Designing for Temporal Motivation

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ABSTRACT

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Time is an inseparable factor in human behavior, affecting how people think and what they value. The temporal dynamics of human perception has been a long-standing topic of interest in a broad range of disciplines including, but not limited to, sociology, economics, psychology, marketing, behavioral science, HCI, and CSCW. However, there is a critical unexplored design space of time – how time could be addressed as a tailoring strategy and what is meant by the right time when it comes to human motivation. In this dissertation, drawing upon Construal Level Theory (CLT), I investigate how the temporal aspects of a target affect people's

motivation to participate in the target behavior and how we might tailor technology design to address temporal motivation. I focus on the three dimensions of temporality: temporal distance, duration and (uncertain) deadline.

To examine temporal distance as a tailoring strategy, I first gained an understanding of what drives motivation as time goes by through a series of field and online experiments. I then designed and tested three design strategies that address temporal motivations to increase intention to participate in events on social media. In my exploration of duration as a time-based strategy, I studied how people differ their financial wellness goals and the related behaviors by the goal-durations—focusing on their tool use practices through interviews. Lastly, to explore how to increase motivation when there is no fixed deadline to a task, I explored how individuals perceive an earthquake and earthquake preparedness behaviors, and what might potentially motivate them to act upon a precautionary measure by leveraging the theoretical premise of CLT. Drawing together my findings across these studies, I offer theoretical contributions to deepen our understanding on motivation by time and practical considerations for designing technology to address the dynamics of temporal motivation.

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To my mom and dad

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CHAPTER 1. INTRODUCTION

Time is an inseparable factor in human behavior. Throughout history, individuals and societies have experienced, utilized, negotiated, and conceptualized time in various ways, permeating people's daily life and thus their technology use (Duncheon & Tierney, 2013). Time animates the way technologies are used in social situations, affecting how people interact with others and make sense of their lives (Laguerre, 2004). Time also has been a long-standing topic of interest within the fields of human-computer interaction (HCI) and computer-supported cooperative work (CSCW; Lindley, 2015). However, within the context of technology, a critical unexplored design space of time exists—time as the basis of a tailoring strategy. My research explores how time affects motivation to act and how we might tailor technology design to address temporal motivation to support their physical and psychological well-being.

1.1 Motivation of Thesis

Tailoring technologies, computing products that provide information relevant to individuals to change their attitudes or behaviors, are known as useful in interventions to support behavior change or increase user engagement (Fogg, 2002). Tailoring strategies are likely to be more effective at influencing behavior than one-size-fits-all designs, as they enhance the relevance of information presented and produce greater desired changes in response to the communications (Hawkins, Kreuter, Resnicow, Fishbein, & Dijkstra, 2008; Petty & Cacioppo, 2012). A *tailoring* strategy means providing bespoke interventions (e.g., messages, designs) to a *target*, whose properties that could be tailored on are diverse –for example, the properties of a target for tailoring could be users (e.g., curated contents for user's personal preference on Instagram), devices (e.g., different designs features of Gmail apps for iPad and iPhone) and locations

(different design appeals by countries on IKEA webpages). However, one critical property remains underexplored for a tailoring strategy: the *temporal aspects of a target.*

Time has the potential to be a base of a tailoring strategy as changes in time change how people think and what they value. The temporal dynamics of perception have been studied in various fields, including economics, psychology, sociology, and education. For example, people tend to place more value on receiving an item at an earlier date compared with receiving it at a later date (time preference: Frederick, Loewenstein, & O'Donoghue, 2002) and are known to overcommit to events in the future (planning fallacy: Mitchell, Thompson, Peterson, & Cronk, 1997). People are likely to perceive the same behavior differently in the future as opposed to the present because temporal distance from a target changes what is salient in one's mind—the so-called mental representation (temporal construal: Trope & Liberman, 2003, 2010). These phenomena collectively suggest people's perception systematically differs by time, indicating how they are motivated also could be differentiated.

However, it is unclear how the temporal aspects of a target could or should be addressed for a tailoring strategy to influence motivation. Motivation[1] refers to the condition of being motivated to perform a certain behavior (Merriam-Webster, n.d) and *temporal motivation* can be defined as the motivation or willingness to exert effort to enact the behavior, which could be systematically changed by the temporal aspect of a target (e.g., delay of a reward: Steel & König, 2006). What constitutes motivation are varied and rather complex— motivation (behavioral

[1]Motivation, what energizes human behavior, what directs such behavior, and how this behavior is maintained or sustained (Steers & Porter, 1987), is conceptually similar to intention to perform a behavior, "indications of how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behavior" (p.181) (Ajzen, 1991). Building on prior research that operationalized motivation as intention (Ajzen, 1991; Rhodes, Blanchard, Matheson, & Coble, 2006; Sheeran, & Orbell, 1999), which is the key predictor of behavior (Ajzen, 1991), in my thesis, I consider motivation and behavioral intention in the same manner as a target outcome of a time-based tailoring strategy.

intention) is a comprehensive function of multiple salient perceptions relevant to the behavior (Ajzen, 1991). Various motivation theories postulate that individuals' thoughts, beliefs, and emotions are collectively central processes that underlie motivation (Ryan, 2012; Bandura, 1998, 2004; Rhodes, Blanchard, Matheson, & Coble, 2006).

Understanding how motivation to perform the target behavior (i.e., temporal motivation) changes is critical to better utilize time as a base of a tailoring strategy in technology or service designs. Despite the wealth of theories on motivation (e.g., Theory of Planned Behavior: Ajzen, 1991, Self-Efficacy Theory: Bandura, 1986), temporal aspects were rarely factored in these theories, reducing their predictive powers to account for motivations in the future (McEachan, Conner, Taylor, & Lawton, 2011).

More recently, the temporal motivation theory (TMT: Steel & König, 2006) has been proposed to provide an integrative framework of temporal motivation by combining multiple major social science theories (expectancy theory: Vroom, Porter, & Lawler, 2005; hyperbolic discounting: Ainslie & Haslam, 1992; and prospect theory: Tversky & Kahneman, 1979). TMT focus primarily on how temporal distance to a target event changes how people value the target (e.g., the *delay* of a reward : Steel & König, 2006; Steel, Svartdal, Thundiyil, & Brothen, 2018). However, there are additional dimensions of time, such as the duration of a target, and targets with no clear set deadlines that are not examined via TMT. These, as I will discuss later, are important and useful dimensions of time that could also be utilized in tailoring.

Construal level theory (CLT: Trope & Liberman, 2003) can further help explore a tailoring strategy for temporal motivation. CLT describes the relation between psychological distance from a target and the extent to which people's thinking (e.g., about target events and

behaviors) is abstract or concrete (Trope & Lieberman, 2003), offering a framework to understand intertemporal perceptions by temporal distance (Leiser, Azar, & Hadar, 2008), which might be applicable to another dimensions of time. Work on CLT also provides empirical evidence about how the psychological distance from a target could be useful for tailoring interventions to make the same behavior more appealing and hence more persuasive (e.g., providing a concrete message when a campaign is planned in the near future, but not when it is planned in the far future : Kim, Rao, & Lee, 2009), shedding light on how we might approach temporal motivation as a tailoring strategy. However, work on CLT focused on construals activated by temporal distances from targets (Trope & Lieberman, 2003), overlooking a wide range of various dimensions of time (Lee & Liebenau, 2000; Schriber, 1986), which may undermine the opportunities to address the breadth of temporal motivation. It is also unclear if or how CLT could be leveraged as a tailoring strategy in practices such as technology design.

