moving forward within the journey.

Shared experiences of time. Finally, there is an assumption that the stakeholders present in a journey map (implicitly or explicitly) experience time in the same way, or that different experiences of time are not central to the journey map of an experience. The most important stakeholder in a journey map is the user and where other stakeholders appear implicitly (for example, when considering sales associates

in the cell phones store or customer service associates available 24/7 for Lancôme) there is little consideration for their experience of the shared time (Sharma, 2014).

These assumptions indicate that, while journey maps engage directly with time, there is room to explore additional dimensions of temporality within the method. For example, the designer could present multiple views of the same process by layering journey maps to explore the objectivity/subjectivity of time; provide opportunities for users to refuse the experience; and/or consider the temporality of stakeholders who are implicitly present in the journey map but whose journey isn't the central focus. Specific adaptations to the method are proposed in Section 6.3.

6.2.3 Other Assumptions

While the eight theory-to-practice commitments are related to time and materials, they surfaced some additional assumptions of the journey maps.

Stakeholders. In both Sharma's (2014) work on power chronography and Puig de la Bellacasa's (2017) work on making time for care, the interconnectedness of stakeholders and the experience of multiple stakeholders is of central concern. Journey maps, by centering the user, make assumptions about which stakeholders' experiences are relevant. In both examples above (see Figure 1 and Figure 2), the user's experience is being mapped and other stakeholders are only included implicitly (e.g., sales associates in the cell phone store, customer service agents working 24/7 for Lancôme).

(Un)happy paths. Second, journey maps assume that the most important thing to consider is the happy path – or the journey the user will take assuming there are no issues, errors, or bumps along the road. Jackson's (2014) broken world thinking encourages us to consider breakdown, maintenance, and repair as important sites of creativity – most of which are missing from the examples. The Lancôme example does consider breakdown but in terms of replacing the defective artifact instead of how to repair it. The forces that influence the invisibility of information technology raised by Borning, Friedman, and Logler (2020) include the focus on utopian visions as one of the five forces that suppress materiality. While journey maps are working at a smaller scale, they are reifying the utopian visions by focusing on the happy path scenario.

By considering these assumptions in the journey map method, the designer could expand the temporal and material richness of the artifacts. For example, the designer could legitimize stakeholders

beyond the end user by considering their temporal experiences in the journey map; add in possible points of failure to explore alternative paths; or create a journey map that explores the worst experience someone could have moving through a specific process to understand where things might go wrong. Specific adaptations to the method are proposed in the following section.

6.3 Journey Map Method Adaptation

The assumptions embedded in the journey map method are opportunities for method adaptation. In order to address the limitations resulting from some of the assumptions discussed in Section 6.2, I drew on the theory-to-practice commitments to ideate possible adaptations for the method. Specifically, I generated potential ways to alter, extend, or adjust the journey map method in response to these commitments, and then grouped the potential adaptations by similarity. In the following sections, I adapt the journey map method by introducing five changes that account for the eight theory-to-practice commitments and illustrate how such adaptations could be carried out in the two example journey maps (see Figure 1 and Figure 2). In this section, I introduce the new and amended steps to the journey map method, based on the theory-to-practice commitments. In the following section, I show the steps in the context of the original method.

6.3.1 Materiality: Material Reflection

Often in journey maps the users' experience and enjoyment of the materials present are not highlighted. According to Adamson (2018), reflecting on the materiality of our everyday objects can help us recover material literacy. In this proposed new step, I've created space for the designer to foreground the materiality in the journey map when the user first encounters the artifact or experience. And, while material reflection is not limited to the first time the user comes in contact with the artifact or experience being mapped, the first touch presents a unique opportunity to draw the user's attention to the materiality of their experience. Accordingly, to adapt the journey map method to surface the materiality of the first touch experience I propose the following:

New step: Circle the moment the user first comes into contact with any material artifacts in the experience. What is this moment like for them? How, if at all, does the user notice

and interact with the materials present? If the experience is entirely digital, what material aspects are salient to the user?

To consider the implications of this new step, let's apply it to the example journey maps, beginning with the Lancôme Brand experience (Figure 1). The moment that the user first comes into contact with a Lancôme product is when it arrives following an online purchase. The moment they first interact with the product depends on many factors: Is the user in a hurry? Is the user still excited about receiving the product? Has the experience of unpackaging the product been designed in a way that draws their attention to the experience? For example, imagine the user has purchased a face cream from Lancôme. If they receive the product in a nondescript box and the packaging is uninteresting and cheaply made, they may quickly open it without a second thought. However, if the packaging is a rich sensory experience, the user may pause to notice what they are doing. That's not to say that the packaging has to be wasteful. It's entirely possible to design a compelling experience using sustainable materials. And for the face cream itself, does the user take a moment to experience the way it smells? The way it feels on their skin? The packaging could include prompts to encourage the user to do so, and perhaps even describe ingredients that contribute to the scent and texture.

To apply the new step in the cell phone buying experience example journey map (Figure 2), there are two moments when the user may first come into contact with a cell phone. If the user has opted to shop in the store, they may encounter several phones while they are exploring their options, and if they decide to purchase a phone in the store, they will receive their specific phone after it is activated by the sales associate. While looking at different options, users may be considering many different aspects of the phone, and materiality may or may not be a priority. Here, the sales associates could encourage material reflection by asking questions like "How does it feel to hold that particular model in your hand?" thereby directing the user's attention to the artifact's weight and material presence. If the user has decided to purchase a new phone in the store, the sales associate could make space for material reflection by allowing the user to spend some time with the new phone, and, if appropriate, asking questions about material aspects of the phone to guide the user to reflect on this dimension. If the user purchases a new cell phone online, the first time they'll interact with their specific new phone is when it is delivered (they may have seen several options in a store before deciding to purchase online, but delivery

would be the first time they interact with their specific phone). To foreground material reflection here, we can draw on some of the same techniques from the Lancôme example, for instance, by intentionally designing a sensory-rich unpacking experience and prompting the user to reflect on the cell phone as a physical artifact. These two examples demonstrate that the addition of this new step to the method creates space for the designer to foreground material reflection for the user, and how the journey map, and as a result the experience, could be changed to surface materiality.

6.3.2 Temporality: Exits, Endings, and Other Alternative Timelines

A journey map is often presented as a singular, linear experience. The user enters the experience at the beginning and exits when the experience is over. Sometimes there are alternative routes considered (e.g., as in Figure 2), but typically with the same goal in mind – a successful experience, a happy path. Five of the theory-to-practice commitments ask us to consider exits, endings, and other alternative timelines: ways of saying no (Odell, 2019), challenging us to think about where things go wrong (Borning, Friedman & Logler, 2020; Jackson, 2014), thinking about how things end (Chödrön, 2000), and more broadly challenging us to consider how things could be different (Orlikowski & Yates, 1999). To adapt the journey map method to account for exits, endings, and other alternative timelines, I propose the following:

New Step: Add exits. How could the user gracefully refuse this experience? From the beginning? At key points along the way? Map the user's exit strategy at various points.

New Step: Reconsider the ending. Is the user's experience really the end of the story? What about the material objects that are part of the experience – do they persist after the user's experience is over? What about the experience itself – for how long will the experience be available and how will it be discontinued?

Amended step: Look for insights. What patterns emerge? Anything surprising or strange? Question why certain steps occur, the order they occur in, what could go wrong, and so forth. Ask yourself how you might innovate each step.

To adapt the two example journey maps using these new or amended steps, several changes can be made. Taking the Lancôme brand experience (Figure 1) as an example, we can consider how

users might gracefully refuse the experience at various points. From the very start, the user may reflect critically on her needs and determine that she does not need to purchase a new product, resulting in graceful exit number one. After conducting research on Lancôme products, the user may decide that the product does not meet her needs, resulting in graceful exit number two. The user may decide after making the purchase that she no longer wants the product, and cancel the order before it ships, resulting in graceful exit number three. Or perhaps after it arrives, she changes her mind, returning the product, resulting in graceful exit number four. The point of detailing these exit strategies is to empower the user to make informed and reflective decisions about the process and to acknowledge that moving through the timeline from start to finish is not inevitable.

To apply the next new step to the Lancôme example (Figure 1), we can consider what happens after the current timeline ends. Imagine that the user has kept their face cream and used it all. Now it's time to dispose of the container. Here, the designer could create a separate journey map to follow the container's process through disposal and decay. Stepping back, the designer can think about the experience in and of itself. How long will Lancôme, the brand, exist? What does the end of Lancôme look like? The point here is to recognize that everything will come to an end eventually.

To apply the amended step to the Lancôme example (Figure 1), the designer can ask, what could go wrong? The Lancôme example has one such consideration, related to the breakdown of the product in the warranty window. But here the designer could also consider other types of failures, such as the product getting lost in the mail, or causing a skin reaction in the user. Both of these considerations add depth to the journey map and break the designer out of utopian visions to explore the unhappy path.

Next, I apply the two new steps and one amended step to the cell phone purchasing example (Figure 2), beginning with graceful refusals. The cell phone purchasing example immediately provides a lever through which to consider refusal as it starts with the user's decision to purchase a cell phone. Here the designer could consider that the user decides not to purchase a new cell phone, either going without a cell phone, repairing a broken phone, or continuing to use their current phone. At any point in this journey map the user could make the decision not to purchase a new cell phone, including by canceling the order for a new cell phone after it's been purchased or returning the cell phone after they've received it. Providing these exit strategies underscores that the user is empowered to refuse.

In applying the second new step to Figure 2, the designer can think about what happens to two cell phones along this journey map. Assuming that the user is replacing an old phone, the designer can think about the journey of that old phone. Does it get donated or thrown away? Does the user keep it as a backup? In the current example, this is not considered, but adding this step draws our attention to the material parts of the journey which are not considered. Similarly, the designer can consider what happens to the newly purchased phone over time. Is it maintained in such a way that prolongs use? Or does it quickly become obsolete? When the time comes to replace that phone, is it donated or thrown away? If either phone is disposed of the designer can explore the decomposition of the materials included in the device. Stepping back, consider cell phones as an experience. For how much longer will they be around? Will they be replaced by a new technology in the near future or go out of style? Again, nothing lasts forever.

To apply the amended step to the cell phone buying experience the designer can ask, what could go wrong? Similar to the Lancôme example, the designer can explore what would happen if the user purchased a cell phone online which never arrives, or if the new phone were to malfunction soon after purchase. Again, the goal here is to break out of utopian visions and explore unhappy paths. In both of these examples, the two new and one amended step create space for the designer to consider exits, endings, and alternatives, adding temporal and material richness to the existing journey map method.

6.3.3 Stakeholders: Considering Multiple Temporalities

Both Sharma's (2014) theory of power chronography and Puig de la Bellacasa's (2017) work on care in more than human worlds concern themselves with, among other things, stakeholders who are not the user. In the case of power chronography, Sharma is additionally concerned with that stakeholder's experience of time and how it may or may not be equitable to other stakeholders. In adapting the journey map method to account for stakeholders, I expand who is considered in the design method and use those stakeholders' experience to make changes to the journey map. As discussed in Section 6.2.3, the standard journey map method does not surface the experience of stakeholders beyond the user, despite their implicit inclusion in various touchpoints along the journey map (e.g., as customer service agents staffing a call center to support the user). To adapt the journey map to account for the experiences of additional stakeholders I am proposing to add the following step:

New step: List the stakeholders (including non-human stakeholders) who are required to support each touchpoint on the journey map. Consider each stakeholder, what is the experience from their perspective? Based on each stakeholder's experience, what could be changed about the journey map to improve their experience?

To understand the implications of this new step, consider applying it to the first example journey map on the Lancôme brand experience (Figure 1). Here, the list of stakeholders would include people who have reviewed Lancôme products in the past which the user is reading, the user's friend from whom they seek advice, employees who manufacture the products, employees who deliver the products, and the customer service agents who are available 24/7. For now, I will set aside the stakeholders who have reviewed products in the past or are friends of the user to explore the temporal dynamics with regard to the employees of Lancôme who are implicated in this experience. The employees who deliver the product and are customer service agents may have an uneven temporal experience in this example if they are required to work odd hours to support the user's journey (e.g., working weekends to ensure on-time delivery or overnight to staff a customer service call center). In response to these concerns, the designer could extend the expected delivery window for Lancôme products (e.g., communicating to users that their products will arrive in three to five days instead of within 24 hours). The designer could also adjust user expectations about when customer service agents are available. Instead of providing 24/7 customer service coverage Lancôme could limit live customer service support to regular business hours and provide options for asynchronous support. By reducing the temporal burden on the stakeholders who may experience uneven temporal requirements the designer can move toward temporal equality in this experience.

Applying this new step to the cell phone purchasing example (Figure 2), the designer can identify the following stakeholders: employees who manufacture cell phones or cell phone components, the sales associates working in the stores, and the employees who deliver the cell phones when purchased online. Like the Lancôme example, the designer can and should consider the temporal burden placed on these employees, particularly if they are required to work odd hours to support the experience. Again, the designer can adjust user expectations around delivery times (e.g., ships within three to five days instead of within 24 hours), set store opening hours to reasonable times (e.g., closed on Sundays), and work to

reduce overall consumption of new phones to reduce strain on the supply chain for manufacturing new phones. The aim here, again, is to consider the temporality of all involved stakeholders instead of just the user's needs, moving toward more equitable distributions of time.

6.4 Adapted Journey Map Method

Below are the instructions for the adapted journey map method, with the adaptations called out using underlined text:

1. Choose a process or journey that you want to map.
2. Write down the steps. Make sure to include even small steps that may seem trivial. The goal is to get you to consider the nuances of the experience that you may normally overlook.
3. Organize the steps into a map. Usually we display the steps sequentially in a timeline. Your map may include branches to show alternative paths in the customer journey. You could also use a series of pictures or whatever method fits your data.
4. New step: Circle the moment the user first comes into contact with any material artifacts in the experience. What is this moment like for them? How, if at all, does the user notice and interact with the materials present? If the experience is entirely digital, what material aspects are salient to the user?
5. New step: List the stakeholders (including non-human stakeholders) who are required to support each touchpoint on the journey map. Consider each stakeholder, what is the experience from their perspective? Based on each stakeholder's experience, what could be changed about the journey map to improve their experience?
6. New Step: Add exits. How could the user gracefully refuse this experience? From the beginning? At key points along the way? Map the user's exit strategy at various points.
7. New Step: Reconsider the ending. Is the user's experience really the end of the story? What about the material objects that are part of the experience – do they persist after the user's experience is over? What about the experience itself – for how long will the experience be available and how will it be discontinued?
8. Look for insights. What patterns emerge? Anything surprising or strange? Question why certain steps occur, the order they occur in, what could go wrong, and so forth. Ask yourself how you might innovate each step.
9. If possible, show the map to people familiar with the journey and ask them what you've overlooked or gotten out of sequence.

6.5 Reflecting on the Adaptation of the Journey Map Method

In using the eight theory-to-practice commitments to adapt the journey map method, I developed four new steps and amended one step to enact the theoretical constructs from Chapter 5. Sometimes subtle changes, like amending an existing step, are enough to accommodate a new theory-to-practice commitment within an existing method. Other times, new steps are needed. Several of the theory-to-practice commitments offered multiple paths for adapting the methods which I did not explore in depth here (for example, the idea of creating intersecting timelines in which different stakeholders' journey maps are overlaid to explore their differing experiences which was prompted by thinking with the theory-to-practice commitment based on Sharma's work) indicating that there are likely many plausible ways to adapt a given method to account for a new theory-to-practice commitment.

The introduction of these eight theory-to-practice commitments to the existing journey map method creates space for innovation, both in the method itself as well as in the design of the experience being mapped. In introducing theory-to-practice commitments to an existing method, the designer opens the potential to both apply theory and explore a new design space which would otherwise have been left unconsidered.