Therefore, in my thesis, I aim to broaden the scope of temporal motivation through CLT and explore the potential of time as a base of a tailoring strategy, focusing on distance, duration, and (uncertain) deadline, which are the major dimensions of time as identified by various scholars who have studied temporality (Lee & Liebenau, 2000; Schriber & Gutek, 1987; Zerubavel, 1985). Drawing upon the definitions of temporality used in prior work (Lee & Liebenau, 2000; Schriber & Gutek, 1987; Zerubavel, 1985), in this thesis, I define these temporal dimensions as:

- *Distance* refers to the amount of temporal space between the present and the location of target activities and tasks at particular points over the continuum of time.
- *Duration* refers to the amount of time to complete a target task or goal.

- Deadlines often indicate the existence of a fixed time by when a target task or activity is to be done. *Uncertain deadlines*, the actual focus of this thesis, refer to the nonexistence of any fixed deadlines.

As the target's temporal properties can influence perceptions of and motivation to perform target behaviors, understanding how these temporal aspects of a target affect motivation will help designers incorporate and utilize the temporal dynamics as a tailoring strategy in practice.

1.2 Thesis Statements

My thesis claims are summarized in the following statements:

- Understanding the ways in which various dimensions of time affect one's motivation to perform a target activity can help identify opportunities to design a time-based tailoring strategy.
- Tailored designs in consideration of temporal motivation can lead to a higher intention to perform the desired activity.

1.3 Research Questions and Methodologies

To verify the thesis statements, I explored how time affects people's motivation and their technology use and in what ways we may tailor a design to address temporal motivation as overarching research questions. Specifically, I examined the following research questions (RQs) that crosscut the thesis statements, through a mixed-method approach:

- **RQ1:** How can temporal distance of a target be utilized as a tailoring strategy? How do people change their motivation as temporal distance of a target from distal to proximal vary? If temporal distance can be integrated into technology design, what would it look like? What sort of design is effective when the target behavior is planned for the near or far future?
- **RQ2:** How can duration of a target be utilized as a tailoring strategy? What kinds of short-long-term goals do people have, and how might their goal-pursuit practices differ by goal duration? How could technology better support financial wellness goals, considering the duration of the goals?
- **RQ3:** How can we tailor designs for tasks or activities for which deadlines are uncertain? How do people act upon tasks when the time to complete the task is uncertain, such as a preparatory plan for an earthquake that may or may not occur at some point in the future? What would be an effective way to promote activities with uncertain deadlines?

By examining 1) in which ways various temporal aspects of a target play a role in motivation, 2) how time-based designs could look like in technology contexts, and 3) how effective these tailored designs are in increasing one's intention to perform target behaviors, I claim that we can define temporal motivation-based design principles for improving technologies that better engage users and support their behavior change as intended. In this thesis, I draw upon construal level theory (CLT: Trope & Lieberman, 2003), a social psychology theory that describes the relation between psychological distance and the extent to which people's thinking is abstract or concrete, as an underpinning theoretical premise to explore temporal motivation in various dimensions of time.

To answer RQ1 and explore temporal distance as a tailoring strategy, I conducted a series of field and online studies that deepened our understanding of what drives motivation as time goes by and how temporal motivation is nuanced. I also designed and tested three design strategies that address different motivations to increase intention to participate in events on social media. In addressing RQ2, I studied how people differ in their financial wellness goals and the related behaviors by the goal durations—focusing on their tool-use practices through interviews. To answer RQ3, I conducted a set of online experiments to examine the effects of different information designs to promote earthquake preparedness.

1.4 Contributions

Findings from the studies in my thesis provide a better understanding of how time plays a role in motivation and how we might apply temporal motivation in practices such as technology or service designs. The contributions of my thesis include:

- Empirical Knowledge
  - The way people change their motivation to participate in a social event as temporal distance from the event decreases.
  - Peoples' expectations and practices toward personal finance goals with different durations.
  - People's various perceptions toward an earthquake and the potential motivators to increase earthquake preparedness, whose deadline is inevitably uncertain.
- Theoretical Contributions
  - Connecting CLT to different theories (theory of planned behavior, goal-setting theory).
  - Applying CLT in various domains including social events, personal finance goals, and disaster preparedness.

- Elucidating the theoretical boundary of CLT by revealing limitations in leveraging CLT in the different dimensions of time beyond temporal distance: duration, uncertain deadline.

- Design Implications
  - Constructing and evaluating visual and information design-mockups that provide insights of temporal motivation-based design (temporal distance of an event in Study 2; uncertain deadline of a task in Study 4).
  - Suggesting design guidelines on how to address temporal motivations to encourage user engagement in the context of service or technology that supports social events, personal finance goals, and disaster preparedness.

1.5 Dissertation Overview

My thesis sought to understand how to utilize various dimensions of time as a base of a tailoring strategy. This work deepens our understanding of temporal motivation and provides as well as examines time-based design guidelines time through a series of studies. In Chapter 2, I begin this discussion by reviewing current research and theoretical frameworks helping understand and design time-based strategies. In Chapter 3, I examined how temporal distance from events affect people's motivation and explored how we could design for temporal distance to increase user engagement through field and online experiments. Building on this work, I created design artifacts that elucidate temporal motivation in the context of events on social media and tested them in Study 2. In Chapter 4, I examined how goal durations affect people's perception and their tool use through interviews with finance coaches and people who have used tools for personal finance goals (Study 3). In Chapter 5, I explored how people perceive tasks with uncertain deadlines and what might potentially motivate them to act upon a precautionary

measure from the perspective of CLT (Study 4). Finally, I summarize the findings of this work in Chapter 6 and discuss the contributions of this work and opportunities for future work in Chapter 7. The summary of my research questions and findings from each study are presented in Table 1.

Research Questions	Summary of Findings
Temporal Distance from an Event	
How do people change their motivation as temporal distance from a target event from distal to proximal varies?	• I found that what comes to people's minds differs by temporal distance from the target behavior, and what leads them to perform the behavior differs as time passes.
What sort of design is effective when a target event is planned for the near- or far-future?	• To get widespread attention or when an event is planned far in advance, people are more likely to join the event if its introduction design activates high level construal, in other words it should highlight the *why* aspect of the event (e.g., the potential benefits of participation), and use more abstract images such as illustrations with a focus of textual information • To encourage proximal behaviors or help stick to plans, the design should activate low level construal: emphasizing the *how* aspect of the event (e.g., the means of participation), and using more concrete images (e,g, photos) • To improve RSVP accuracy, the design should help assess one's capability of the behavior in advance (e.g., a RSVP system that automatically shows a conflicting schedule on a calendar app)
Duration of Goals	
What kinds of short/long-term goals do people have, and how their goal-practices differ by goal durations?	• I discovered that short- and long-term financial wellness goals featured with different characteristics (e.g., how the goals are concrete, affective, and social-norm concerned), and people use tools differently for their personal finance goals. • I found the intricate relationship between short- and long-term financial wellness goals – tradeoff between short- and long-term financial goals often posed challenges to balance various goals. These goal durations are fluid as the goal-pursuit is progressed or the situation is changed.
How could technology better support financial wellness goals, considering goal durations?	• To support short-term goals, systems and services should encourage users to specify the details of goals (e.g., having them decide the precise target date and amounts) and to actively check the progress toward the goals (e.g., providing daily analytics of one's cash flow) • To support long-term goals, systems and services should utilize social norms that relates with users' and helps them connect with their core values (e.g., having describe why it is important for them to achieve certain goals) • To help balance multiple goals with varied durations, systems and services should change the focus of the strategy as the goal-duration varies while supporting lapse and impulsivity management
Uncertain Deadline for a Task	
How do people act upon tasks when the time by which the task has to be completed is uncertain, such as earthquake preparedness?	• I found that for people who perceive an earthquake as proximal, the congruency of low-level construals (emphasizing how-focused information) could increase motivation to perform the behavior (earthquake preparedness) whose deadline is uncertain • I found that for people who perceive an earthquake as distal, the congruency of high-level construals (emphasizing why-focused information design) could decrease their motivation to perform the behavior whose deadline is uncertain, *if* they do not value the behavior
What would work to promote activities with uncertain deadlines?	• To support people who think the perceived end-date of the behavior is proximal, emphasize *how* of the behavior and provide actionable recommendations (e.g., providing plan forms) • To support people who have negative attitude toward the behavior and who perceive an earthquake may occur far in the future, de-emphasize the importance of the behavior, and instead focus on lowering the perceived barrier of the behavior (e.g., the ease of doing the behavior)

Table 1. Summary of Research Questions and Findings

CHAPTER 2. THEORETICAL FOUNDATIONS & RELATED WORK

My dissertation is motivated by prior work and theories in a broad range of disciplines including, but not limited to sociology, economics, psychology, marketing, behavioral science, HCI, and CSCW. In this section, I discuss the background of my dissertation, focusing on the two main topics: theoretical perspectives on time and various dimensions of time in HCI research.

2.1 Theoretical Perspectives on Time and Human Computer Interaction Research

Throughout history, changing social, cultural, and institutional contexts have generated different ways of conceptualizing time (Duncheon & Tierney, 2013). In this section, I first describe the major perspectives on temporality (Hornik & Zakay, 1996; Jefferson, 1985; Laguerre, 2004; Lee & Liebenau, 2000), providing a broad background and epistemological stance of my thesis in an exploration of temporal motivation. Then, I introduce the concept of the *temporal construal* based on CLT (Trope & Lieberman, 2003) as an underpinning theoretical premise of the studies (Studies 1–4) in this thesis.

2.1.1 Concepts of Temporality

Broadly, time can be conceptualized in four ways: clock time, socially constructed time, virtual time, and psychological time (Hornik & Zakay, 1996; Laguerre, 2004; Lee & Liebenau, 2000).

2.1.1.1 Clock Time

Clock time views time as a universal, measurable construct dictated by the clock and the Western calendar (James & Mills, 2005). Based on the notion of clock time, we can make plans for the

future, as time advances linearly from past to present to future. We can also allocate the same amount of time for a certain plan every week, as the time intervals are mathematically equal: each second is like every other second and another week reoccurs every 7 days (Zerubavel, 1981). Thus, the world in which we live is fairly structured—we can orient ourselves toward an objective notion of time, such as dates, time tables, and timelines (Zerubavel, 1981). Alongside industrial capitalism, clock time emerged as the dominant perspective in which time is treated as an interchangeable commodity that can be spent, saved, wasted, invested, divided, managed, budgeted, shared, and used up (Birth, 2004). People who spend less time completing tasks are often lauded for using time wisely, and numerous systems are designed to be more efficient (Duncheon & Tierney, 2013). From the perspective of clock time, time dimensions may mean the mechanical variations of time (Zerubavel, 1981), such as X days in advance from an event (distance), Y weeks in total to achieve a goal (duration), and Z months left to the end-date (deadline).

2.1.1.2 Socially Constructed Time

Another view of time is socially constructed time, which posits that people may not interpret time in uniform ways and time perceptions are not static (Schriber & Gutek, 1987). From this perspective, what time is and how it is experienced depends on the "basic sociocultural processes through which temporality is constructed" (Munn, 1992, p. 92). Subjective time perceptions could assign different meanings to specific activities within a society, which then influence individual and collective behaviors (Mosakowski & Earley, 2000). Socially constructed time challenges the assumption that singular truth and realities exist—rather, it emphasizes the fragmented and effervescent quality of experienced time (Gershuny & Sullivan, 1998).

The rise of information and communication technology has changed the way people engage in activities and social relationships, which in turn, transforms how people experience, think about, and construct time (Duncheon & Tierney, 2013; Hassan, 2003; Mazmanian, Erickson, & Harmon, 2015). Within the HCI and CSCW community, how people negotiate time while using technology, as a social practice, has been a long interest of researchers (Lindley, 2015)—they examined how time is socially shaped by studying the various social factors that influence how people use technology, including cultural norms (Reinecke, Nguyen, Bernstein, Michael, & Gajos, 2013), social relationships (couples: Thayer, Sirjani, & Lee, 2013; cohabiting family members: Neustaedter & Bernheim Brush, 2006; distant family members: Forghani, Neustaedter, Vu, Judge, & Antle, 2018), and collaborative situations (Chen, Poon, Ramakrishnan, & Aragon, 2016; Nilsson & Hertzum, 2005; Reddy, Dourish, & Pratt, 2006). Taken together, socially constructed time highlights the relativistic view of temporality as social experiences, indicating richer variations of temporality experiences, collectively agreed upon by society members, beyond just absolute numbers (Zerubavel, 1981).

2.1.1.3 Virtual Time

The advance of information and communication technology also enabled new rhythms of time to emerge, virtual time, which may better serve the digital or virtual space (Laguerre, 2004). The earlier notion of virtual time was computational system-specific. Jefferson (1985) defined virtual time as a global, one-dimensional, temporal coordinate system imposed on a distributed computation to measure computational progress and define synchronization among systems. As technologies became more integrated into individuals' lives and societies, the perspective of virtual time became broader; according to Laguerre (2004), virtual time refers to "the socio-

technological production, inscription, mediation, experience, and embodiment of time" (p. 225), which manifests itself through the collapse of temporal boundaries and the compression of time-distance, blurring the temporal boundaries that had shaped physical and social structures throughout history. The notion of virtual time consists of a different set of axes. For example, virtual time features hybridity, indicating that real time is mixed with virtual time as people move back and forth from one type to another in the process of completing a specific task. Ubiquity is also an important aspect of virtual time, meaning that one is able to accomplish a task in a continuous time period despite the vagaries of different time zones (see Laguerre, 2004 for details).