Chapter 7: Translation: From Theory-to-Practice Commitment to Toolkit

Having demonstrated the adaptation of a design method in Chapter 6, in this chapter, I turn to a design toolkit, the value sensitive design Envisioning Cards. Other toolkits I considered adapting include the Thing from the Future toolkit (Candy & Watson, 2018) and the Tarot Cards of Tech (Artefact, 2017). Like the journey map method, Envisioning Cards already have an explicit commitment to time and materials, but there is still ample room to explore with relation to materiality and temporality. First, the temporality of the Envisioning Cards tends toward the longer term and does not address social or experiential aspects of time. Second, materiality within the Envisioning Card set tends to frame this concept in relation to sustainability, again, leaving room to explore the social or experiential aspects of materiality. And third, Envisioning Cards, and value sensitive design more broadly, have not historically engaged the dominant logics in a critical way, as is one of my goals in this dissertation. By adapting Envisioning Cards in this chapter, I aim to broaden the toolkit in light of the theoretical constructs and theory-to-practice commitments from Chapter 5.

7.1 Envisioning Cards: Description and Examples

The Envisioning Cards are a card-based toolkit for bringing consideration of stakeholders, values, time, and pervasiveness to the design context (Friedman & Hendry, 2012). There are four envisioning criteria, akin to a suit, for the Envisioning Cards – time, stakeholders, pervasiveness, and values. Each card focuses on a theme from one of the envisioning criteria. On the front of each card is a title and image related to the card's theme. On the back of each card, there is descriptive text to explain the main concept evoked by the card and a design prompt for enacting the concept. In 2018, Yoo and colleagues (2022) developed a supplementary set of cards, incorporating concepts from multi-lifespan design in the form of 13 new cards.

Envisioning Cards are intentionally flexible and intended to be used by designers (conceptualized broadly as anyone engaging in design action) in a variety of design settings (e.g., educational contexts or industry practice) at any stage of the design process (e.g., ideation, heuristic critique, evaluation). When selecting an Envisioning Card to use as part of their ideation process, the designer reads the main

concept on the back of the card, then follows or adapts the instructions in the design prompt. Depending on the insights they gain from the design activity, the designer may take further actions, like iterating on the design of their system as demonstrated in the work of Yoo and colleagues (2013). Envisioning cards have been used in many contexts, including design research, design education, and evaluation, each described further below.

In a research co-design setting, Yoo and colleagues (2013) introduced Envisioning Cards as part of a model for prompting reflection-on-action to support ideation. Participants in the design research study, acting as designers, were asked to design a cell phone prototype for keeping young homeless people safe; then participants were asked to iterate on their initial prototypes in response to a value scenario³ (Nathan, Klasnja & Friedman, 2007; Woelfer et al., 2011), and then to iterate on their prototype a second time in response to an Envisioning Card. The use of Envisioning Cards in this action-reflection model led to divergent thinking around social and contextual issues related to technology which are often ignored.

The Envisioning Cards have been used extensively in educational settings. For example, in an introductory information science course⁴ in the Information School at the University of Washington for which I was the lead Teaching Assistant, we used Envisioning Cards to scaffold the ideation process for writing value scenarios such as “Sleeve” (Ballard et al., 2019). Specifically, students first used cards from the Thing from the Future toolkit (Candy & Watson, 2018) to invent a future technology. Then they used the design prompts from the Envisioning Cards (Direct Stakeholder card, Indirect Stakeholder card, Widespread Use card, and cards from the Time and Multi-Lifespan Design envisioning criteria) to ideate ways their invented technology might solve problems for a direct stakeholder while having rippling effects on the broader social and environmental context. Their analyses took the form of a value scenario. (See also Appendix B.)

Envisioning Cards can also be used as a tool for evaluation, as demonstrated by Friedman and Hendry’s (2012) analysis of cloud computing infrastructure. In this analysis, Friedman and Hendry use the

³ Value scenarios are narratives written to surface human and technical aspects of different technologies and contexts. They emphasize how direct and indirect stakeholders may be impacted by technology, effects of widespread and longer term use, and other systemic effects (Friedman & Hendry, 2019)

⁴ Batya Friedman, Stephanie Ballard, and Nicholas Logler. 2019. INFO 200: Intellectual Foundations of Informatics. University of Washington Information School. Unpublished.

Political Realities, Environmental Sustainability, and Crossing National Boundaries Envisioning Cards to raise questions and concerns about cloud computing such as the use of resources like electricity to support the project of cloud computing.

Below is an example from the original set of Envisioning Cards (Figure 3 and Figure 4) and an example from the multi-lifespan supplementary set (Figure 5 and Figure 6).

Figure 3. Front side of an Envisioning Card from the original set. The card title is *Indirect Stakeholders*, and the image shows a home located at the foot of several wind turbines. Image credit: <https://www.envisioningcards.com/>.



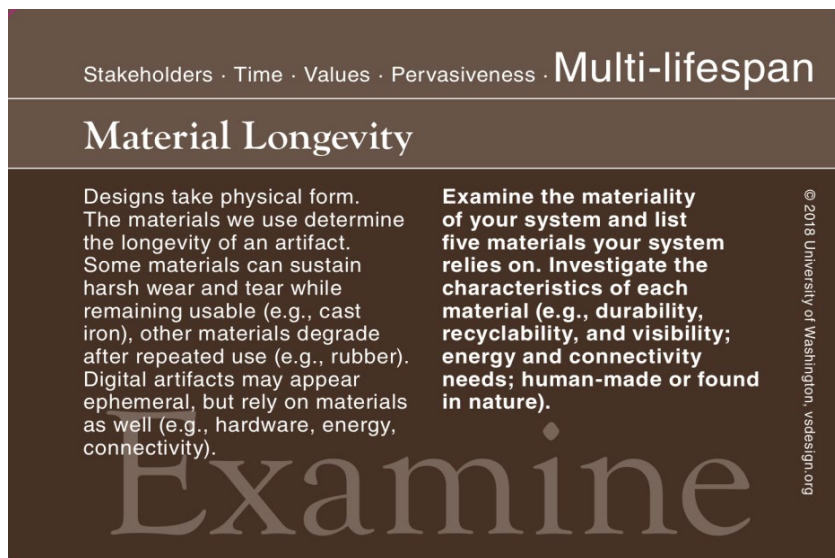
Figure 4. Back side of an Envisioning Card from the original set. The row across the top indicates which of the envisioning criteria this card belongs to (*Stakeholders*) and repeats the title. Below the title, text in the first column describes the key concept of the card and the text in the right-hand column prompts the designer with an action related to the key concept. Image credit: <https://www.envisioningcards.com/>.



Figure 5. Front side of an Envisioning Card from the multi-lifespan design envisioning set. The card title is Material Longevity, and the image shows several different types of materials (wood and steel) aged over time. Image credit: <https://www.envisioningcards.com/>.



Figure 6. Back side of an Envisioning Card from the multi-lifespan supplementary set. The row across the top indicates which of the envisioning criteria this card belongs to (Multi-lifespan) and repeats the title. Below the title, text in the first column describes the key concept of the card and text in the right-hand column prompts the designer with an action related to the key concept. Image credit: <https://www.envisioningcards.com/>.



Within the Envisioning Card toolkit, time is a central theme. There is an entire envisioning criterion dedicated to time in the original set, and the supplementary set of Envisioning Cards covering concepts from multi-lifespan design is inherently related to time. The cards from the time envisioning criteria in the original set cover a wide range of temporal concepts, including Reappropriation (how system use changes over time), Choosing Not to Use (how deliberate non-use affects people's daily lives), Obsolescence (what happens when systems are no longer supported), and The Long Now (how future generations may use systems). Cards from the multi-lifespan supplementary also cover a wide range of temporal considerations, including Future Stakeholders (how people born in the future may be impacted by systems), Long Cycles in Nature (how long-term natural cycles are related to systems), and Pause (how intentional inaction can be used in system design). Across both the original set and the Multi-Lifespan Supplementary Set of Envisioning Cards, the temporal focus tends to be on the longer term, with little attention to experiences of time.

Within the Envisioning Card toolkit, materiality is less of a central focus but still present. There are two cards (one from the original set and one from the multi-lifespan supplementary set) that surface concepts related to materiality: Environmental Sustainability and Material Longevity. The Environmental Sustainability card asks the designer to consider the materials needed to build a system and how the system could be used to support positive environmental outcomes. The Material Longevity card asks designers to consider the materiality of systems and how those materials last over time. In both cards, there is a focus on reducing the environmental impact of technology, but again, little attention to how people experience the materiality of systems.

7.2 Surfacing Assumptions and Laying the Foundation for Toolkit Adaptation

To both surface the underlying assumptions of the Envisioning Cards and to begin to adapt Envisioning Cards, I took each theory-to-practice commitment (see Table 4) and applied them to the existing Envisioning Cards, including the multi-lifespan supplementary set. Specifically, I used the theory-to-practice commitments to ask, how is this concept represented in the existing Envisioning Cards? If the method doesn't capture the theory-to-practice commitment, what does this say about the assumptions

that underlie the Envisioning Cards? How can the Envisioning Cards be adapted to accommodate this theory-to-practice commitment? Below, I summarize the assumptions of Envisioning Cards that surfaced in this exercise.

7.2.1 Assumptions about Materials

In the existing Envisioning Card set there are two cards related to materiality – Environmental Sustainability and Material Longevity. Both cards place an emphasis on the environmental aspects of materials in the design of systems, but they do not explore other concepts related to materiality such as those foregrounded by the theory-to-practice commitments.

Material intelligence. Within the existing Envisioning Cards, there is no emphasis on the experience or connection to materials as articulated by Adamson (2018) in describing material intelligence. In both cards related to materiality, the designer is asked to describe the materials necessary in the design of their system, which is one important component of material intelligence. But the focus in the existing cards is, again, on the environmental impact on those materials instead of the kind of material reflection that Adamson advocates. And while knowing about materials and where they come from is a component of material intelligence, the existing Envisioning Cards are missing the focus on the kinesthetic experience with materials that Adamson is arguing for.

Five forces. As articulated by Borning, Friedman, and Logler (2020) there are five forces which come together to make the materiality of information technology invisible, one of which is the economics of information technology. A culture of consumption and obsolescence, lack of support for older devices, lack of repairability, and business models which rely on constant use and growth all conspire to minimize the material impacts of information technology. Within the existing Envisioning Cards, there is a commitment to minimizing the environmental impact of technology, but without recognizing some of the forces which work to make that very task difficult.

Breakdown. Jackson argues that we live in a world always on the verge of coming apart, and always being reconfigured and held together through acts of maintenance and repair. According to this argument, any approach to minimizing the material impacts of technology must include consideration of maintenance and repair. While the Envisioning Cards do acknowledge that materials can break down

over time, there is no exploration of how to respond to that breakdown, which Jackson (2014) points out can be important and creative sites of innovation.

Here the existing cards related to materiality lay a foundation from which to explore additional concepts related to materials through the Envisioning Card toolkit.

7.2.2 Assumptions about Time

Envisioning Cards have a strong engagement with the temporal concept of the longer term, or prompting designers to consider timelines decades or centuries into the future. Overall, however, Envisioning Cards do not engage with other temporal concepts, such as those surfaced by Chödrön (2000) and Orlikowski and Yates (1999).

Subjectivity and objectivity of time. In their work on temporality, Orlikowski and Yates propose an enacted view of time and argue that everyday action and practices are what constitute temporal rhythms. For example, our continued agreement to attend university on the quarter system is what makes a university a quarter-based system. There is nothing inherent to the university which makes it so, but our continued social participation within that temporal rhythm is what enacts a quarter-based university system. Within the Envisioning Card set, there is a great emphasis on time over the longer term, but not necessarily on individual or collective experiences of time and how individual and group actions work to shape shared temporalities.

Impermanence. Chödrön's Buddhist perspective on the longer term includes at least two components: change and endings. Change is the reality that everything around us is constantly evolving and that nothing is fixed. Endings are the reality that nothing will truly last forever. Within the Envisioning Card set, change, especially over the longer term, is well considered. However, there is no acknowledgment of endings within the Envisioning Card set, which is interesting given the toolkit's focus on the longer term. This is noticeable in the context of the card *The Long Now*, which asks designers to envision their system over five-year periods to imagine how the system will change over time. Here, there is no acknowledgment that these systems will eventually cease to exist.

As time has a strong footing within the existing Envisioning Card sets, the adapted Envisioning Cards in Section 7.3 serve to complement and expand the way time is conceptualized within Envisioning Cards as a toolkit for design.

7.2.3 Other Assumptions

The analysis of the Envisioning Cards using the eight theory-to-practice commitments surfaced several other assumptions, unrelated to materiality and temporality.

Systems of power. Several of the theory-to-practice commitments emphasize the power dynamics between stakeholders including Sharma's (2014) theory of power chronography and Odell's (2019) work on refusal. Both of these works take a critical stance to existing systems of power, leveraging critiques of capitalism to analyze its effects on inequitable experiences of time (Sharma, 2014) and our attention (Odell, 2019). While value sensitive design and Envisioning Cards by extension place emphasis on identifying both direct and indirect stakeholders, value sensitive design has not historically engaged in critical reflection on relationships between these stakeholders nor the power dynamics between identified stakeholders (Friedman & Hendry, 2019, p 176). Similarly, value sensitive design has not historically engaged in critiques of systems of power like capitalism or racism (Friedman & Hendry, 2019, p 176). Incorporating these theory-to-practice commitments into Envisioning Cards pushes the set to engage more directly with these important ideas and makes space to consider structures of power through the toolkit.

Non-human stakeholders. A core component of value sensitive design is stakeholder considerations, so it's no surprise that stakeholders is an envisioning criterion of Envisioning Cards, and that eight Envisioning Cards are related to stakeholders. None of these cards, however, explicitly mentions non-human stakeholders as a category to consider in the design of systems. Indeed, only two Envisioning Cards mention animals (as one example of a non-human stakeholder) at all – Long Cycles in Nature and Collect Now. The identification and legitimation of non-human stakeholders is explored briefly in *Value Sensitive Design: Shaping Technology with Moral Imagination* (Friedman & Hendry, 2019, p 175) and so including this consideration here is a natural extension of stakeholder identification work as conceptualized by value sensitive design and within the existing Envisioning Cards.

In the next section, I describe how I adapted the Envisioning Cards based on the analysis of the eight theory-to-practice commitments.

7.3 Adapted Envisioning Cards

The design process for creating an Envisioning Card involves crafting three main components: main concept, design prompt, and image. The main concept on the Envisioning Card communicates a theoretical construct to the designer in a very brief passage – generally in 40 words or less. Indeed, one of the challenges of designing an Envisioning Card is communicating new and often challenging ideas concisely for the format. The design prompt of an Envisioning Card is what mobilizes the theoretical construct. Using the language of the model of knowledge types in design, the design prompt on an Envisioning Card enacts the theory-to-practice commitment for a given theoretical construct. The main concept conveys the theoretical construct, while the design prompt invites the designer to take some concrete design action that enacts the theoretical construct. Lastly, the image ties the main concept and the design prompt together by evoking the theme.

In designing this set of adapted Envisioning Cards, I went through multiple iterations. I began by brainstorming potential ideas for an Envisioning Card for each of the theoretical constructs and the theory-to-practice commitment pairs in Table 4. Then, converging, I sketched an idea for one Envisioning Card for each theoretical construct/theory-to-practice commitment pair. I went through several drafts, revising the main concept and prompt each time. After the first two iterations, I made additional progress by applying each design prompt to two examples, asking, How would this card apply to an Amazon Alexa device? How would this card apply to a mechanical pencil? By working through these very different examples, I was able to further refine the design prompts on the cards. Finally, I selected an image that evokes the theme of the card.