Within the HCI and CSCW communities, researchers looked at inscribing virtual time in design by exploring the idea of using time as the focal point of design (Hallnäs & Redström, 2001; Lundgren, 2013; Redström, 2001). In designing temporality, they focused on how virtual space afforded various rhythms of real time. For example, Lundgren (2013) classified the temporal themes, using terms such as live time, sequential events, juxtaposed events, etc. (see Lungdren, 2013 for details), and described how these are currently manifested in technology design and can inspire designers in practice to better support user experiences. Research on slow technologies (Hallnäs, Jaksetic, Ljungstrand, Redström, & Skog, 2001; Hallnäs & Redström, 2001; Odom, 2015; Odom, Banks, Durrant, Kirk, & Pierce, 2012) examined how the slow pace of time in virtual space enables users to engage in rich experiences, such as reflection or a new understanding of physical space.

To summarize, studies regarding the perspectives of virtual time tend to focus on the embodiment of time on or around technology—how time is manifested in technologies and

virtual spaces, how people react to new representations of temporality, and how their personal and social practices are appropriated accordingly.

2.1.1.4 Psychological Time

Psychological time may refer to perceived temporal dimensions (Zakay, 2014) and is one of the most important dimensions for understanding human behaviors (Hornik & Zakay, 1996). In this thesis, I posit that psychological time may provide the more appropriate framework to explore the design space for temporal motivation compared with other perspectives of temporality (clock time, socially constructed time, and virtual time) for two reasons, as described below.

First, motivation for behavior change mainly refers to adjusting perception and behavior; for example, Ajzen (1991) explained that one's behavior is formed by perceived attitude, perceived social norm, and perceived behavior control. Psychological time is a result of the individuals' perceived needs and values, which creates their particular goals, which are then translated into action. Psychological time provides individuals' information processing systems with essential information that enables the representation of the environment such that adaptive behavior becomes possible (Zakay, 2014). Therefore, psychological time is more relevant to understand individuals' motivation with regards to temporality compared with virtual time (focusing on the embodiment of time on technology), socially constructive time (collectively constructed time perception by society or culture), or clock time (a reflection of natural chronometric order).

More importantly, second, psychological time focuses on how psychological factors can affect the temporal patterning of behavior (McGrath, 1988). These factors may be varied and include time orientation (the relative dominance of past, present, or future in a person's thought:

Jason, Schade, Furo, Reichler, & Brickman, 1989), time perception (the transformation of stimulus time to judgmental time: Graham, 1988), and time preference (individual's value and expectation on time: Frederick et al., 2002). Collectively, they help us understand how behavior is influenced by the interactions between internal perception and external circumstances of time (Zakay, 2014). Research has examined how these factors are associated with an individual's perception and decision-making. For example, Simons, Vansteenkiste, Lens, and Lacante (2004) focused on future time perspective (FTP), the present anticipation of future goals, and found that having a deep FPT enhances motivation, deep conceptual learning, and better performance, as it increases the instrumentality of one's present behavior. Focusing on time discounting, the tendency of people to discount rewards as they approach a temporal horizon in the future or the past, Frederick et al., (2002) found that individuals tend to prefer immediate gratification and expect more rewards the longer they need to wait. Focusing on temporal construal (individuals' mental representation), another ample set of literature collectively examined how individuals' perception toward a target differs by the temporal distance from the target. This body of work is based on the work of Trope and Liberman (2003), which I further discuss in the next section. Overall, these studies show how individuals differ in their motivations and behaviors based on their perception of time, suggesting psychological time is a suitable standpoint to explore temporal motivation and the related tailoring strategies.

2.1.2 Temporal Construal Theory

In my thesis, I use CLT (Trope & Liberman 2003, 2010) as a theoretical framework that describes the effects of temporal distance on perception from the stance of psychological time. The theoretical premise of CLT and the related research provides a solid background to explore a

tailoring strategy by time, which I detail in this section, underpinning the series of my studies on designing temporal motivation.

2.1.2.1 Theoretical Premise of Construal Level Theory

Construal level refers to the ways that people encode and retrieve information, like a mental representation. Cognitive psychology explains that people use cognitive structures, such as schemas and categories, for information processing, and these structures may be more abstract or more concrete (Brown, 1958). CLT posits that a construal enables people to think about things they cannot directly experience, such as the past, the future, other people, or hypothetical events (Trope & Liberman, 2003, 2010). Although people cannot experience what is not present, they can make predictions about the future, remember the past, imagine other's reactions, and speculate about what might have been. Predictions, memories, and speculations are all mental constructions, removed from direct experience, which serve to transcend the immediate situation and represent psychologically distant objects (Trope & Liberman, 2003, 2010).

Psychological distance is a subjective experience that something is close or far away from the egocentric reference points of self, here, and now (Trope & Liberman, 2003, 2010). CLT describes the relationship between psychological distance and the degree to which an individual's thinking toward an object or event is abstract or concrete. The different ways in which an object might be removed from that point—in time, space, social distance, and hypotheticality—constitute different distance dimensions: spatial distance, temporal distance, social distance, and hypotheticality (Trope & Liberman, 2003, 2010). Of the four dimensions of psychological distance, this thesis mainly relies on construal level prompted by temporal distance; however, these distance dimensions tend to be interrelated and share a common meaning that people access automatically, even when it is not directly related to their current

goals (Trope & Liberman, 2003, 2010). Studies found that one distance dimension may affect its perceived distance on other dimensions (Fujita, Henderson, Eng, Trope, & Liberman, 2006; Liviatan, Trope, & Liberman, 2006; Trope & Liberman, 2010, 2011; Wakslak & Trope, 2008). For example, close locations should bring to mind the proximal rather than the distant future, oneself rather than other people, and likely rather than unlikely events.

CLT postulates that individuals are more likely to construe objects and events situated in the distant future in abstract, decontextualized, and high-level terms. They also tend to have a greater focus on why people do things and central characteristics that are likely to be invariant. However, when it comes to the objects and events in the near future, more concrete, contextualized, and low-level construal is activated, focusing on how people do things and peripheral characteristics (Trope & Liberman 2003, 2010). For example, high-level construal may involve attending to overarching goals, attributing personality traits to people, and evaluating decisions regarding moral principles. Low-level construal, in contrast, involves applying relatively specific, detailed, and contextualized representations focused on observable features of a target, focusing on situational explanations of people's behavior, and evaluating decisions regarding ease or other practicality considerations. The activation of high- versus low-level construal produces systematic differences in individuals' understanding of objects and events, leading to changes in evaluation, judgment, and action (Eyal, Liberman, Trope, & Walther, 2004; Liberman & Förster, 2009; Spassova & Lee, 2013; Wakslak & Trope, 2008; Wan & Rucker, 2013). Since Trope and Liberman (2003) theorized CLT, a number of studies have validated, utilized, and extended its theoretical premise. A snapshot of the major studies is presented in Table 2.

	High-level Construals	Low-level Construals
Conceptualization		
Definition (Liberman & Trope, 2008)	Abstract, schematic and decontextualized representations that extract the gist from the available information (p.1202)	Concrete, relatively unstructured, contextualized representations that include subordinate and incidental features (p. 1201)
Characteristics of Construal (Trope & Liberman, 2003)	• Abstract • Simple • Structured, cohere • Decontextualized • Primary, core • Superordinate • Goal-relevant • End-goal • Central	• Concrete • Complex • Unstructured, incoherent • Contextualized • Secondary, surface • Subordinate • Goal-irrelevant • Mean of goal • Peripheral
Effects		
Mental representation		
• Attention: what is "seen" or "perceived (Smith and Trope, 2006; Walslack et al., 2006)	• Big picture; gestalt; "the forest"	• Component parts; details; "the trees"
• Categorization (Liberman et al., 2002)	• Create fewer, broad groups of objects	• Create more, narrow groups of objects
• Interpretation of actions (Fujita et al., 2006, Liberman and Trope, 1998)	• Focus on why the action is performed, a superordinate purpose	• Focus on how the action is performed, a subordinate purpose
• Inference : Explanation of behavior (Henderson et al., 2006; Nussbaum et al., 2003)	• Viewed in terms of abstract dispositions (Traits, values, attitudes) of the actor	• Viewed in terms of specific situational factors
Prediction (Henderson et al., 2006)	• Focus on global trend	• Focus on local deviation
Preference (Trope and Liberman, 2000)	• Positive aspect • Cognitive aspect	• Negative aspect • Affective aspect
Evaluation • (Trope and Liberman, 2003)	• Based on central, goal-related issues • Based on desirability, value of the end state	• Based on peripheral, goal-irrelated issues • Based on feasibility, means used to reach end state
• (Stephen, et al., 2006)	• More politeness concerned	• Less politeness concerned
• (Agerström, Björklund, 2009)	• More morally concerned	• Less morally concerned

Table 2. The Details on Construal Level Theory

2.1.2.2 Construal Level Theory as Tailoring Strategy

Tailoring strategies are useful in interventions or systems for behavior change (Krebs, Prochaska, & Rossi, 2010; Kreuter & Wray, 2003). Compared with nontailored strategies, tailored informational intervention is more likely to be read, remembered, and viewed as personally relevant (Brug, Campbell, & van Assema, 1999). Further, it enables individualized feedback, commands greater attention, is processed more intensively, and contains less redundant information (Kreuter, Farrell, Olevitch, & Brennan, 2013). Thus, a tailored informational intervention is likely to evoke favorable perceptions from individuals (Rimer & Kreuter, 2006) and engender more positive outcomes from the intervention (Dijkstra & De Vries, 1999). Tailored interventions have led to positive outcomes across a variety of contexts, such as binge drinking (Chiauzzi, Green, Lord, Thum, & Goldstein, 2005), diet (Oenema, Brug, & Lechner, 2001), and smoking (Strecher, Shiffman, & West, 2005). Tailoring allows for personal and relevant content presentation based on various elements, such as likes or dislikes, needs, and current behaviors (Kreuter et al., 2013).

CLT is compelling for tailoring strategies for temporal motivation in part because it offers a systematic framework to comprehend distinctions in intertemporal decisions, such as for now or later (Leiser et al., 2008), and to understand why and how individuals change their perceptions according to contextual cues, such as time (Wiesenfeld, Reyt, Brockner, & Trope, 2017). More importantly, CLT suggests one robust way to increase the effectiveness of an intervention is by matching the construal fit—a congruity between temporal representation and the construal level of information concerning the behavior. Work with CLT explored how the construal fit could make the same behavior more appealing and hence more persuasive. For example, when an event is planned in the far future (construed abstractly), an abstract message is known to be more appealing; when the event is planned in the near future (construed concretely),

a concrete message is found to be more favored (Kim, Rao, & Lee, 2009). Three possible explanations exist for a construal fit. First, individuals could pay more attention if information is congruent with the construal level that is more salient at the time (Katz & Byrne, 2013) and therefore process the information more thoroughly (Fujita, 2008). Second, if the information is at the level of construal that is congruent with one's mental representations, the individual may process information more fluently, which leads to a sense of *feeling right.* Then, they may misattribute their feeling right experience to the focal behavior, so that they are likely to favor the behavior (Aaker & Lee, 2006). Third, when a construal fit leads to enhanced fluency or ease of understanding meanings (Aaker & Lee, 2006; Lee & Aaker, 2004), perceptions of ease of processing could translate into perceptions of ease of engaging in the behavior, resulting in greater self-efficacy and motivation and behaviors that are more positive (White, MacDonnell, & Dahl, 2011).

Construal congruency could occur at the different parameters (e.g., individual's construal level orientation, construal level perception of choice, psychological distance to choice, and message intervention: Katz & Byrne, 2013; message topic, design, and individuals' processing styles: Lee, 2019), and through various ways (e.g., why/how topics: Kim et al., 2009; White et al., 2011; gain/loss framing: Pounders, Lee, & Mackert, 2015; promotion/prevention focus: Lee, Keller, & Sternthal, 2009; positive/negative mood frames: Bless & Burger, 2017; interdependent/independent self-view: Spassova & Lee, 2013). These studies explain how perception differs by time, serving a conceptual basis of temporal motivation and its design space in this thesis. However, their investigations focus on a single dimensional perception, such as mental representation, prediction, preference, or evaluation of targets (see Table 2), rather than motivation, which I elaborate upon in the following section.

2.1.2.3 Limitations of Construal Level Theory for Temporal Motivation

In my exploration, I found a few limitations of CLT concerning its use as a lens to understand temporal motivation and its application to theoretical prepositions in practice.

First, there is a lack of understanding on how CLT could account for and be leveraged for influencing temporal motivation. It remains unclear whether or how matching the construal fit could be applied in practices such as technology or service design. Many prior studies used stylized interventions with limited contextual information (e.g., word completion task: Lee, Keller, & Sternthal, 2009; generation certain ideas for the given topic by answering the guiding questions: Henderson & Trope, 2009), which limits the ability of designers and practitioners to use CLT for their work. How might the idea of construal fit work on social media? What design features could and should be used for tailoring strategies, and what would they look like? Indeed, design guidelines that are clearer and more practical could be helpful.

Second, CLT has been developed only based on temporal distance (Trope & Lieberman, 2003), and related research mainly focuses on construal activated by temporal distances from targets. Beyond temporal distance, however, there is a wide range of various dimensions of time (Lee & Liebenau, 2000; Schriber, 1986), and opportunities remain to expand the theoretical premise of CLT to other dimensions of time, which I detail more next.

2.2 Dimensions of Time

Time could be categorized in various ways. Zerubavel (1981) delineated four dimensions of the temporal profile of any situation: sequence, duration, temporal location, and recurrence; Schriber & Gutek (1987) conceptualized 14 different dimensions of time including sequence, allocation,

schedule, pace, deadline, punctuality, temporal buffers, autonomy, time boundaries, synchronization, routinization, temporal buffers, awareness of time as a resource, and future orientation; Lee and Liebenau (2000) defined six dimensions of temporality in the business context: duration, temporal location, sequence, deadline, cycle, and rhythm. Of these various dimensions of temporality, in my thesis, I focused on the three dimensions that are most common: distance (or temporal location or scheduling), duration (or allocation), and (uncertain) deadline. In this section, I review prior work focusing on these three dimensions of temporality.