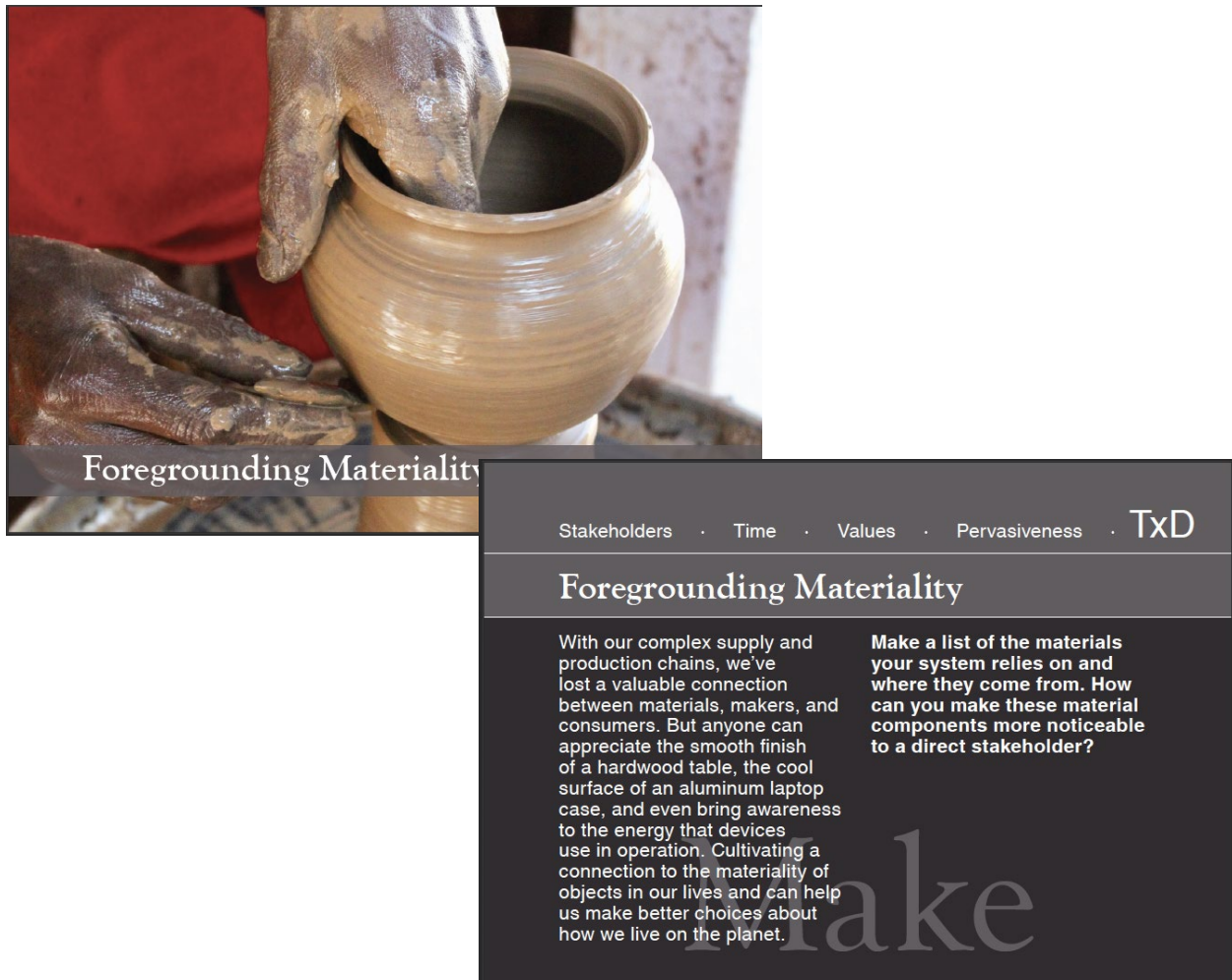
There are two main differences in my process for adapting the Envisioning Cards compared to the process for adapting the journey map method. First, in adapting the Envisioning Cards I used both the theoretical construct and the theory-to-practice commitment, whereas when adapting the journey map method I used only the theory-to-practice commitment. This is because the Envisioning Card, as described above, makes the theoretical construct explicit in the card's main concept. The theoretical construct distilled from each selected piece is a productive starting point for developing the card main concept. The second difference between adapting the journey map method and the Envisioning Card method is the level of granularity each affords the specific theory-to-practice commitments. In adapting

the journey map method, I introduced five adaptations based on the eight theory-to-practice commitments, consolidating some ideas into a single adaptation in response to that particular method. In adapting the Envisioning Cards, I created a separate card for each selected piece to better capture the nuances of each individual theoretical construct and theory-to-practice commitment. When applying Envisioning Cards in a design space, the designer is not expected to consider each Envisioning Card, rather they might choose three to five cards and spend time with those ideas. By creating an individual card for each of the eight selected pieces, I was able to better capture the nuance of the theoretical constructs and theory-to-practice commitments, but also create a broader set from which designers using Envisioning Cards can explore. Below, I describe and share the resulting Envisioning Card for each of the eight selected pieces.

7.3.1 Foregrounding Materiality

My analysis of the existing Envisioning Cards using the theory-to-practice commitment based on Adamson's (2018) work on material intelligence surfaced several cards related to materials within the existing Envisioning Card set, including Materiality Longevity and Environmental Sustainability, however, both cards focus on the longevity of materials and not people's connection to material experiences. To enact this theory-to-practice commitment I designed an Envisioning Card that would prompt designers to consider the connection direct stakeholders have to the material experience of the system being designed. Like the other Envisioning Cards related to materials, the action begins with listing materials necessary for their system. Unlike the other cards related to materials, the designer is then asked to make the material aspect of the system more prominent for a direct stakeholder in order to facilitate material reflection.

Figure 7. The Foregrounding Materiality Envisioning Card. Image credit: Balaji Malliswamy via [Unsplash](#).



7.3.2 Do Less

My analysis of the existing Envisioning Cards using the theory-to-practice commitment based on Odell's (2019) work surfaced that the closest existing card is Choosing Not to Use. This card asks the designer to consider how choosing not to use a system will affect a person's daily life. While similar to the concept of refusal, choosing not to use is missing the critical focus on productivity and the pressure to make things productive. In order to work with this theoretical construct and theory-to-practice commitment pair, I designed an Envisioning Card that prompts the designer to directly consider the concept of refusal as a response to the pressure to optimize. The challenge in creating this card was to productively use a theory-to-practice commitment that's rooted in resisting productivity.

Figure 8. The Do Less Envisioning Card. Image credit: Daniel Herron via [Unsplash](#).



Stakeholders · Time · Values · Pervasiveness · TxD

Do Less

The artist Tehching Hsieh says we fill up our time in an attempt to fill our lives with meaning and asks, through his art, what if we empty our time instead. The external and internal pressure to optimize and make our time more productive are formidable, but the result is a compressed, unsatisfying experience of time. What can we gain by refusing to optimize or be productive?

Consider the ways your design project is responding to pressure to optimize or be productive. What can you say no to? How can you do less? How can you make space for other stakeholders to do less?

Consider

7.3.3 Actual Cost of Materiality

My analysis of the existing Envisioning Cards using the theory-to-practice commitment based on the work of Borning, Friedman, and Logler (2020) surfaced two closely related existing cards – Material Longevity and Environmental Sustainability. However, these two cards do not engage in the market forces aspect which is central to the ideas put forward by Borning, Friedman, and Logler (2020). In order to work with this theoretical construct and theory-to-practice commitment pair, I designed an Envisioning Card that pulls forward the economic aspect of material decomposition. In particular, I wanted to highlight that spaces where materials decompose or are disposed cost money to operate, and that cost is usually borne by local governments. The offloading of the cost of spaces for decomposition and disposal (i.e., landfills) decreases the cost of information technology for the consumer. As garbage and refuse handling is incredibly complex and varies based on materials, location, and many other factors, it was challenging to determine an estimate for how much it would cost to support an artifact through this stage of life. To do this, I used a rough estimate of how much it costs to maintain a square foot of a landfill per year (Duffy, 2005). The actual costs of material disposal for a given system will be highly variable, but this card prompts designers to consider the cost of material disposal in the creation of their system instead of deferring that cost to subsidized public services.

Figure 9. The Actual Cost of Materiality Envisioning Card. Image credit: Zoran Milich via [Getty Images for National Geographic](#).



7.3.4 Temporal Reflexivity

My analysis of the existing Envisioning Cards using the theory-to-practice commitment based on Orlikowski and Yates's (1999) work surfaced many related cards. Indeed, time is an entire envisioning criterion of the Envisioning Cards, but the existing cards focus almost exclusively on the longer term and system users over time. There is room in the existing set to consider other temporal dimensions including how our temporal practices and structures are enacted as is the focus of Orlikowski and Yates (1999). In order to work with this theoretical construct and theory-to-practice commitment pair, I designed an Envisioning Card that drew designers' attention to our ability to change our temporal structures through design work.

Figure 10. The Temporal Reflexivity Envisioning Card. Image credit: Jon Tyson via [Unsplash](#).



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Temporal Reflexivity

We rely on a variety of temporal structures to organize action. Some examples include clocks, calendars, regularly scheduled meetings, summer vacations, and even the long-term assumptions of continued growth. While we perceive many of these temporal structures as fixed, we can change them. The first step is practicing temporal reflexivity – awareness of the human potential for reinforcing and altering temporal structures.

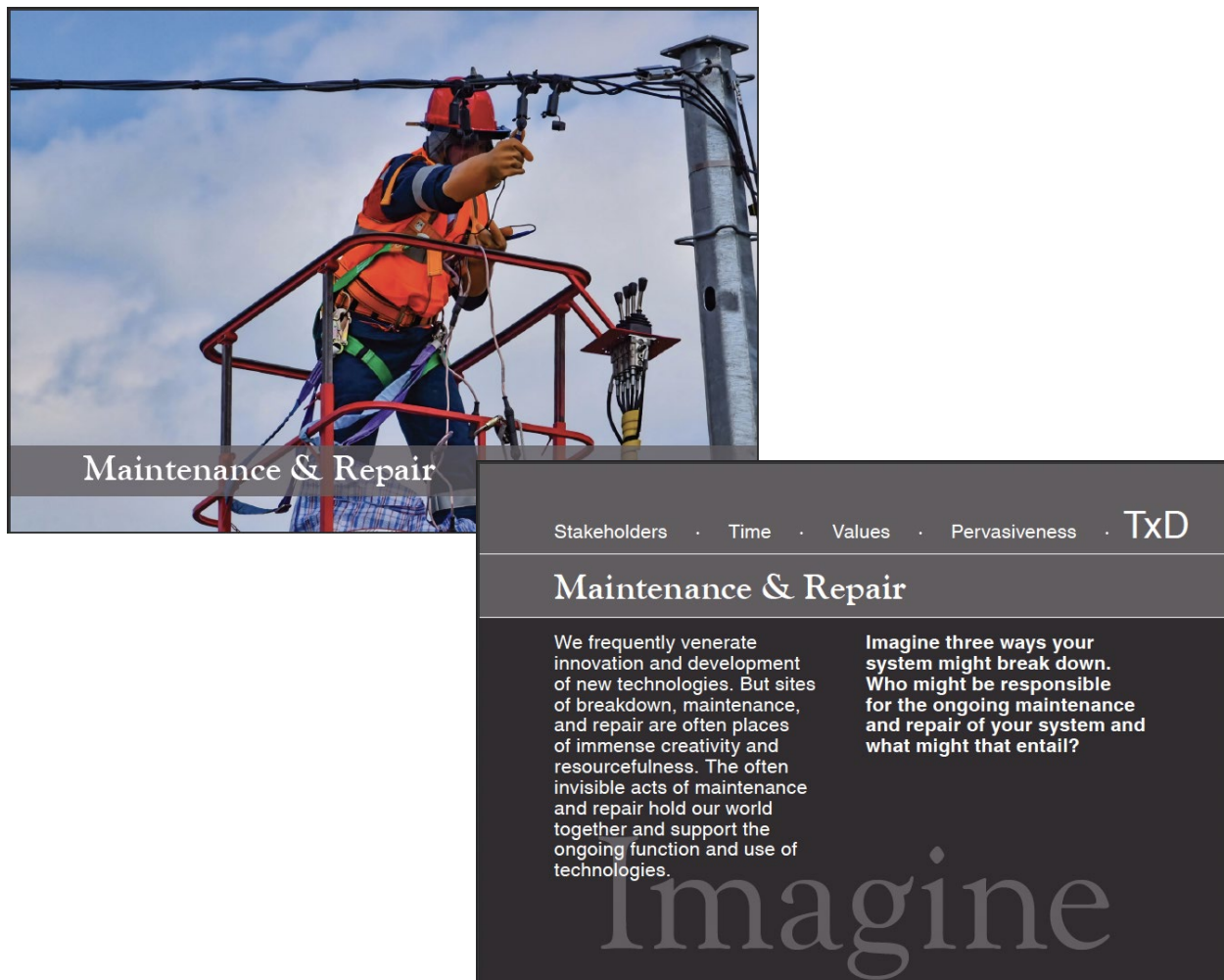
Identify a temporal assumption your system makes and give three examples of how this temporal assumption manifests in your system. How might you change this temporal assumption?

Identify

7.3.5 Maintenance & Repair

My analysis of the existing Envisioning Cards using the theory-to-practice commitment based on Jackson's (2014) work surfaced the closely related card *Obsolescence*, which touches on the idea that technology may become obsolete over time. But in broken world thinking (Jackson, 2014) subtly situates the focus on maintenance and repair of technology as sites for innovation. One existing card, *Reimagining Infrastructure*, slightly conflicts with the construct of maintenance and repair, as it prompts designers to consider new infrastructure (as opposed to caring for existing infrastructure). Despite this potential conflict, my value sensitive design colleagues and I have long discussed the need for an Envisioning Card on this topic. In order to work with this theoretical construct and theory-to-practice commitment pair, I designed an Envisioning Card that prompted designers to not only consider how their systems might be repaired but who would be responsible for conducting those repairs.

Figure 11. *The Maintenance & Repair Envisioning Card*. Image credit: ehmitrich via [Unsplash](#).



7.3.6 Temporal Justice

My analysis of the existing Envisioning Cards using the theory-to-practice commitment based on Sharma's (2014) work surfaced a gap in the existing Envisioning Cards related to the interrelatedness of stakeholders and the power dynamics between them. While there is a lot of attention to stakeholders in the existing Envisioning Cards, there is no consideration for how their temporal experiences may differ. In order to work with this theoretical construct and theory-to-practice commitment pair, I designed an Envisioning Card that drew attention to the temporal experience of indirect stakeholders of the system at hand.

Figure 12. The Temporal Justice Envisioning Card. Image credit: ŠJú via [Wikimedia Commons](#).



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Temporal Justice

Temporal inequalities result from the ways we experience time differently based on our intersectional identities (class, race, gender, and immigration status). While the taxi driver and the frequent business traveler share the cab ride to the airport, their experience of that time is vastly different.

Identify the stakeholders whose labor, and therefore time, is used to design, manufacture, and support the system. Does the system rely inequitably on the time of some stakeholders over others? Think of 3-5 ways your system might lead to more equitable temporalities for direct and indirect stakeholders.

Identity

7.3.7 Non-human Stakeholders

My analysis of the existing Envisioning Cards using the theory-to-practice commitment based on Puig de la Bellacasa's (2017) work surfaced many related cards. Indeed, stakeholders is an envisioning criteria of cards in the existing Envisioning Card set. While many of the stakeholder cards implicitly leave room for the consideration of non-human stakeholders, none of the cards call out this group explicitly, which I've done in the card below.

Figure 13. The Non-human Stakeholders Envisioning Card. Image credit: Arnaud Mariat via [Unsplash](#).



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Non-human Stakeholders

From a non-human-centered approach, humans, non-human animals, other living organisms and man-made objects are bound together in interconnected and complex ecologies. Yet we don't often consider non-human stakeholders in the design of technology. What would a data center look like if we thought about the ants that lived on that land? Would we build it at all?

Brainstorm 3-5 non-human stakeholders, including your system as a stakeholder. How are these stakeholders interconnected? How does your system implicate the other stakeholders?