2.2.1 Temporal Distance from a Target

One of the important temporal aspects of a target is temporal location (Zerubavel, 1981; Lee & Liebenau, 2000) or scheduling (Schriber & Gutek, 1987), which are both concerned with when situations and events take place (e.g., at 10:00 a.m. for a meeting; Zerubavel, 1981; Lee and Liebenau, 2000; Schriber& Gutek, 1987). Temporal location allows for the possibility of prediction and the resolution of temporal uncertainty (McGrath & Rotchford, 1983). Locating an event at a specific point over the continuum of time serves as the basis of scheduling by which activities or events are prearranged at particular points in time. Temporal locations of target events or activities are often socially standardized (e.g., local television news is routinely scheduled for 6 p.m.; Zerubavel, 1981). Planning for the future helps one to manage time effectively, be involved in activities that would have otherwise been left out, and allocate involvements in the various domains of life in desirable proportions (Zerubavel, 1981). People are capable of locating an event at a particular point over the continuum of time beyond just the present moment as they traverse the temporal distance from the past to the future (Trope & Liberman, 2003).

The more the temporal location of the target event or activity becomes separated from the perceiver's present time, the more one's temporal distance from the target increases (Trope & Liberman, 2010). Various theories explained how people differ their perception as their distance from temporal location changes. For example, time discounting research, which investigates differences in the relative valuation placed on rewards (usually money or goods) at different points in time by comparing its valuation at an earlier date with one for a later date (Frederick et al., 2002), shows that present rewards are weighted more heavily than future ones. Once rewards are very distant in time, they cease to be valuable due to the consideration of time required while waiting for the reward. Research on the planning fallacy has shown that people generally tend to be positive about the future (Mitchell et al., 1997) and overcommit to events in the future (Buehler, Griffin, & Ross, 1994), as they underestimate the time needed with an optimism bias (Tversky & Kahneman, 1979).

Studies related to CLT explore how temporal distance from a target affects the way people perceive a certain object or event, providing insights for a tailoring strategy with consideration of temporal distance. Temporal distance is known to influence people's perception, preference, and evaluation of future events by changing the way they construe these events (Trope & Liberman, 2003; see Table 2). However, how would the changed perception affect one's motivation and, hence, behavior as time goes by? How might we use temporal motivation? No studies have explored how the temporal dynamics of perception affects one's motivation toward planned activities or events or how temporal motivation by distance could be utilized in technology design. Understanding the factors that drive temporal motivation would provide insights to tailor designs considering temporal distance. Thus, in my thesis, I first explore temporal motivation focusing on distance in Chapter 3.

2.2.2 Duration of a Target

In general, duration may refer to the amount of time, whether planned or expended, devoted to a task or activity (Lee & Liebenau, 2000) or how long events or situations last (Prasopoulou, Pouloudi, & Panteli, 2006). In my thesis, duration of a target is defined as the amount of time to complete a target task or goal.

Duration is primarily concerned with the amount of time based on a conventional standard of time measurement (e.g., hours or days; Duncheon & Tierney, 2013). For this reason, duration is often used to measure the levels of experiences or engagement in technology (Lee & Liebenau, 2000). Researchers also noted the socially constructed concept of duration beyond just the total amount of time spent. For example, Zerubavel (1981) remarked that numerous events in social life have a relatively fixed duration on a regular basis: the duration of activities, such as working hours (8 hours), tea time (20 minutes), or classes at school (50 minutes), are socially conventional, which explains the primacy of timetables and schedules in our society (Lee & Liebenau, 2000). Duration is also closely related to social norms (Zerubavel, 1981). For example, we have a fairly well defined idea of what the "proper" durations of events are, when is "too early" to leave, or how long is "too long" to stay at a place.

Regarding motivation, duration is often discussed in the context of goal-setting (Locke & Latham, 1990). Goals, referring to the object or aim of an action, for example, to attain a specific standard or proficiency, usually within a specified time limit (Locke & Latham, 1990), are an integral part of behavior change as they guide one's focus and help sustain momentum (Locke & Latham, 1990). Duration serves as a tool of time control in the pursuit of goals—people are more likely to achieve a goal when it is short-term rather than long-term because long-term goals are too abstract or distant in time to have much effect on action and possess little motivational power

in the present. Studies suggest that short-term goals are important as they mobilize effort and direct what one does in the present and they foster self-motivation in achieving future goals like stepping stones toward the destination (Bandura & Simon, 1977; Locke, Cartledge, & Knerr, 1970). Studies on goal-setting theory often consider short-term goals as a means of attaining long-range goals (Bandura & Simon, 1977; Locke, Cartledge, & Knerr, 1970). For example, if one's goal is to lose 10 pounds, they may set a goal to lose 1 pound a week over 10 weeks. This notion inspired technology design (e.g., Fitbit) so that systems tend to focus on the smaller and shorter-term goals (e.g., daily goals) in supporting long-term behavior change (e.g., increasing physical movement).

How, then, might the duration of goals affect motivation? From the perspective of CLT (Trope & Lieberman, 2003), it might be plausible to assume that people may activate their high-level construal when thinking about their long-term goals because the moment of goal achievement is likely to be temporally far, whereas they may activate low-level construal for short-term goals as the end-dates are more imminent. If this is true, it may also mean that we could better support people's goal-related behaviors by providing interventions that are congruent to the salient level of individuals' construal. However, no study has examined whether or how the theoretical premise of CLT might be applicable to duration, beyond temporal distance, in the context of behavioral goals. If we understand how duration plays a role in people's motivation, we could provide better support tailored to their different goals with varying durations. To understand temporal motivation with regards to the duration, I took an exploratory approach in the context of personal finance goals, which I discuss in Chapter 4.

2.2.3 Uncertain Deadlines for a Target

Deadlines refer to a certain moment in time when tasks or events are required to be completed (Lee & Liebenau, 2000). Deadlines are known to increase productivity by helping one pace effort to complete tasks (Kim, Nembhard, & Kim, 2016) and by encouraging one to manage time efficiently by creating time pressure (a fixed time limit marking an end to some endeavor; Höffler & Schwartz, 2011). Researchers have observed how people change their behavior before a deadline—when ample time is allowed (when a deadline is in the far future), people are likely to delay their pace as they generally discount future outcomes and then pick up their pace as the deadline approaches (Bluedorn & Denhardt, 1988; Fried, Slowik, & Slowik, 2004), which is often labeled as 'deadline rush' (König & Kleinmann, 2005). Other work utilized the concept of deadlines to increase external motivations in various domains. Many systems, including *Houston* (Consolvo, Mcdonald, & Landay, 2009), *UbiFit* (Consolvo et al., 2008), and *GoalPost* (Munson & Consolvo, 2012), encourage users to increase their physical activities by having them set daily or weekly deadlines (goals). The time-bounded property of SMART goals (T in SMART) also serves as a deadline to nudge people to work toward the end-date sooner rather than later (Bovend'Eerdt, Botell, & Wade, 2009), such as for increasing academic performance (Lawlor, 2012) or diabetic patients' self-management skills for chronic symptoms (Swanson, 2016). Overall, work on deadlines often focused on its existence or the importance of meeting it as part of attitude or behavior change (Lee & Liebenau, 2000).

It is important to note that not every task is eligible to set a particular deadline—sometimes, practitioners or designers need to promote tasks without fixed time limits of outcome or rewards (e.g., getting a flu shot, purchasing fire insurance, recycling) or to increase engagement with objects for which an occurrence is unknown (e.g., climate change). Tasks with uncertain deadlines have no specific time when they should be completed by or when the

engagement would happen. In contrast to the deadline effect (Konig & Kleinmann, 2005), if plenty of time remains for attaining the goal or completing the tasks (a longer deadline) people tend to infer that the task is more difficult (Zhu, Bagchi, & Hock, 2019) and slow down their pace to fill the available time (Lunenburg, 2011). Furthermore, the lack of a deadline is known to lower productivity (Locke & Latham, 1984). These collectively indicate the challenges faced when promoting a task without a fixed deadline, which raises the question of what strategy might be useful for these cases.

Another example of tasks with uncertain deadlines might be a contingency plan for high-impact, low-probability events (Lee, Preston, & Green, 2012), so-called *disaster preparedness*. Disaster preparedness refers to a course of action designed to help individuals or organizations respond effectively to a significant situation that may or may not happen in the future (Anson, Watson, Wadhwa, & Metz, 2017), such as fires, earthquakes, floods, and hurricanes. When disaster events might occur is unknown and (depending on the area) is likely to be perceived as low risk. Consequently, individuals are less likely to act upon the preparatory tasks (Anson et al., 2017) because the time by which the tasks are needed to be completed is unfixed (Meyer & Kunreuther, 2017). This leads to the question of how we might better help promote disaster preparedness. What kinds of approaches are needed to increase motivation when it is challenging to set a clear deadline? Considering the fact that the levels of disaster preparedness remain very low despite various efforts that are made to promote and support disaster preparedness (Meyer & Kunreuther, 2017; Verrucci, et al., 2016), it is critical to understand how we might increase the level of disaster preparedness. Individual preparedness behaviors often have positive spillover effects for the larger community in addition to personal benefits to the individual (Linnemayr, O'Hanlon, Uscher-Pines, Van Abel, & Nelson, 2016); therefore, encouraging preparedness

behaviors is important for both individual and public health. However, a lack of understanding remains regarding how to promote tasks without such a deadline, leaving me with a pertinent question: How can we address temporal motivation when there is no fixed deadline? This question will be addressed in Chapter 5.

2.2.4 The Opportunities for Research

To summarize, through a literature review, I found gaps in our current understandings on temporal motivation with regards to three different dimensions of time: distance, duration, and uncertainty. Considering these limitations as an opportunity, in my dissertation, I aim to expand our knowledge on temporal motivation by using CLT as theoretical background and by translating its theoretical premises into tailored design.

CLT helped me approach time-based tailoring strategies in the three different ways. First, it helped identify which factor may be more influential to motivation depending on temporal distance, allowing me to understand the underlying mechanism of temporal motivation (Chapter 3). Second, it implied the rich contexts around goals with different durations, leading me to examine how duration affects goal-related behaviors (Chapter 4). Third, it helped better understand in what ways people could be nudged to act upon desired tasks when an object is uncertain and when the task needs to be completed by (deadline) is unfixed (Chapter 5).

CHAPTER 3. TEMPORAL DISTANCE FROM EVENTS ON SOCIAL MEDIA

To address my first research question *(RQ1: Whether and how can temporal distance be utilized as tailoring strategy?),* I conducted two studies - Study 1 aimed to understand how people change their motivation over time, and what factor is the most influential to form intention to perform the planned behavior through a set of field (Study 1a) and online (Study 1b) experiments. Building on Study 1, Study 2 aimed to examine the effect of three different temporal distance-based strategies through a series of online experiments (Study 2a, 2b, 2c).

In this chapter, I first discuss the study background of events on social media, and then present the two studies (Study 1, Study 2) that I examined the effect of temporal distance on motivation under the context of events on social media. These enabled me to understand what drives the dynamics of motivation by temporal distance, to translate the findings into the design artifacts and to test them in informing the design guidelines for technology design.

3.1 Events on Social Media

Social media such as Facebook and Meetup is increasingly important in event planning, helping organizers plan and promote their private (e.g. movie night) or public (e.g. conferences), online (e.g. yoga webinars) or offline (e.g. dining out) events. They also help potential participants navigate various social events (e.g. aggregated lists of events), interact with others (e.g. sharing comments and photos) and express their intentions to join the events (e.g. RSVP). Social media connects event organizers and participants, helping organizers to host successful events.

To make events on social media successful, it is important for the organizer to increase event engagement. First, it helps attract generate interest in the event from potential participants, and encourages more RSVPs or actual attendees at events, which is a common indicator as to the

success of an event. It may help with the promotion of the event by reaching larger audiences on social media, resulting in the broader impact of publicizing it (Heldman, Schindelar, & Weaver, 2013). It may also benefit event organizers by strengthening their reputation, as well as social media platform itself, by sustaining the number of active users, which is important to the health of social media and collaborative systems (Ehrlich, 1987; Grudin, 1988).

A body of research explored how to increase event engagement (Macedo, Grande, & Grande, 2015; Qiao et al., 2014) or how to predict ones' preference toward events, which also eventually increase event engagement. For example, Zhao, Liu, & Crespi (2012)) found that event content (e.g. title, descriptions), time (e.g. day of the week), location, and one's social connections (e.g. followers), as well as prior experiences of the events affect one's preference of which events to attend. Similarly, Huang, Wang, & Yuan (2014)found that event participation is shaped by one's social perceptions of the event's nature (e.g. public or private), their relationships with others (e.g. the strength of their connections to other invitees), and the medium used to communicate event information (e.g. a targeted invitation via email or spam communication via a Facebook page). Lu, Farzan, & Lopez (2017) found that reducing uncertainty about the event and increasing the sense of inclusiveness to the community are key for newcomers to decide on what to attend.

However, there remains one key design dimension that prior work has overlooked in order to enhance users' preference and hence their event engagement—temporal distance from the event. While a body of research in economics and psychology (Frederick et al., 2002; Steel & König, 2006; Trope & Liberman, 2010) suggests that temporal distance from the event may play an important role in one's decision to participate in the event, no prior work has yet explored how to utilize intertemporal dynamics in technology design, especially in the context of

promoting an event on social media. Thus, I focused on temporal distance of social events to explore different design strategies for increasing event engagement on social media.

There are several reasons why I chose events on social media as the study context. First, events on social media is where temporal distance may present multiple challenges. For example, event organizers or designers may want to promote the event starting tomorrow or the online course starting one month after their registration, which they need to promote the event at the different time frame. However, a number of systems exist to be designed and examined to encourage users' immediate engagement and behaviors, rather than later ones (Fogg, 2003). Studies focusing on immediate behaviors also often note that their findings become less applicable for more distant behaviors (Conner, Sheeran, Norman, & Armitage, 2000). Furthermore, even though someone says they will participate in the future, they will not necessarily do so. People's intention changes with time— they can all recount times when they said they would do something, but decided against it when the time came. These challenges also indicate the potential for temporal-distance-based strategy on social media event platforms, however, no studies examined how to tailor design for temporal distance. Lastly, studies on CLT often explored how people changes their perception on the event-type activities depending on temporal distance (e.g., A guest lecture; Liberman and Trope, 2008), which my work could solidly build upon and extend by exploring temporal motivation in-depth. I wanted to provide the evidence-based design strategies for increasing motivation depending on temporal distance.