Brainstorm

7.3.8 Impermanence

My analysis of the existing Envisioning Cards using the theory-to-practice commitment based on Chödrön's (2000) work surfaced two closely related cards and two conflicting cards. The closely related cards are Obsolescence (which prompts the designer to consider a time when the system is no longer supported) and Changing Hands (which focuses on how individual users will let go of the system as it passes ownership). These cards effectively capture the change aspect of Chödrön's articulation of impermanence, but neither of these cards engages directly with how the designer should conceptualize and proactively design the end of a system. The two conflicting cards are The Long Now (which asks the designer to consider a world in which the system is still in use fifty years from now) and Pause (which implies that design work will restart as opposed to end). These related cards indicate that while Envisioning Cards engage effectively with ideas related to the longer term, they do not engage as much with ideas related to impermanence, endings, or letting go of existing systems. In order to work with this theoretical construct and theory-to-practice commitment pair, I designed an Envisioning Card that prompts designers to consider the ending and design for it.

Figure 14. The Impermanence Envisioning Card. Image credit: Rafael Zamora via [Unsplash](#).



7.4 Reflecting on the Adaptation of the Envisioning Card Toolkit

Here I offer three reflections on the adaptation of Envisioning Cards in this dissertation.

First, while Envisioning Cards, when done well, are a simple tool, developing them is not always a straightforward process. After the second iteration of content for the adapted Envisioning Cards I struggled to make progress in moving from ideation to clear and concise main concepts and design prompts. The introduction of test cases was instrumental to making progress, demonstrating the value of the use of examples in method and toolkit development. In this case, applying early versions of the draft Envisioning Cards to both an Amazon Alexa and a mechanical pencil provided a way to gain traction and move toward clarity.

Second, the model of knowledge types in design works to break the task of adapting design methods and toolkits into manageable pieces. This is beneficial for the process of developing an Envisioning Card. The theoretical construct provides the foundation for a main concept on an Envisioning Card. Someone adapting an Envisioning Card may need to provide additional detail or examples to make a theoretical construct an appropriate main concept, but the core concept is already concisely defined. The theory-to-practice commitment guides the development of the design prompt for an Envisioning Card, by providing an action-oriented statement for enacting the theoretical construct. Someone adapting an Envisioning Card can use the theory-to-practice commitment to develop a design prompt that makes the action concrete. For example, the theory-to-practice commitment based on Jackson's (2014) work states that *the designer must foreground breakdown, maintenance, and repair as essential to the story of technology and of innovation*. To center breakdown, maintenance and repair as a design prompt, the Maintenance & Repair Envisioning Card invites designers to reflect on how their system might break down and who might be responsible for that repair, effectively taking action that is aligned with the theoretical construct and theory-to-practice commitment. The challenge in creating a design prompt lies in creating a statement that is general enough to apply across design situations but specific enough to lead to meaningful action or reflection in a specific design situation.

Last, the beauty of Envisioning Cards is they introduce an idea and invite the designer to work with it. It may be a brand-new idea to the designer, the idea may not be entirely clear to the designer, or the idea might not even apply to the design project, but the designer can generally still take some design

action based on the prompt. The challenge in creating Envisioning Cards lies in helping others move from abstract ideas to design action.

In the previous two chapters, I demonstrated how to use theoretical constructs and theory-to-practice commitments translated using the model of knowledge types in design to adapt a design method and toolkit. In the next chapter, I report on an educational case study using the model of knowledge types in design to teach others how to adapt design methods on their own.

Chapter 8: A Brief Educational Case Study

8.1 Introduction

After putting forward the model of knowledge types in design in response to R1 and using it to adapt a design method and design toolkit in response to R2, I turn now to R3: could this model and the associated skills be taught to novice designers as they adapt design methods? To answer this question I conducted an empirical, educational case study, for which there are three research questions: (RQ3.1) Can participants apply a toolkit that was adapted using the model of knowledge types in design, introducing the concepts into a design situation? (RQ3.2) Can participants use the model of knowledge types in design to successfully translate theory-to-practice commitments? And, finally, (RQ3.3) can participants use the theory-to-practice commitments to adapt existing design methods?

8.2 Methods

8.2.1 Research Setting

In this educational case study, I used the model of knowledge types in design to teach method adaptation as part of an undergraduate course related to time and design. The class took place at a large research university in the pacific northwest of the United States in Winter Quarter 2021 (January 2021 - March 2021). I was a teaching assistant for this course in two of the times it was previously offered, and in Winter 2021 I was the Instructor of Record. As this course took place during the Coronavirus pandemic, all instruction was conducted remotely. During the ten-week course, participants read and discussed works related to temporality, and, to a lesser extent, materiality, and took part in design studios. In the design studios, participants engaged in design activities aimed at using ideas about time in the design process. Each week of the course had a different focus (e.g., machine time; time and worldview; attention; time and materials; etc.). Among other works, participants read several of the eight pieces selected for this dissertation (see Chapter 5) including those by Borning, Friedman, and Logler (2020); Jackson (2014); Orlikowski and Yates (1999); Puig de la Bellacasa (2017); and Sharma (2014). Participants did not read the pieces by Adamson (2018); Chödrön (2000); or Odell (2019).

For the version of this class taught in Winter 2021, I made several changes to the course to collect the data used in this case study. Specifically, I altered three course activities (design studios) and three written assignments (reflections on those design studios) to evaluate the model of knowledge types in design. As the instructor of the course, I did not review the submissions for these three design studios or written assignments until the quarter ended and final grades were submitted.

8.2.2 Participants

Participants were students in an undergraduate, upper-level, elective design course related to time and design in Winter Quarter of 2021. There were 35 students enrolled in the course. As the course was offered through the informatics program, many of the participants (though not necessarily all) were informatics majors. Informatics majors at this particular institution are diverse (across many dimensions including race, nationality, and socioeconomic status), driven, busy, fascinated by technology, and tend to be overly utopian in their views about technology (Ko, 2023).

Participants were able to exclude their data from the study by opting out and data for students who submitted make-up design studios individually (not as part of a group) have been excluded. For each design studio, the number of groups and participants is enumerated in Table 5 below.

Table 5. The number of groups and individual participants whose data was analyzed in this chapter.

Design Studio	Number of groups	Number of individual participants
Envisioning Cards	10	29
Method Adaptation: Journey Maps	8	26
Method Adaptation: Choose Your Own Method	9	30

8.2.3 Activities

As my goal in the course was to teach participants how to engage in the work of adapting methods, I paid considerable attention to how to introduce these concepts. Indeed, in previous instances of the course, the instruction team had received feedback that the segment on adapting design methods was particularly challenging. Thus, introducing the model as a teaching tool and structuring the design studios from most constrained to least constrained were pedagogical decisions made to support learners. Across

the three design studios, participants were randomly assigned to design groups. We would begin each design studio by discussing the assignment together as a class, addressing any initial questions, and then separating into breakout rooms for the design work. Depending on the design studio, we sometimes came back together as a group to discuss specific points part way through the design studio. During each design studio, participants could request a check-in; otherwise, I did not circulate through the breakout rooms. For each design studio, participants wrote a short, one- to two-paragraph reflection about their experience in the design studio.

In the first, most constrained design studio, participants applied the adapted Envisioning Cards from Chapter 7 to an existing Internet of Things (IoT) device. Students chose an existing Internet of Things device, redesigned it from the perspective of planned obsolescence (making the device more likely to break down and need replacing), then redesigned it from the perspective of sustainability (making the device more environmentally friendly). Finally, they selected two of the adapted Envisioning Cards from Chapter 7 and applied those Envisioning Cards to the design of the IoT device. By design, in using Envisioning Cards the theoretical construct is already identified, the theory-to-practice commitment is already translated, and the design action is already prompted. Here, participants practiced applying new theoretical knowledge in a particular design situation.

In the second design studio, participants all worked to adapt the same method, the journey map method. First, the participants applied the existing design method, building a journey map for a user of an IoT device of their choosing. Then, I asked participants to identify a theoretical construct from one of five readings and then translate that theoretical construct into a theory-to-practice commitment. The five readings from which the participants could identify theoretical constructs were those by Borning, Friedman, and Logler (2020); Jackson (2014); Orlikowski and Yates (1999); Puig de la Bellacasa (2017); and Sharma (2014). Then, using the theory-to-practice commitment, participants adapted the journey map to account for the new idea(s) introduced by the theoretical construct. In this design studio, participants adapted the outputs of a design method, a journey map they had created using the standard method.

In the final, least constrained design studio, participants chose any design method they wanted, identified a theoretical construct from one of the same five readings as before, translated a theory-to-

practice commitment, and used the theory-to-practice commitment to adapt the design method of their choice. In this design studio, three groups chose to adapt field observations, two groups chose to adapt affinity diagrams, and one group chose to adapt each of the following methods: interviews, surveys, personas, and value propositions.

The progression across the three design studios is akin to taking the training wheels off a bicycle. In each stage, there were fewer constraints and less structure placed on the design work of adapting a design method.

8.2.4 Coding and Data Analysis

To answer the three research questions associated with this case study, I coded and analyzed design studio and written reflection data from the course using several different approaches, each of which is described in this section.

Applying the Adapted Envisioning Cards. Data from this design studio includes design work from ten groups and written reflections from 29 participants. To analyze this data, I read through the full data set several times, identifying and making notes about interesting moments of both design work and reflection. After several passes, themes started to arise from the data – when using the adapted Envisioning Cards, participants were designing with, thinking with, and talking with the ideas from the adapted Envisioning Cards. However, there were also times when participants misinterpreted or misapplied the concepts from the Envisioning Cards. In a final coding pass on the data, I identified 54 excerpts which were coded as one of the following codes: designing with theory, thinking with theory, talking with theory, or misunderstanding. To assess the reliability of the coding, a secondary coder coded 54% of the excerpts, and Cohen's kappa was $k=0.687$, indicating substantial agreement.

From Theoretical Construct to Theory-to-Practice Commitment. Data from this activity includes 17 translation pairs (a theoretical construct and theory-to-practice commitment) developed across the two method adaptation design studios. To analyze this data, each theoretical construct and each theory-to-practice commitment were coded according to the structure in Table 6 below. To assess the reliability of the coding, a secondary coder coded 30% of the pairs, and Cohen's kappa was $k=0.531$ indicating moderate agreement.

Table 6. Codes applied to the theoretical constructs and theory-to-practice commitments and their meaning.

Code	Theoretical construct	Theory-to-practice commitment
Yes	The theoretical construct can be identified as coming directly from the identified reading.	The theory-to-practice commitment can be identified as a reasonable action statement coming from the theoretical construct OR the reading.
Maybe	The theoretical construct can be identified as closely related to the identified reading.	The theory-to-practice commitment can be identified as a reasonable action statement closely related to the theoretical construct OR the reading.
No	The theoretical construct cannot be identified as coming from the identified reading.	The theory-to-practice commitment cannot be identified as a reasonable action statement coming from the theoretical construct OR the reading.

Adapting Method: Journey Maps. Data includes design work from eight groups and 26 written reflections from participants. To analyze this data, I identified 36 excerpts which were coded using the same coding scheme which was applied to the Envisioning Card data: designing with theory, thinking with theory, talking with theory, or misunderstanding. To assess reliability, a secondary coder coded 56% of the excerpts, and Cohen's kappa was 0.7, indicating substantial agreement.

Adapting Methods: Choose Your Own Method. Data includes design work from nine groups and 30 written reflections from participants. To analyze this data, I identified 33 excerpts which were coded using the same coding scheme which was applied to the Envisioning Card data: designing with theory, thinking with theory, talking with theory, or misunderstanding. To assess reliability, a secondary coder coded 30% of the excerpts, and Cohen's kappa was 0.78, indicating substantial agreement.

8.3 Findings

8.3.1 Applying the Adapted Envisioning Cards

To address RQ3.1, the 54 excerpts from this design activity were coded as designing with theory, thinking with theory, talking with theory, or misunderstanding. Table 7 below enumerates how frequently the codes were applied to the excerpts.

Table 7. The percentage of excerpts coded with each of the codes.

Code	Percentage of excerpts coded
Designing with theory	33.3%
Thinking with theory	40.7%
Talking with theory	5.6%
Misunderstanding	20.4%

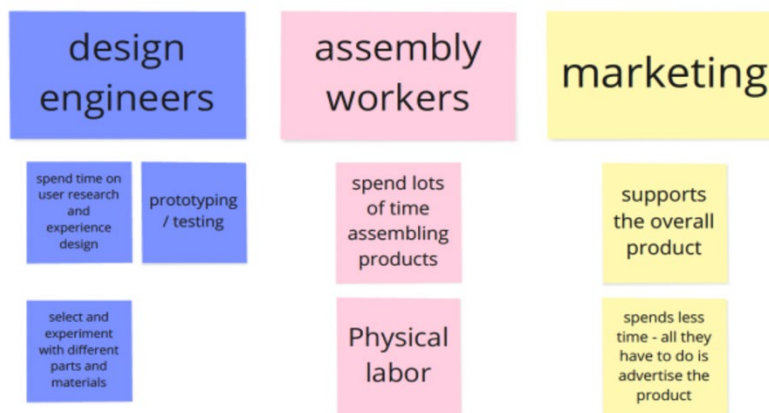
The goal of using the adapted Envisioning Cards is to apply the theoretical constructs in design practice. That is, to enable action aligned with the theoretical construct via the theory-to-practice commitment. In 79.6% of the 54 excerpts from this design activity and accompanying reflections, participants were acting with theory, either by designing, thinking, or talking with the concept introduced by the adapted Envisioning Card.

Excerpts that demonstrate participants were designing with theory come from the design work and provide evidence for a relevant design change to the artifact after the Envisioning Card was introduced. For example, one group introduced the adapted Envisioning Card Impermanence, which prompts designers to consider what happens to a system when it ends, to the IoT device Furbo, an automatic pet treat dispenser. In considering impermanence in relation to this device, the participants introduced a design change: the device should be compostable. Whether or not this is technically possible, a compostable IoT pet treats dispenser certainly embodies the concept of impermanence. As another example, a different group applied the Maintenance & Repair Envisioning Card to a Google Home virtual assistant. In considering maintenance and repair, this group added a feature to the Google Home which detects damage and instructs the owner on how to contact support for repairs. In both of these examples, participants introduced these design changes in response to the Envisioning Cards.

Excerpts that demonstrate participants were thinking with theory were present in both design work and in written reflections. These excerpts include notes or reflections on the design studio that are on topic for the Envisioning Card(s) introduced, but the notes or reflections don't represent a design change in the IoT device. For example, one group introduced the Non-human Stakeholders Envisioning Card, which asks designers to identify three to five non-human stakeholders and describe their

interrelations, to their IoT device of smart light bulbs. When thinking with this Envisioning Card, they note “insects and other animals that might be impacted by the radio waves of WIFI and Bluetooth” as a non-human stakeholder to consider. Here, this group has identified a stakeholder (thinking with), but they’ve not made any design changes to the IoT device in response to this idea. As another example, a different group introduced the Temporal Justice Envisioning Card, which asks designers to identify whose time is used in the making of the system and how their system could lead to more equitable temporalities, to their IoT device of smart light bulbs. In Figure 15 below, the group identifies stakeholders of their IoT device and describes how their time is differentially impacted (thinking with), but they don’t propose any changes to the IoT device itself. Often, thinking deeply about a new theoretical construct is a first step in designing with theory, and here there is evidence that participants were able to think with theory in this particular design situation.

Figure 15. An excerpt that shows participants thinking with theory in response to the Temporal Justice Envisioning Card.



There were fewer documented examples of participants talking with theory. However, as the design work analyzed here was collaborative, participants likely engaged in rich conversation which was not documented in the design work or written reflections. One example of talking with theory comes from a participant’s written reflection. In their group, they applied the Non-human Stakeholder and Temporal Justice Envisioning Cards to their IoT device and said of the activity, “We did not end up making any changes to our design based on the discussion and activity we did from the Envisioning Cards, but we did

talk about how non-human stakeholders and temporal justice could be involved in the design of our product.” Like thinking with theory, conversation is an important first step in design, and here there is evidence of talking with theory.

The analysis of these excerpts provides evidence that working with the adapted Envisioning Cards, a toolkit that was adapted using the model of knowledge types in design, enables designing, thinking, and talking with specific theoretical constructs in a particular design situation.

8.3.2 From Theoretical Construct to Theory-to-Practice Commitment

In response to RQ3.2 and across two design studios, participants identified a reading to work with, articulated a theoretical construct, then translated that theoretical construct into a theory-to-practice commitment. The 17 theoretical constructs were coded as Yes, Maybe, or No, indicating whether they were directly related to the identified reading, somewhat related to the identified reading, or not related to the identified reading. Similarly, the 17 theory-to-practice commitments were coded as Yes, Maybe, or No, indicating whether they were directly related to the identified theoretical construct or identified reading, somewhat related to the theoretical construct or identified reading, or not related to the theoretical construct or identified reading. Table 8 below enumerates how frequently the codes were applied to the theoretical constructs or theory-to-practice commitments respectively.

Table 8. Percentage of theoretical constructs and theory-to-practice commitments coded as Yes, Maybe, or No.

Code	Percentage of theoretical constructs coded	Percentage of theory-to-practice commitments coded
Yes	70.6%	52.9%
Maybe	5.9%	35.3%
No	23.5%	11.8%

Identifying theoretical constructs. In 76.5% of cases, participants were able to identify a theoretical construct that was either directly related or somewhat related to the key themes of the readings (i.e., the theoretical construct was coded as *Yes* or *Maybe*). For example, one group selected Sharma’s work from which to identify a theoretical construct and articulated: “Power chronology [*sic*] is a concept where everyone fits into a hierarchy based on their role in capitalism/society, and the way they spend their time and experience their time reflects their position in that hierarchy.” While this may not be a

word-for-word articulation of Sharma's main ideas, it reflects a deep understanding of Sharma's (2014) central concept, power chronography. In less than a quarter of cases, the theoretical constructs were coded as *No*, indicating that participants failed to articulate a theoretical construct that was related to the reading. In these cases, either the identified theoretical construct was a misinterpretation of the reading or the meaning of the theoretical construct was not clear enough to the coders. For example, a different group also selected Sharma's work from which to identify a theoretical construct and articulated this theoretical construct: "Speed time theory [*sic*]: Society seems to think time goes more quickly, regardless of technology." While Sharma does mention speed theory in her work, she is problematizing this concept and arguing for a more nuanced way of understanding temporalities across society (Sharma, 2014).

Translating theory-to-practice commitments. While there were fewer clear yeses in this category, in 88.2% of cases, participants were able to translate a theory-to-practice commitment that was clearly or somewhat related to the reading or the identified theoretical construct (i.e., the theory-to-practice commitment was coded as *Yes* or *Maybe*). For example, the group which accurately articulated a theoretical construct based on Sharma's work in the example above translated a theory-to-practice commitment as: "To design with the idea of power chronology [*sic*], we must recognize the social hierarchies we are working within and constructing for our product (considering all stakeholders involved)." This theory-to-practice commitment maintains the underlying ideas from Sharma, but moves toward an action-oriented statement where designers should recognize and consider certain aspects of the design situation, namely all involved stakeholders. In contrast, 11.8% of cases were situations where participants were not able to translate a theory-to-practice commitment that was related to the reading or the theoretical construct. For example, the group above who incorrectly articulated a theoretical construct based on Sharma's work also translated a theory-to-practice commitment which does not clearly reflect either the ideas of the theoretical construct or the work from Sharma, saying: "To design with this theory, we need to consider how long the focus/target takes to complete something and whether they seem to be in a hurry." This theory-to-practice commitment, while action-oriented, doesn't reflect the underlying ideas of Sharma's work (that our temporalities are bound together and made inequitable through the lens of capitalism) or of speed theory (the role of technology in "speeding up" time).

When the theoretical construct was wrong, but the theory-to-practice commitment was right.

Interestingly, there were two cases where participants articulated a theoretical construct that was coded as *No*, indicating that it was not related to the identified work but did translate a theory-to-practice commitment that was related to the theoretical construct. In other words, in these two cases, participants did not accurately reflect the ideas of the identified author(s), but they were able to translate an action-oriented statement based on the idea that they did articulate. For example, one group identified that they were working with ideas from Jackson (2014) and articulated the following theoretical construct: “Repair is about space and function, it accounts for the durability of the old, but also the appearance of the new.” This theoretical construct does not reflect the main ideas of Jackson’s work (namely that maintenance and repair are important sites for creativity and innovation). But, the group’s theory-to-practice commitment is an action-oriented statement that can be linked to their claim: “To design with this idea, we must account for the durability and repairability of materials.” So, while the group did not accurately reflect Jackson’s ideas, they were still able to move toward an action-oriented statement based on an idea. This is an early indication that the model supports translation work, even when there is a disconnect between the identified work and the stated theoretical construct. Conversely, this problematizes the relationship between theory and design and just how and when designers should claim to be working with specific theories.

8.3.3 Method Adaptation: Journey Maps

In response to RQ3.3, participants were asked to adapt the journey map method in response to a theory-to-practice commitment they translated. The 36 excerpts from this design activity were coded as designing with theory, thinking with theory, talking with theory, or misunderstanding. Table 9 below enumerates how frequently the codes were applied to the excerpts.

Table 9. The percentage of excerpts from the Method Adaptation: Journey Map design studio coded with each of the codes.

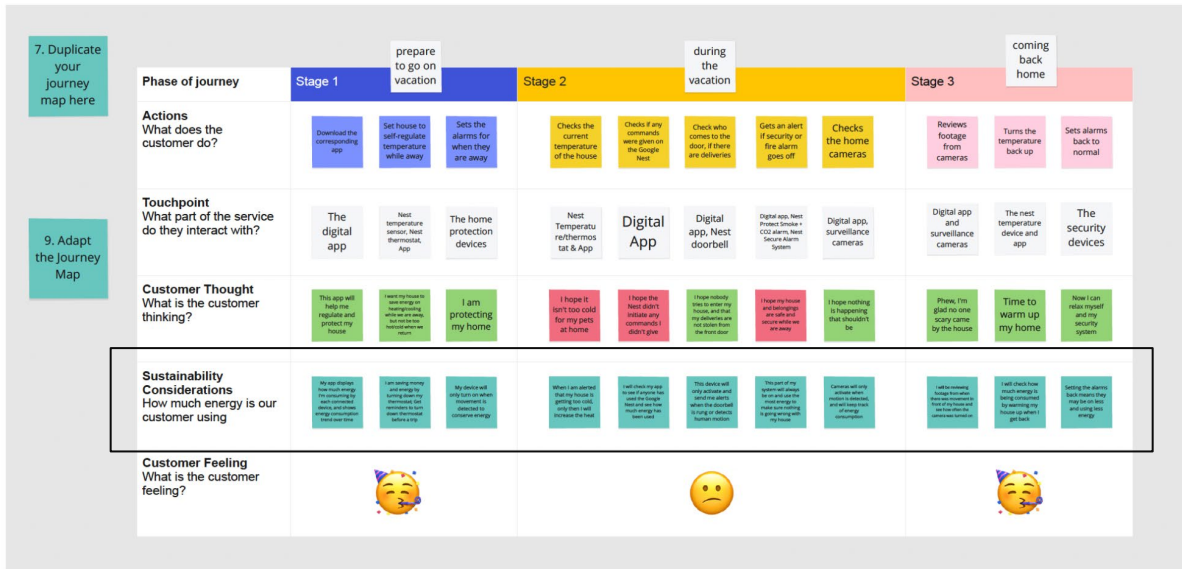
Code	Percentage of excerpts coded
Designing with theory	52.8%
Thinking with theory	41.7%
Talking with theory	2.8%
Misunderstanding	5.6%

The goal of adapting the journey map method is to apply the theoretical constructs in design practice. That is, to enable design action aligned with a theoretical construct. In 97.3% of the 36 excerpts from this design activity and accompanying reflections, participants acted with theory, either by designing, thinking, or talking with the theory-to-practice commitment.

Excerpts that indicate participants were designing with theory come from both the design and reflection data and indicate that a design change was made to the journey map after the introduction of a theory-to-practice commitment. In the journey maps, these changes primarily took two different forms: the introduction of new touchpoints or the introduction of a new layer of consideration. One group created a journey map for their IoT device, smart lightbulbs, and then introduced a theory-to-practice commitment based on the work of Borning, Friedman, and Logler (2020), which emphasized the need to make data flows from IoT devices more visible. In order to do this, they added a new touchpoint to their journey map, which introduced a new feature to visualize how data moves from the app to the IoT device to other locations. In reflecting on their adaptation, one participant from this group said: “We chose to refer to the Borning, Friedman, and Logler reading that discussed the concept of invisible materiality. It helped us appreciate all of the data and information transfer that occurs but is invisible to the naked eye. As a result, we made changes to our journey map to help spotlight the processes behind the data transfer to the user to make them more apparent.” A different group also identified Borning, Friedman, and Logler’s (2020) work as the source of their theoretical construct and theory-to-practice commitment but introduced a different adaptation to their journey map. This group added an additional layer called “Sustainability Considerations” to their journey map on the Google Nest to surface material considerations related to the

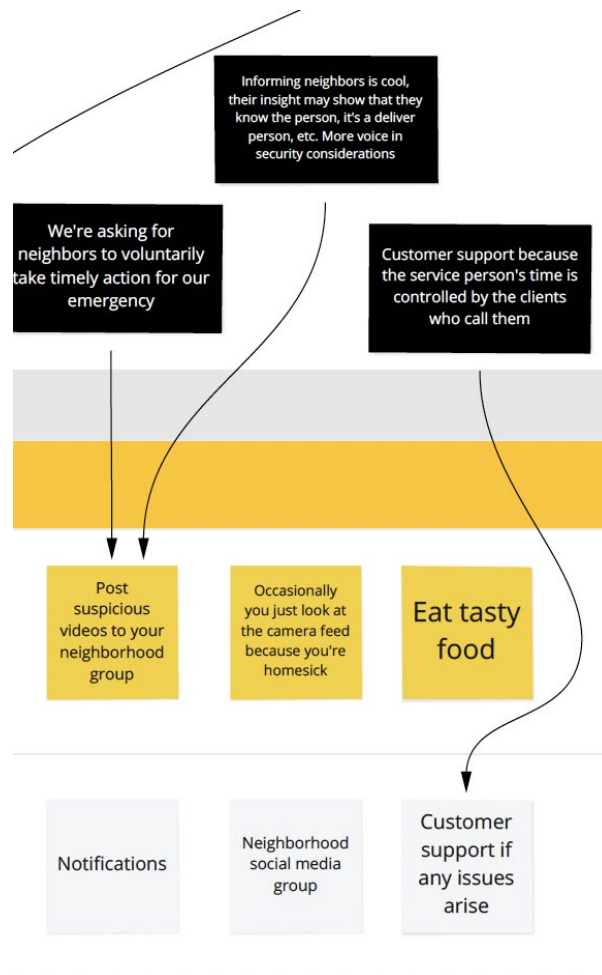
IoT device across multiple touchpoints (see Figure 16 below). For example, one such consideration is that the app associated with Google Nest displays energy consumption trends over time.

Figure 16. An adapted journey map from a group of participants who introduced a layer called “Sustainability Considerations” in response to a theoretical construct and theory-to-practice commitment based on Borning, Friedman, and Logler’s (2020) work. The addition is highlighted by a black rectangle.



Excerpts that demonstrate participants were thinking with theory were present both in the design work and in the written reflections. For example, one group created a journey map for a Ring security system, then identified Sharma’s (2014) piece to work with and articulated a theoretical construct and theory-to-practice commitment based on Sharma’s work. The group then used that theory-to-practice commitment to annotate their existing journey map to highlight uneven temporalities (see Figure 17 below). In reflecting on this process, one participant from this group said: “We made 11 annotations that analyze our journey map through the lens of power chronology [sic]. This process was challenging because the issues we identified (including having resources to install and utilize the security system, utilizing neighborhood communication features, etc.) are integral to the way the system works and are difficult to adjust. However, this approach to annotating the user journey map with different considerations or issues would be helpful in identifying issues throughout the entire lifecycle of a product.” While the group did not necessarily make changes to the journey map or IoT device using these insights, this is evidence of important “thinking with theory” work.

Figure 17. An excerpt from a group's adapted journey map where they used a theory-to-practice commitment based on Sharma's (2014) work to annotate their journey map in order to consider all stakeholders involved.



In this design studio, there was one example of talking with theory present in the written reflections. One group created a journey map for a Roomba, then introduced ideas from Orlikowski and Yates (1999) to adapt the design method. This group reported struggling with the adaptation work and did not make any relevant adaptations to their journey map. However, one participant from this group reported on their discussion, saying: “Our discussion was valuable. We discussed how the writing touched on that many temporal structures are used to coordinate and manage time. We began to think of the Roomba as one of these structures. With the Roomba managing time and sweeping at regular intervals, the family’s life becomes much more simple and allows for less of a need to manage time (in regards to cleaning).” This example provides evidence that even in the absence of design adaptations to

the method, participants were actively engaging in conversation relating to the theory-to-practice commitments they were introducing to the design situation.

8.3.4 Method Adaptation: Choose Your Own Method

Also in response to RQ3.3, participants were asked to choose a design method and adapt it in response to a theory-to-practice commitment they translated. The 33 excerpts from this design activity were coded as designing with theory, thinking with theory, talking with theory, or misunderstanding. Table 10 below enumerates how frequently the codes were applied to the excerpts.

Table 10. The percentage of excerpts from the Method Adaptation: Choose Your Own Method design studio coded with each of the codes.

Code	Percentage of excerpts coded
Designing with theory	54.5%
Thinking with theory	21.2%
Talking with theory	0%
Misunderstanding	24.2%

In 75.7% of the 33 excerpts from this design activity and accompanying reflections, participants were acting with theory, either by designing or thinking with the theory.

Designing with, thinking with, and talking with theory. In this design studio, there were no excerpts that indicated that participants were talking with theory. However, given they were engaged in a group design activity it is likely that discussions went unreported in the written reflections. There were, however, several examples of both thinking with theory and designing with theory in this design studio.

Examples of thinking with theory can be seen in both the design work and written reflections. For example, one group chose the personas method to adapt, then selected Puig de la Bellacasa’s (2017) work from which to identify a theoretical construct, then translated that theoretical construct into a theory-to-practice commitment. In using their theory-to-practice commitment to identify assumptions in the persona method, this group introduced a new line of thought related to personas and the longer term, asking, “how the same persona might interact with a design throughout time.” This group went on to make several adaptations to the persona method to enact this theory-to-practice commitment.

There are several excellent examples of design method adaptation from this design studio, indicating that participants were able to design with theory using the model of knowledge types in design. In most cases, participants adapted the method by adding additional steps. For example, the group discussed above using Puig de la Bellacasa's work added three steps to their persona method to account for longer term considerations, including "create scenarios for both long-term and short-term results," and "specify different points in time and think about how the same personal would interact or think differently." A different group chose to adapt the field observation method, using a theoretical construct and theory-to-practice commitment based on Sharma's work (2014). In identifying assumptions for the field observation method, participants in this group identified that field observations typically follow one participant, but using the theory-to-practice commitment based on Sharma's work they brought attention to the fact that designers may need to observe multiple people in the field site to better understand the temporalities of those involved in the field observation method. Thus, they adapted the method to observe multiple people in the field site as well as observing them in contexts outside of the field site. A different group also chose to adapt the field observation method, in this case using Orlikowski and Yates's (1999) work. In their adaptation of the method, this group surfaced that temporal structures may vary across similar field sites and adapted the method to be repeated across multiple locations, for example, at both a quarter-based and semester-based university.

Drift. At this point, participants had been designing, thinking, and talking with these ideas for several weeks, and concepts began to merge together in a phenomenon I call drift. In drift, ideas from multiple pieces are explicitly present even though participants indicated just one piece as the source of the theoretical construct of focus. In one example, participants chose Orlikowski and Yates (1999) as the source of their theoretical construct and theory-to-practice commitment when adapting the field observation method. In addition to designing with the theory-to-practice commitment they translated, they also surface ideas related to materiality, stating in a written reflection: "Something surprising I found was how field observations do not usually account for materiality even though one may have to travel to a location which may consume gas, money, etc." Even though this group selected a piece which foregrounds temporality, they also surfaced the material implications of the method, echoing the sentiments of Borning, Friedman, and Logler (2020). In a different example, the participants identified

Borning, Friedman, and Logler (2020) as the source for their theoretical construct and theory-to-practice commitment when adapting the method affinity diagrams. In addition to designing with that theory-to-practice commitment, they also consider the temporal dynamics of affinity diagrams and how the period during which the activity takes place affects insights garnered from the method. While this theoretical construct can't be directly linked to one of the other four pieces from the design studio, the idea resonates with the temporal assumptions surfaced by Orlikowski and Yates (1999) as well as other ideas surfaced in the quarter. In these cases, drift shows that these participants developed a deep understanding of the theories they are engaging with and have insights on how to apply them in a design situation unprompted – in other words, the surface area for what is in scope theoretically had drifted.

Adapting design methods is a difficult task, but the examples here demonstrate that participants were able to make progress using the model of knowledge types in design, and productively talk, think, and design with theory.

8.3.5 Misunderstandings

To better understand the limitations of the model of knowledge types in design as a tool for facilitating work between theory and practice, I paid close attention in the data analysis to the places where participants made errors. Across the data from the three design studios, there were several different types of misunderstandings, summarized in Table 11 below and described in this section. Up until now, data has been reported at the excerpt level, but in this section I report data at the group level to normalize for error types that can only occur once. For example, in the Envisioning Card design studio, one group had four excerpts marked as misunderstandings of the type *incorrect interpretation of the referenced piece or concept*. In Table 11 below, I've reported that as one error. Similarly, if a group articulated a theoretical construct which was not clearly related to the identified work, that has also been reported as one error of the type *incorrect theoretical construct*.

Table 11. A description and count of different types of misunderstandings across the three design studios.

	Envisioning Cards	Method Adaptation: Journey Maps	Method Adaptation: Choose your Own Method
Error types reported at the group level	N= 3	N= 3	N=9
Incorrect interpretation of the referenced piece or concept	2	0	3
Incorrect theoretical construct	0	2	2
Incorrect translation of a theory-to-practice commitment	0	0	2
Non-insight	1	1	0
Not a method or adaptation	0	0	2

Incorrect interpretation of the referenced piece or concept. The most frequent misunderstanding type was the incorrect interpretation of the referenced piece, or in the case of Envisioning Cards, the card concept. For example, in one case a group working with the Do Less Envisioning Card focused on the use of smart locks to optimize time around the home, as opposed to more generally reflecting on the concept of refusal or doing less. In another case, a group working with ideas from Borning, Friedman, and Logler (2020) surfaced the materiality of working with the affinity diagram method, stating that the use of post-it notes to document ideas constitutes a material impact. Their solution to move to digital tools, however, did not account for the invisible materiality of information technology, which is core to Borning, Friedman, and Logler's point. I posit that this type of error is less to do with the model of knowledge types in design and more to do with participants as theory learners and not (yet) theory experts.

Incorrect theoretical construct. A more structural misunderstanding of theory appears when participants incorrectly articulate a theoretical construct based on the identified work. In the method adaptation design studios, this is an important step in the process of adapting design methods using the model of knowledge types in design, and in four cases out of 17, participants articulated a theoretical construct that was not clearly related to the identified piece. This happened in two cases for the piece from Sharma (2014), once for Borning, Friedman, and Logler (2020), and once for Jackson (2014). For

example, in working with Borning, Friedman, and Logler's piece, one group articulated the following theoretical construct: "Technology has reached a point in which sustainability and materiality are no longer considerations for production." Whether or not this statement is true in a broad sense, it does not capture the core theme from Borning, Friedman, and Logler: that there are forces which work to minimize the materiality of information technology. A misstep at this point, however, does not always prevent subsequent design work. In two of the four cases where the theoretical construct was incorrect, participants went on to translate a theory-to-practice commitment which turned their theoretical construct into an action-oriented statement. Importantly, these groups were also able to introduce design changes in the studio which were aligned with the identified piece. In two of the four cases, however, participants' initial misconceptualization of the theoretical construct from the identified piece carried over into the theory-to-practice commitment and subsequent design work.

Incorrect translation of a theory-to-practice commitment. In two cases participants both incorrectly articulated a theoretical construct and translated a theory-to-practice commitment that was not an actionable statement clearly related to the theoretical construct or identified piece. For example, one group defined this theoretical construct from Sharma's (2014) work: "Society seems to think time goes more quickly, regardless of technology." From there, the participants translated this theory-to-practice commitment: "To design with this theory we need to consider how long the focus/target takes to complete something and whether they seem to be in a hurry." Here, the theoretical construct was not something Sharma is putting forth in her book (indeed, she is arguing against this interpretation of speed theory), but even if we take the theoretical construct at face value, the theory-to-practice commitment does not operationalize the theoretical construct. The relationship between whether or not the target is in a hurry and how long it takes them to complete a task is not related to the theoretical construct the participants defined, which is about how society as a whole experiences speed up regardless of technology.

Non-insight. In two cases, participants made changes to the method or artifact which were conceptually close to the referenced piece or concept, but which were not quite operationalizations of the relevant theory-to-practice commitment. For example, one group chose to apply the Temporal Inequality Envisioning Card based on Sharma's (2014) ideas about uneven temporalities. In applying the card, they point out that people who earn more money will be able to use their IoT device (smart lights). This insight,

while pointing out a basic income inequality, doesn't quite get at the uneven temporalities that are central to Sharma's thinking. In another case, a group chose to work with Orlikowski and Yates's (1999) ideas around enacted temporal structures in their journey map of a Roomba. In response to introducing a theory-to-practice commitment based on Orlikowski and Yates's work, they point out that Roomba's have scheduling functions, and while scheduling functions are indeed a temporal structure this point does not quite get at the enacted view that is central to Orlikowski and Yates's work. In both of these cases, one could say that the participants are thinking in the right direction but not quite there. Again, this is most likely due to the participant's being theory learners and not (yet) theory experts.

Not a method or adaptation. There were two instances in the choose your own method design studio in which participants either chose something that wasn't a method or did not appropriately make adaptations to a design method. In one case, the participants chose to adapt value propositions as part of the choose your own method design studio. However, the participants did not articulate value propositions as a design method (a focused activity or process intended to uncover or develop particular kinds of design insights or directions). Instead, they articulated an example of a value proposition as a design artifact and therefore did not appropriately adapt a design method. In the second case, participants chose to adapt the interview method, but did not introduce any changes to the method to account for the theory-to-practice commitment.

Given the limitations of this case study, it is premature to draw conclusions about whether these misunderstandings are the result of shortcomings in the model or due to a natural variation in how this population engaged in the work of adapting design methods. These misunderstandings do, however, point to future directions to explore in both the model and method adaptation more broadly.

8.4 Reflecting on the Model and its Use as a Tool for Teaching Method Adaptation

Here, I offer three reflections on using the model as a tool for teaching method adaptation.

The work of translating theory-to-practice commitments as moving away from theory and toward design. In coding the theoretical construct and theory-to-practice commitment pairs, there were far more clear yeses for theoretical constructs and far more maybes for theory-to-practice commitments, indicating

that moving from theoretical construct to theory-to-practice commitment introduces noise. The work of translating a theory-to-practice commitment is fundamentally a transformation, so while the goal is to create an action-oriented statement that aligns with the theoretical construct, the work of creating that statement can introduce a conceptual distance between the theoretical construct and the theory-to-practice commitment. After all, if the theoretical construct were already in an action-oriented state, there would be no need to do the work of translating between theory and practice. This introduces a question about how large the conceptual distance can be between a theoretical construct and a theory-to-practice commitment or the subsequent design work. This largely depends on the designer's goal. If the goal is to design in alignment with a theoretical construct or set of theoretical constructs, as was the goal in this dissertation, then the conceptual distance should be as small as possible. In contrast, if the designer's goal is to use a theoretical construct as an interesting input for design but has no commitment to enacting that theoretical construct in a rigorous form then that project might accommodate a larger conceptual distance.

Method adaptation is a challenging task that learners are unaccustomed to, but see value in.

Despite learning a variety of methods in design courses, participants had not yet encountered the idea of adapting existing design methods. One participant said: "It is a new experience for me to be redesigning the design method itself." As appropriating methods is key to professional design practice (Gray, 2016; Harrison & Tatar, 2011), it is important that novice designers learn these skills. That's not to say it's without difficulty. In reflecting on the design studio work, several participants discussed how challenging the journey map and choose your own method design studios were. One participant stated: "The process overall was challenging. It's weird and uncomfortable to re-design a design method that we are taught to use all the time. It was challenging to "break the form" and think creatively about how we can realistically alter design methods to account for time perspectives and materiality, especially in the method we chose, which we thought to be rather simple." Despite the challenge of adapting methods, participants did see value in the practice of incorporating new theoretical constructs into established design methods. One participant stated: "The adapted journey map did help me think about design perspectives that normally get ignored through the journey map process."

The model can support the task of adapting methods. As discussed in the findings, there is evidence that the model can support novice designers as they do the work of adapting design methods. Despite some challenges, in the majority of cases, participants were able to successfully use the model of knowledge types in design to talk, think, and design with theory when adapting established design methods. One participant stated that the “steps,” referring to the model of knowledge types in design, supported their work to adapt design methods: “If it wasn't for the steps that we had to follow, I would have thought this would have been an incredibly difficult studio, mainly because I wouldn't know how to approach it whatsoever. I think the steps that were used genuinely really helped frame our minds and guide through what we needed to understand...I feel like this is a great set of instructions to help someone slowly learn the method.”

This case study provides initial evidence that the model of knowledge types in design enables novice designers to engage with specific theoretical constructs in design practice. Specifically, designers were able to apply an adapted toolkit, use the model to define theoretical constructs, translate theory-to-practice commitments, and use those theory-to-practice commitments to adapt existing design methods such that they could design, think, and talk with theory in a specific design situation.

8.4.1 Limitations

There are, of course, several limitations to this approach and analysis. First, this data collection took place in an undergraduate course in a population that may not reflect novice designers writ large. Second, as the data collection took place in just one section of this class, there was a relatively low number of participants. Additionally, the design work analyzed in this chapter was conducted during in-class, one hour and fifty minute long design studios. The resulting design work often lacks the depth one would expect in other design contexts, such as industry design practice. Given these limitations, the results from this analysis are not intended to be generalizable beyond this specific case study, rather they are early evidence of the model of knowledge types in design's applicability by others engaging in work to adapt design methods.

Chapter 9: Heuristics for Method and Toolkit Adaptation

Reflecting on this work and in response to RQ4, I offer heuristics to guide novice designers, design researchers, and practitioners taking up the work of adapting design methods or toolkits by introducing theoretical constructs and theory-to-practice commitments. Reflecting on my experience adapting the design method and toolkit in Chapters 6 and 7, I developed a set of seven heuristics. I used these seven heuristics to guide participants in the educational case study, reported in Chapter 8, as they adapted design methods. Drawing on insights from participants in the case study and further reflection on the adaptation of design methods and toolkits, I revised and expanded the original set of seven heuristics to the set of ten presented in the last section of this chapter.

9.1 The Original Seven Heuristics

In this section, I describe the original seven heuristics, how they emerged in my own design practice, provide an example of how I applied them in the course of my dissertation work, and describe, in a general sense, the work that the heuristic supports. For each heuristic, the name is in bold and italicized, the text of the heuristic is in italics, and the description of how the heuristic emerged, was applied, and the work it supports follows. In this section, the heuristics are presented with the name, text and order used in the educational case study.

Follow your intuition. *If you are drawn to a specific method and reading pairing, pay attention to that! It's a great place to start.* This heuristic emerged as I worked to frame my dissertation work, both in selecting literature through the process described in Chapter 5 and in the method and toolkit selection process described in Chapters 6 and 7. I paid close attention to interesting ideas within candidate literature and interesting combinations between those ideas and potential methods and toolkits to adapt. This helped me find productive levers for the design work that took place in Chapters 6 and 7. For example, the pairing between the theoretical construct based on Sharma's (2014) work in combination with the journey map method was compelling, given that journey maps typically center the experience of one stakeholder and Sharma's ideas are about how people experience shared time differently based on how the market values their labor. Given that the pool of potential literature, methods, and toolkits is very

large, this heuristic focuses on making productive first steps in narrowing down the field when doing method adaptation work.

Identify assumptions. *All methods carry assumptions. These assumptions focus your attention on certain aspects of the design space and not others, making certain outcomes more likely than others. Surfacing assumptions creates an opening to change the assumption.* I surfaced this heuristic through the analyses I did of the journey map method and Envisioning Card Toolkit using the theory-to-practice commitments (see Chapters 6 and 7). Once the theory-to-practice commitments, methods, and toolkits are identified, a productive place to start is using the theory-to-practice commitments as levers to understand what assumptions are embedded in the existing methods and toolkits. For example, using the theory-to-practice commitment based on Jackson's work (*The designer must foreground breakdown, maintenance, and repair as essential to the story of technology and of innovation*), I surfaced an assumption in the existing Envisioning Card set: while the Envisioning Cards do acknowledge that materials can break down over time, there is no exploration of how to respond to that breakdown, which Jackson (2014) points out can be important and creative sites of innovation. Surfacing this assumption in the Envisioning Cards pointed to an opportunity for adaptation. This heuristic surfaces areas in methods and toolkits where the introduced theory-to-practice commitments can be leveraged in the adaptation process.

Layer adaptations. *If you're having a hard time introducing a particular theory to a method, try introducing a different theory then revisit.* This heuristic emerged as I attempted to adapt the journey map method in response to theory-to-practice commitments which describe relational ideas, such as the theory-to-practice commitment based on Sharma's work (*The designer must consider whose time is implicated in design and how equitably*). I realized that in order to gain traction, I needed an adaptation to the method that would make other stakeholders within the journey map explicit. To do so, I introduced the theory-to-practice commitment based on Jackson's work (*The designer must foreground breakdown, maintenance, and repair as essential to the story of technology and of innovation*) which, in turn, introduced a new group of stakeholders (those who perform maintenance and repair). This made adaptations in response to Sharma's ideas of the shared yet disparate experience of time among

stakeholders more feasible. This heuristic provides a way forward when the designer encounters a challenge to incorporating a specific theory-to-practice commitment in a design method.

Use examples. *Try applying the adapted method to a few specific technologies (like a mechanical pencil or an IoT device). This can help make your ideas more concrete and show you what areas need more specificity.* I developed this heuristic while adapting the Envisioning Card Toolkit. In the process of creating adapted Envisioning Cards for each of the eight theory-to-practice commitments, I reached a stage where I knew the descriptions and design prompts needed further refining but was unsure of how to proceed. To get “unstuck,” I applied each draft adapted Envisioning Card in two example scenarios (the design of an Amazon Alexa and of a mechanical pencil). The application of the adapted Envisioning Cards to specific examples surfaced ambiguity and inconsistencies in the card text as drafted, allowing me to further refine and polish the adapted Envisioning Cards. This heuristic points to one way to make progress when, in the process of adapting design methods, the designer needs to understand how the adapted method might work in practice.

Complete the method, then ask what’s missing. *Take a look at the output of your method, then use the theory to identify gaps and make changes.* This heuristic emerged for me in the process of adapting the journey map method. Some design methods, like the journey map method, result in specific design artifacts, like a completed journey map. In the process of adapting the journey map method, I looked at both the instructions for the method, and also some example journey maps as resulting artifacts. Examining the resulting artifacts before adapting the method was productive for thinking through different ways the eight theory-to-practice commitments were or were not represented in the existing method. This heuristic indicates a path for adapting design methods that result in artifacts, by looking at examples of the finished artifact to better understand the method.

Translate the theory into a practice commitment. *Theoretical constructs tell us something about the world, but they aren’t always packaged for application. Consider how to enact the theory.* This heuristic emerged from my work with the model of knowledge types in design as a tool for translating between theory and practice. Often, there is conceptual work that needs to be done in order to move an idea from its original articulation as a theoretical construct, to something that can be considered in design practice. For example, the theoretical construct based on Jackson’s work (*We live in a centrifugal world*,

always on the verge of coming apart, and always being reconfigured and held together through acts of maintenance and repair. This work, while often invisible, is a site of creativity, imagination, and artfulness) is an articulation of Jackson's (2014) idea about broken world thinking, but it is not a statement from which design action is easily accessible. Translating this theoretical construct into a theory-to-practice commitment (*The designer must foreground breakdown, maintenance, and repair as essential to the story of technology and of innovation*) makes design action more clear. This heuristic supports the step between theory and practice as defining a theory-to-practice commitment.

Break the form. *Don't get attached to the form the method presents itself in. You may need to break the existing structure to incorporate the new ideas.* This heuristic emerged from my ideation process when adapting the journey map method in response to the eight theory-to-practice commitments. Some of my initial brainstorming around what adaptations may be interesting were notable departures from the way journey maps are currently drawn. For example, in response to the theory-to-practice commitment based on Sharma's work (*The designer must consider whose time is implicated in design and how equitably*), I had the idea to create layered or intersecting journey maps for the different stakeholders who may be sharing the experience but have different perspectives on it. This heuristic serves to encourage divergent thinking around existing methods when doing adaptation work.

9.2 Educational Case Study: Participants' Use and Reflections on the Original Seven Heuristics

The original seven heuristics were given to participants for the design studio on adapting design methods of their choice in the educational case study described in Chapter 8. As part of their written reflections for the design studio, participants were asked to reflect on the seven heuristics and describe how they were useful when adapting methods. The table below enumerates how frequently participants identified each heuristic as being useful in their process for adapting a design method.

Table 12. The original seven heuristics and how frequently participants named them as useful to their process of adapting a design method.

Heuristic	How frequently it was named as useful
Follow your intuition	2
Identify assumptions	12
Layer adaptations	2
Use examples	5
Complete the method, then ask what's missing	5
Translate the theory into a practice commitment	3
Break the form	2

In their written reflections, participants described that many of the heuristics were useful to support reflection on their design process while adapting design methods. For example, one participant said of the *Identify assumptions* heuristic, “The tip about identifying assumptions was really helpful because it helped my group take a step back and analyze some of the things we thought were base-level expectations.” Another participant, when discussing the heuristic *Complete the method, then ask what’s missing* said, “Thinking about the output also made it easier to identify gaps related to the theory and apply changes.”

9.3 Further Reflections on and Refinement of Heuristics

After receiving feedback from the participants and further reflection on the process of adapting design methods and toolkits, I refined and expanded the original seven heuristics to the ten final heuristics detailed in Section 9.4. The table below describes the changes made to each heuristic and why it was made.

Table 13. A comparison of the original seven heuristics to the final ten heuristics, describing where they originated from and why they were changed.

Original heuristic	Final heuristic	Original source	Rationale for change
Follow your intuition	Follow your intuition in choosing methods and theoretical constructs to explore	Method and theoretical construct selection	Renamed and expanded in response to participant reflection
Identify assumptions	Identify assumptions	Method and toolkit adaptation	Added additional detail
Layer adaptations	Sometimes, layers of adaptations are necessary	Method adaptation	Added additional detail
Use examples	When in doubt, try it out	Toolkit adaptation	Renamed and expanded in response to participant reflection
Complete the method, then ask what's missing	Examine the method outputs and ask what's missing	Method adaptation	Renamed to clarify the heuristic is about method outputs and added additional detail
Translate the theory into a practice commitment	Translate the theoretical construct into a theory-to-practice commitment	Model of knowledge types in design	Renamed and expanded in response to participant reflection
Break the form	Break the form	Method adaptation	Added additional detail
	Identify theoretical constructs that are meaningful to engage in light of your project goals	Further reflection on the theoretical construct selection	Added upon reflection of the process for scoping this dissertation work to materiality and temporality
	Treat the work of adapting methods like a design process	Participant reflection	Added in response to participant reflections on the process for adapting methods
	Sometimes, changes can be subtle	Further reflection on the method adaptation	Added upon reflection on adapting the journey map method which had, in some cases, subtle changes to the existing method to enact the theory-to-practice commitment

The original seven heuristics were refined and expanded in response to further reflection on my own design process, as well as in response to participant insights. For example, the heuristic *Use*

examples became *When in doubt, try it out* in response to participants' reflections that it wasn't the example per se which helped their design process, but rather the activity of testing the method even in a lightweight way. One participant said, "By running an example through my head, I was able to understand parts of the field observation that could potentially benefit from introducing a temporal perspective." I also developed three new heuristics, described below.

Identify theoretical constructs that are meaningful to engage in light of your project goals.

When setting out to adapt design methods, identify the goal of the adaptation work. Is it to mobilize a specific theory or theories? Is it to solve a specific problem in a particular design situation? Understanding why you want to adapt design methods will help you determine which theoretical constructs to work with and in what ways. This heuristic emerged as the result of my reflection that the scoping of the entire project of adapting design methods will determine which theoretical constructs are relevant and meaningful to engage. In this dissertation, as discussed in the Introduction, I am particularly interested in theoretical constructs related to materiality and temporality, which limits the scope of what literature is relevant. However, other projects will have different requirements and orientations, so the first step in the process for adapting a design method should be to define the goals of the project and use those goals to direct the search for relevant theoretical constructs. This heuristic supports the work to understand the purpose of the adaptation project, which will help set the scope for what ideas are meaningful or productive to consider.

Treat the work of adapting methods like a design process. Diverge, then converge. The work of designing methods is like other design work in that it requires divergent thinking (the generation of many ideas) and convergent thinking (the narrowing of ideas to one or more options to pursue in detail).

This heuristic emerged from several participants' reflections on method itself. Several participants articulated that the work of adapting methods helped them realize that methods are flexible, imperfect processes with embedded assumptions, and that they as designers can rework and adapt existing design methods. One participant said, "since these methods are taught to us as solid go-tos for designing, we never really think about how the methods themselves could still be faulty/have room for improvement." These and similar reflections from participants led me to realize it's important to make explicit how

designers can and do design the design process itself. This heuristic points the designer toward the often iterative process of design.

Sometimes, changes can be subtle. *In some situations, a small tweak to the existing method is enough to accommodate a theory-to-practice commitment.* This heuristic emerged from further reflection on the nature of the adaptations made to the journey map method. In response to the eight theory-to-practice commitments, I often added new steps to the journey map method, but there was one instance where I made a subtle change, amending an existing step in order to foreground a specific idea more clearly. I realized that sometimes we need big changes in design methods in order to mobilize a specific idea, but in other cases, a subtle change may be enough to enact a new idea in the design process. This heuristic balances one of the original seven heuristics, which encouraged designers to *Break the form* in doing method adaptation work.

9.4 Ten Heuristics for Adapting Design Methods and Toolkits Using the Model of Knowledge Types in Design

The ten final heuristics below offer direction to novice designers, design researchers, and practitioners who want to adapt design methods to enact specific theoretical constructs. The title of the heuristic is in bold and italicized, the text of the heuristic is italicized, and an example follows. They are ordered to match the general structure of the method adaptation process, from heuristics that support project scoping (*Identify theoretical constructs that are meaningful to engage in light of your project goals*) to heuristics that support specific design moves in method adaptation work (*Break the form*). These heuristics guide the way for others who wish to adapt design methods and toolkits using the approach taken in this dissertation and informed by the model of knowledge types in design.

1. ***Identify theoretical constructs that are meaningful to engage in light of your project goals.***

When setting out to adapt design methods, identify the goal of the adaptation work. Is it to mobilize a specific theory or theories? Is it to solve a specific problem in a particular design situation? Understanding why you want to adapt design methods will help you determine which theoretical constructs to work with and in what ways. In this work, as one of my interests is in challenging the dominant logics along the dimensions of materiality and temporality, I chose

theoretical constructs from a wide variety of academic disciplines that were related to those two dimensions. In other contexts, different theoretical constructs may be more relevant.

2. ***Follow your intuition in choosing methods and theoretical constructs to explore.*** *To adapt a design method, you need both a method and a theoretical construct. If you are free to choose which design methods and theoretical constructs you work with (i.e., there are no external constraints on your approach), when working through potential pairings, monitor for “sticky” combinations – pairings of theoretical constructs and design methods which catch your attention as a designer and which position you to take action.* For example, the theoretical construct based on Sharma’s (2014) work (*Under global capitalism, we experience time differently based on our intersectional identities and how markets value our labor*) in combination with the journey map method was a sticky pairing for me. Given that journey maps typically center the experience of one stakeholder (the user), my intuition was that the introduction of Sharma’s ideas about the shared yet disparate experiences of different stakeholders to the journey map method would be a productive lever through which to explore the invisible stakeholders within a journey map. Not every combination will be productive or useful, but having an intuition about or being excited about a method and theoretical construct pairing is an important phenomenon to pay attention to as a designer.

3. ***Translate the theoretical construct into a theory-to-practice commitment.*** *Part of the process for mobilizing theory in the adaptation of design methods and toolkits is to understand what, exactly, it means to take action with a specific theoretical construct in mind. To make potential design action more clear, translate the theoretical construct into a theory-to-practice commitment using the formula:*

[Theoretical construct] is something we know about the world. In order to account for this in design, we know we must [theory-to-practice commitment].

For example, using Chödrön’s (2000) work, we can define the theoretical construct and translate a theory-to-practice commitment using the formula: Impermanence is the essence of reality, yet too often we resist impermanence by creating things with the hope that they will last forever is something we know about the world. In order to account for this in design, we know we must

accept that all things must come to an end and be intentional about that ending. The resulting theory-to-practice commitment is an action-oriented statement that can be used to guide the design work needed to adapt design methods.

4. ***Treat the work of adapting methods like a design process. Diverge, then converge. The work of designing methods is like other design work in that it requires divergent thinking (the generation of many ideas) and convergent thinking (the narrowing of ideas to one or more options to pursue in detail).*** For example, when considering the theory-to-practice commitment based on Sharma's work (*The designer must consider whose time is implicated in design and how equitably*) in relation to journey maps, I was able to identify at least two ways to adapt the method: (i) layering journey maps of different stakeholders at intersecting touchpoints and (ii) adding stakeholder considerations to the existing journey map format. After considering the pros and cons of each, I decided to develop the second idea where stakeholder considerations are added to the existing journey map format. Diverging, converging, and iterating in the adaptation of design methods brings rigor to the process of designing design methods.
5. ***Identify assumptions. All methods have assumptions, which focus the designer's attention on certain aspects of the design space and not others, making certain outcomes more likely than others. Use the theory-to-practice commitment(s) to ask questions like: how is this concept represented in the existing method? If the idea is not represented in the existing method, what does that reveal about the existing method? How can the existing method be adapted to accommodate this theory-to-practice commitment?*** For example, in the process for adapting both the design method in Chapter 6 and the design toolkit in Chapter 7, I began by using the translated theory-to-practice commitments from Chapter 4 to identify assumptions in the method and toolkit respectively. Surfacing assumptions creates an opening to change the assumption.
6. ***Sometimes, layers of adaptations are necessary. Sometimes, a theory-to-practice commitment does not yield a productive adaptation at first.*** For example, relational theory-to-practice commitments, such as those based on the work of Sharma (2014) and Puig de la Bellacasa (2017), do not mesh readily with methods considering a singular stakeholder. For these theory-to-practice commitments to offer productive adaptations, or to gain traction at all, the

designer may first need to layer on other adaptations using other theory-to-practice commitments. For example, applying the theory-to-practice commitment based on Jackson's work (*The designer must foreground breakdown, maintenance, and repair as essential to the story of technology and of innovation*), the designer can consider phases of the technology which involve breakdown, maintenance, and repair, introducing a category of stakeholders who perform the maintenance and repair work. From there, the designer can revisit the initial theory-to-practice commitments. For example, in considering the theory-to-practice commitment based on Sharma's work (*The designer must consider whose time is implicated in design and how equitably*), the designer can consider how stakeholders experience shared time differently in the context of maintenance and repair.

7. **Examine the method outputs and ask what's missing.** For methods that result in design artifacts, like journey maps or affinity diagrams, consider the output of the method. Try to identify the assumptions of the method using some example outputs as a guide. For example, in adapting the journey map method in Chapter 6, I used two example journey maps as design method outputs to anchor the method adaptation process and to better understand the journey map method itself.
8. **Break the form.** Don't get attached to the form of the method or the method output. You may need to break the existing structure to incorporate the new ideas. For example, one idea for adapting the journey map method using the theory-to-practice commitment based on Sharma's work (*The designer must consider whose time is implicated in design and how equitably*) was to create overlaid or intersecting timelines based on different stakeholders' perspectives of the process being mapped. Rethinking the form of the method or the method output can create space for new ways of thinking about how to enact a theory-to-practice commitment in a design method or toolkit.
9. **Sometimes, changes can be subtle.** In some situations, a small tweak to the existing method is enough to accommodate a theory-to-practice commitment. For example, in adapting the journey map method using the theory-to-practice commitment based on Borning, Friedman, and Logler's work (*To surface materiality in the design of information technology, the designer must engage*

with the forces working to minimize it), one of the existing steps in the method was amended (see underlined text):

Look for insights. What patterns emerge? Anything surprising or strange? Question why certain steps occur, the order they occur in, what could go wrong, and so forth. Ask yourself how you might innovate each step.

This amended step creates space in the journey map method to push back against utopian visions, one of the five forces surfaced by Borning, Friedman, and Logler (2020) that minimize the visibility of materiality in information technology. The goal of adapting a design method is to focus the designer's attention on a direction that aligns with the theory-to-practice commitment, and at times this requires just a little nudge.

10. ***When in doubt, try it out.*** *Try applying the adapted method to a few specific examples to understand where gaps may exist.* For example, when developing the adapted Envisioning Cards, I applied the design prompts to two technologies (a mechanical pencil and an Amazon Alexa) to understand how the adapted Envisioning Cards would work in practice. The examples indicated several places where the initial instructions were unclear which led to further improvements of the design prompts on the adapted Envisioning Cards.

Chapter 10: Reflections and Conclusion

Thus far, I have generalized a bi-directional model of knowledge types in design to demonstrate how theory is related to design practice, demonstrated the model in use in the direction of theory to practice by translating theory-to-practice commitments from eight theoretical constructs related to materiality and temporality, used the theory-to-practice commitments to adapt one design method and one design toolkit, reported on an educational case study which provides early evidence that the model of knowledge types in design can be used by novice designers to adapt design methods, and provided a set of ten heuristics to guide others who wish to adapt design methods and toolkits using the model of knowledge types in design. In this chapter, I restate the contributions of this dissertation, discuss some limitations of my approach, and close with final reflections and open questions.

10.1 Contributions

In this dissertation, I've made several contributions.

First, a bi-directional model of knowledge types in design to describe how theory can inform design practice and vice versa, articulated in Chapter 4 and demonstrated in use in Chapters 5-9. This model articulates the knowledge types in design – *know-about*, *know-that*, and *know-how* – and their interrelationships. The model provides a structure for moving between theory and practice by way of theory-to-practice commitments and practice-to-theory commitments. In this dissertation, I explored this relationship in one direction, from theory to practice, using the model to structure the adaptation of design methods and toolkits by applying the model to eight theoretical constructs related to temporality and materiality to translate theory-to-practice commitments.

Second, one adapted design method: the journey map method. This adapted design method takes into account the eight theory-to-practice commitments translated in Chapter 5 related to materiality and temporality. The process of adapting the design method, which is reported on in Chapter 6, provides a roadmap for novice designers, design researchers and practitioners interested in the adaptation of design methods using theoretical constructs and theory-to-practice commitments. The resulting adapted method is a tool that designers can use to consider materiality and temporality in the design process.

Third, one adapted design toolkit: a set of adapted Envisioning Cards. These Envisioning Cards mobilize the eight theory-to-practice commitments related to materiality and temporality translated in Chapter 5. Again, the process of adapting the Envisioning Cards, reported in Chapter 7, is a roadmap for novice designers, design researchers and practitioners who wish to adapt design toolkits. The resulting toolkit is a tool that others can use to mobilize concepts related to materiality and temporality in the design process. Taken together, the adapted method and toolkit provide evidence that the model of knowledge types in design can be used to guide the adaptation of design methods and toolkits to enact theoretical constructs in design practice.

Fourth, an educational case study which provides early evidence that novice designers can use the model of knowledge types in design to adapt design methods on their own, as reported in Chapter 8. The analysis of three design studios and the accompanying reflections supports the idea that the model of knowledge types in design, when used as a tool to teach novice designers how to adapt methods, facilitates talking, thinking, and designing with theory in the method adaptation process.

Finally, ten heuristics that others can use to adapt design methods and toolkits. These ten heuristics are intended to guide novice designers, design researchers and practitioners who wish to adapt existing design methods and toolkits in light of new theoretical constructs. Reflecting on my experience adapting the design method and toolkit in Chapters 6 and 7, I developed a set of seven heuristics. I used these seven heuristics to guide participants in the educational case study, reported in Chapter 8, as they adapted design methods. Drawing on insights from participants in the case study and further reflection on the adaptation of design methods and toolkits, I revised and expanded the original set of seven heuristics to the set of ten presented in the last section of Chapter 9.

10.2 Limitations

The work reported here, while making progress on the challenge of moving between theory and practice in design, has two main limitations.

First, as discussed in Chapter 3, there is a limitation to working within the dominant logics and design as currently practiced, given the critiques of the dominant logics. The push for a radical approach presents a non-trivial challenge to the tactic of working within the dominant logics. While this may be

unsatisfactory to some, I take an incremental change approach in this dissertation, moving toward alternatives from within the dominant logics.

Second, there are limitations associated with the educational case study, as discussed in Chapter 8, given the specific context in which I was working and the low number of participants in the course. The course took place within a specific instructional context which does not necessarily reflect novice designers in other contexts. Additionally, the course took place during the coronavirus pandemic and was taught remotely, introducing additional limitations to instruction. Further empirical work is needed to explore how the model of knowledge types in design can be used to support novice and more experienced designers as they adapt design methods.

10.3 Final Reflections and Open Questions

Drawing on my experience working between theory and design, both in this dissertation and in previous work (Ballard, Chappell & Kennedy, 2019; Yoo et al., 2022; Hendry, Friedman & Ballard, 2021), I offer some final reflections and open questions.

Use of the model of knowledge types in design by experienced designers. In the educational case study, I was working specifically with novice designers to understand whether they could use the model of knowledge types in design to adapt design methods on their own. But what about experienced designers? Would they be able to adapt design methods in light of new theoretical constructs by applying the model of knowledge types in design? Or even without using the model of knowledge types in design? Further empirical work is needed to understand how designers of differing skill levels approach this work and how they might use the model of knowledge types in design.

The flexibility of methods as an opportunity to incorporate theoretical constructs. Design methods and toolkits are tools that shape our understanding of what actions are permissible and possible (Winograd & Flores, 1986), and, like other design decisions, the choice of method or toolkit shapes design outcomes (Harrison, Back & Tatar, 2006). At the same time design methods are flexible, adaptable, and extensible (Yoo et al., 2022; Ballard, Chappell & Kennedy, 2019), though this may not always be immediately apparent to novice designers (Harrison, Back & Tatar, 2006). Indeed, there is often room in existing design methods to explore additional concepts. But design methods and toolkits

guide designers' attention toward some things and away from other things. Just because there is room for something within a design method or toolkit does not necessarily mean that it is present in the method or toolkit or that a designer using the method or toolkit will come to a particular conclusion. For example, there's nothing in the stakeholder analysis from value sensitive design which precludes the consideration of non-human stakeholders, but in using the stakeholder analysis method non-human stakeholders are frequently overlooked. But, designers can take advantage of the flexibility of design methods and toolkits to bring important theoretical constructs and theory-to-practice commitments to bear in a design situation by adapting design methods and toolkits to incorporate new ideas. Adapting design methods and toolkits creates new ways of doing things in design.

Limitations of the model of knowledge types in design. In applying the model of knowledge types in design to theories related to materiality and temporality, I did not encounter any specific theories for which I could not articulate a theoretical construct and translate a theory-to-practice commitment. In the method adaptation work, I did not encounter any methods or toolkits for which I couldn't anticipate potential adaptations in response to the theory-to-practice commitments I was working with. This begs the questions, what are the limits of this approach? Are there certain theories, methods, or toolkits which do not lend themselves to adaptation? Additional design work is needed to explore the boundaries of method adaptation.

Re-complicating design through the adaptation of design methods. A lot of the work of modern design and modern design methods is to simplify the design process, making it repeatable and scalable across different design situations. Indeed, this was the focus of the rationalization of design explored by Simon (1969) and systematic design methods explored by Alexander (1964), Jones (1977), and others (Cross, 1980). But the simplification of design and its reduction to design methods abstracts away important details, which, one could argue, has had deleterious effects. By ignoring nuances in design, we also ignore the effects our design work has on elements of the design situation. For example, projects which do not legitimate indirect stakeholders often overlook the effects that a particular technology has on those stakeholders, even in situations where they are significantly impacted. In challenging the assumptions of design methods and adapting design methods using theoretical constructs and theory-to-

practice commitments, designers can re-complicate the design process, surfacing nuances that designers may overlook when using standard methods.

Adapting design methods as designing the design process. Everything is designed, including the ways in which we perform design work. A key skill in professional design practice is the appropriation of design methods in a variety of design situations (Gray, 2016; Harrison, Back & Tatar, 2006). As designers encounter increasingly complex challenges, using theoretical constructs and theory-to-practice commitments in the adaptation of design methods will be one way to secure preferred outcomes and to break out of the dominant logics and mainstream ways of thinking within design as currently practiced. Teaching the adaptation of design methods gives learners permission to make and remake methods to fit different design situations and method redesign is an active part of design learning (Harrison & Tatar, 2011).

The role of theory in theoretically informed design. As discussed briefly in Chapter 4, translation cannot fully transfer the insights derived in theory to practice and vice versa. And as discussed in Chapter 8, moving from theoretical construct to theory-to-practice commitment and subsequently to design work introduces a conceptual distance from the original theory. This begs the question, what is the role of theory once introduced to a design situation? In some design situations, it may be appropriate to use theory loosely as an input, where the conceptual distance between the theory and the theory-to-practice commitment and subsequent design work is irrelevant. The designer has used the theory as one of many inputs and can set the theory aside. But in other design situations, the conceptual distance between theory and the theory-to-practice commitment is of great importance, particularly in situations where designers claim to be doing design work anchored in a specific theory. But how would one go about measuring conceptual distance? And whose right is it to say that someone has used a theory “incorrectly?”

Applicability of practice elements of the model in disciplines outside of design. In this dissertation, I used theoretical constructs that originated outside of the field of design and applied them in design practice by adapting a method and toolkit. Another interesting and open question is if and how the practice elements of the model (methods, toolkits, and heuristics) would apply or differ in disciplines outside of the field of design, such as history or physics. For example, what does it mean to apply a

design toolkit like the value sensitive design Envisioning Cards in the context of a historical analysis and how might that change the focus or findings of the analysis? Interdisciplinary collaboration with scholars from other fields could yield interesting answers to this open question.

The potential overlap between theory and practice. In the model of knowledge types in design and throughout this dissertation, I have held theory and method as two separate ways of knowing and doing which require intention to move between. I have not yet taken up the potential for overlap between theory and practice. In other words, are theory and practice ever the same thing? One example where the two may be the same, or at least blur the boundary significantly, is when someone is designing a theory, such as in Hallnäs and Redström's (2001) work on slow technology. The act of theory making could be considered a design practice, but a full exploration of this space is best left for future work.

These open questions provide a direction for future research in the space of adapting design methods and toolkits and the relationship between theory and practice more broadly, as guided by the model of knowledge types in design.

Appendices

Appendix A: Sources for Levels of Abstraction

Drawing on the approaches from Friedman and Hendry (2019) and Brand (2000), I developed the framework for choosing works related to materiality and temporality at different levels of abstraction: individual, institutional, societal, and global).

Figure 18. Levels of Human Experience from Value Sensitive Design: Shaping Technology with Moral Imagination Friedman and Hendry (2019, p 9). This figure illustrates how value sensitive design has been applied at different levels of human experience, from the individual to the global. This conceptualization was an inspiration for the framework I used to select works at different levels of abstraction.



Figure 1.1
Projects that engage different levels of human experience. Slide reproduced from University Faculty Lecture, University of Washington (Friedman, 2013).

Figure 19. From Stewart Brand's *The Clock of the Long Now: Time and Responsibility* (2000, p :37). This figure shows the order of civilization as conceptualized by Brand. The highest layers move more quickly, the lowest layers more slowly. This conceptualization was an inspiration for the framework I used to select works at different levels of abstraction.

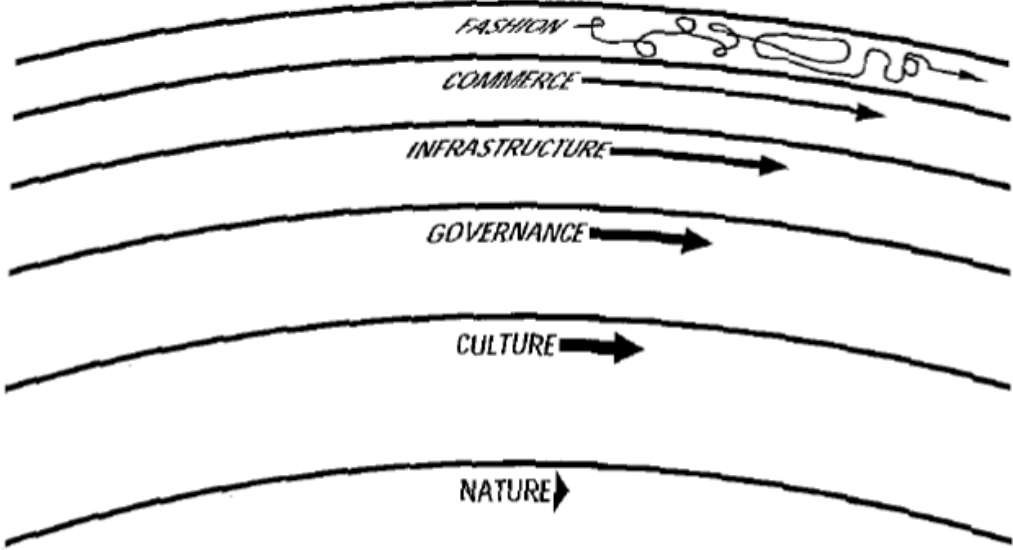


FIGURE 7.1 The order of civilization. The fast layers innovate; the slow layers stabilize. The whole combines learning with continuity.

Appendix B: Instructions for writing a value scenario from INFO 200

The following is an excerpt from the instructions from a design lab taught in the course INFO 200: Intellectual Foundations of Informatics.⁵ This course was taught during Spring Quarter 2019 at a large research university in the Pacific Northwest.

Aims

We have three aims with this lab: (1) To gain firsthand experience envisioning a future and the related societal implications. (2) To gain firsthand experience with one envisioning method, value scenarios. (3) To reflect on how the design of technology shapes aspects of the future.

Materials

- Value Scenario Spec Sheet
- Camera
- Thing from the Future Cards
- Envisioning Cards
- Sample value scenarios

Challenge

When designing technology, we rarely think beyond the end user to include indirect users, widespread uptake over time, and unintended consequences. Nathan and colleagues (2007) developed a method, called a value scenario, that attempts to do this by envisioning the future.

You've already encountered one value scenario, Sleeve (2019). With this lab, your challenge is to envision a "thing" related to your human concern in the future and outline the elements of a value

⁵ Batya Friedman, Stephanie Ballard, and Nicholas Logler. 2019. INFO 200: Intellectual Foundations of Informatics. University of Washington Information School. Unpublished.

scenario. You'll be recording your outline on the spec sheet. You will need to complete your spec sheet, include pictures of it in your final project 2 report, and bring it to the final project fair on June 6.

The actual writing of the value scenario (as a narrative) will occur outside of lab.

Process

- A. In your Project 2 groups (see Canvas), please do the following.
 - 1) Choose your human concern. Before lab you should have agreed on which human concern your group would like to address for Project 2. Take a moment to discuss the human concern you chose and make sure you are in agreement. You'll focus on this human concern throughout Project 2. Write your human concern on the blue card in column 1 on your spec sheet.
 - 2) Select a "future". From your TA, get your Thing from the Future Cards. The green card characterizes the future you're designing for. You'll emphasize this future throughout project 2. Write your "future" on the green card in column 1 on your spec sheet.
 - 3) Select an initial "thing". The pink card describes the initial thing you will focus on for Project 2. This thing will seed your initial envisioning activities. You'll use it in steps 4, 5, 6 and 7. Then, in step 8, you'll spring further into the future, and abstract and extend this thing in interesting ways for steps 8 and 9. Write your thing on the pink card in column 1 on your spec sheet.
 - 4) Divergent thinking: What is it? Generate at least three very different ideas based on your card combination. When generating ideas, use a "brainstorm" practice: To create a comfortable and productive environment for people to bring forth new ideas, all ideas should be accepted without comment or criticism. Sketch each idea in column 1 on your spec sheet.

5) Converge: Choose one idea and develop it further. Consider the proposed ideas from step 4 and discuss the advantages and disadvantages of each. Choose one idea and give it a name. In column 1 on your spec sheet, describe your idea's (a) technical configuration (e.g., does it use satellite data, facial recognition, demographic data, knots on a string, rhythm, movement, etc.?) (b) intended use and (c) an example of its use. This will be paragraph 1 of your value scenario.

6) Describe a direct stakeholder. Take out the "Direct Stakeholder" Envisioning Card. In column 2, list 3-5 direct stakeholders (users) of your idea. Choose one of the direct stakeholders you identified and in column 2, describe (a) the direct stakeholder, (b) their concerns, (c) a benefit and harm of your idea for this stakeholder, and (d) how your idea creates the benefit and harm. This will be paragraph 2 of your value scenario.

7) Describe an indirect stakeholder. Take out the "Indirect Stakeholder" Envisioning Card. In column 3, list 3-5 indirect stakeholders of your idea. Choose one of the indirect stakeholders you identified and in column 3, describe (a) the indirect stakeholder, (b) their concerns, (c) a benefit and harm of your idea for this stakeholder, and (d) how your idea creates the benefit and harm. This will be paragraph 3 of your value scenario.

8) Consider pervasive use. Take out the "Widespread Use" Envisioning Card. Imagine that several decades have passed and your underlying idea has seen widespread uptake. In Sleeve, the underlying idea (brain computer interfaces that detect affect and a physical display of that affect) was transferred to buildings and other physical structures. Consider how else your underlying idea might be used if it becomes widespread. In column 4, describe the widespread use of your idea, three synergistic benefits of widespread use, and three potential breakdowns due to widespread use. This will be paragraph 4 of your value scenario.

9) Select one card from either the Time or Multi-Lifespan Design category. Select one purple or brown card you think would be meaningful to consider for your value scenario. In column 5 of your spec sheet, write the card you chose and why. Follow the card prompt to develop your ideas for this envisioning card. This will be paragraph 5 of your value scenario.

10) Document your work. Take photos of your work

11) Clean up. Return your Thing from the Future cards to your TA. Please help the TA re-arrange desks, etc. if needed.

B. If there is time, exchange value scenarios with a neighboring group. Read the outline of their value scenario from their spec sheet and provide feedback, remembering the lessons you learned about giving constructive feedback in Lab 7. Then, reflect on (a) the process of creating value scenarios; and (b) the limitations and challenges posed by envisioning the future.

Here are some tips for writing and refining a compelling value scenario:

- Name the characters in the scenario. Be inclusive. Consider age, gender, nationality, etc.
- Try beginning paragraph 4 with a phrase like “Several decades have passed” or “After many years” to signal that the time frame has changed.
- Read the scenario aloud to yourself and to others.
- Have others read the scenario aloud to you.

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