3.2 Study 1: Understanding Motivation Changed by Distance

As discussed, studies with CLT inform me how temporal distance affects one's perception (e.g., attitude or evaluation toward an object). However, there is a lack of understanding of how

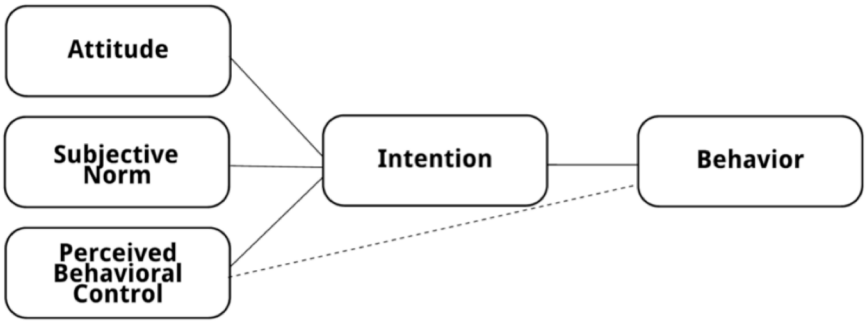


Figure 1. The Model of Theory of Planned Behavior

temporal distance affects one's motivation, and what factors are most influential to the dynamics of temporality. How can we understand temporal 'motivation'?

Theory of planned behavior (TPB) (Ajzen, 1991) provides a systematic way of understanding how one's motivation as time goes by. TPB is one of the most well-known theories that explain and predict people's behavior and has been used to identify and understand what factors influence people's planned behavior such as pro-environmental behaviors (Thieme et al., 2012), physical activity (Chatzisarantis & Hagger, 2005), smoking (Barta & Stacy, 2005), and drunk drive (Stead, Tagg, MacKintosh, & Eadie, 2005). TPB proposes that behavior can best be predicted from a person's behavioral intention (Ajzen, 1991). Behavioral intention (BI) is an indicator of how hard people are willing to try and how much effort they plan to exert toward performing a behavior (Netemeyer, Ryn, & Ajzen, 1991). The theory also posits that intention is a function of three variables: Attitude (AT: the degree to which a person has a favorable or unfavorable evaluation or appraisal of the behavior in question), Subjective Norms (SN: the perceived social pressure to perform or not to perform the behavior.), and Perceived Behavioral Control (PBC: the perceived ease or difficulty of performing the behavior) (Ajzen, 1991). As a general rule, the more favorable the attitude and subjective norm, and the greater the perceived control, the stronger the person's intention to perform a behavior should be. Therefore, the

greater the individual's intention, the more likely they will be to perform a behavior (Conner, Sheeran, Norman, and Armitage. 2000). However, TPB does not explain in what ways intention changes as time goes by. TPB has not been extended to factor in temporal distances and its predictive power of the theory is significantly reduced when used to model far future behaviors (Conner, Sheeran, Norman, and Armitage, 2000).

Applying CLT into TPB could be one way to systematically understand how temporal distance affects one's intention beyond perception, and what factors are most influential to the difference. The construal levels, instigated by temporal distances, have been used to explain the actions people prefer as time changes (Trope & Lieberman, 2003). As previously discussed in the Chapter 2, when thinking about the distant future, people prefer highly desirable behavior as they focus more on the goal of the behavior and less on how to achieve it. On the other hand, when thinking about the near future, people prefer more feasible behaviors even though it might be less desirable because they concern themselves more with the means to reach the goal (Liberman & Trope. 1998). Trope & Liberman attribute this tendency to two main reasons (Trope and Liberman. 2003). First, people are less likely to have low-level contextual information (e.g., time or places) for behaviors in the further future. Second, people are often not motivated to consider specific, "how" aspects of the situation in which a behavior is to be performed until they get closer in time to that situation. Thus, CLT can explain why and how

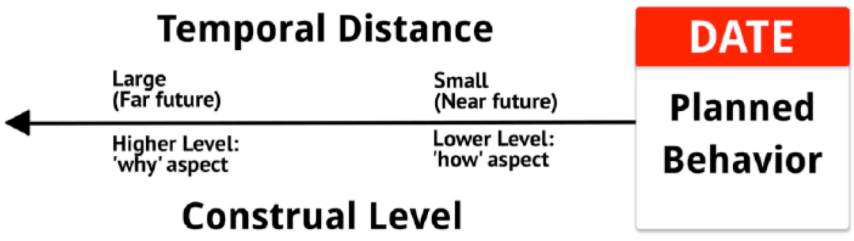


Figure 2. Temporal Distance from Events

people's intention changes as temporal distance to target behavior decreases. When further away (temporally), desirability (the valence of an action's result) may be driving intention and when closer, feasibility (the ease or difficulty of reaching the result) may be driving intention (Trope and Liberman. 2003).

This could mean that when applying CLT into TPB, AT may be closely associated with desirability, and PBC with feasibility. For example, Rosenberg (1956) has stated that attitude is associated to important values of the behavior, and is linked to positive versus negative outcomes. On the other hand, PBC in TPB may be more related with feasibility in CLT as Holbrook (1978) who considered perceived importance and/or desirability of objects as a cognitive elements of attitude. In fact, feasibility is often operationalized and measured as self-efficacy (Dissanayake, 2014; Fitzsimmons & Douglas, 2011), which is one of the main components of PBC in TPB (Ajzen, 1991).

Recent study by Lutchyn & Yzer (2011) also noted the possible relationship between TPB and CLT. They posit that AT (behavioral belief) and SN (normative belief) are linked to desirability, and PBC (control belief) is linked to feasibility. They examined how temporal perspectives affect types of salient beliefs. They asked participants to generate thoughts about behaviors (eating fruits and vegetables, condom usage) within various time frames. They found that individuals have more beliefs related to feasibility of the behavior in the near future, but more thoughts related to desirability of the behavior in the distal future (Lutchyn & Yzer, 2011). Therefore, to build on this idea of connecting TPB with CLT, I conducted two studies to explore how different temporal distances affect peoples' intention to perform behaviors, using TPB factors. First, to replicate results from Lutchyn & Yzer (2011) using TPB concepts, I examine how temporal distance is associated with the amount of a certain type of thoughts.

Specifically, I expected people to have more thoughts related to AT in the further future, but more thoughts related to PBC in the near future. I hypothesized:

- H1: People will produce more attitude beliefs when considering behaviors in far future than when considering behaviors in the near future.
- H2: People will produce more perceived behavior control beliefs when considering behaviors in near future than when considering behaviors in the far future.

Assuming perception affects and forms motivation (Ajzen, 1991), CLT can explain why and how people's intention changes as temporal distance to the target behavior decreases. When further away (temporarily), AT (desirability: the valence of an action's result) may be driving intention and when closer, PBC (feasibility: the ease or difficulty of reaching the result) may be driving intention. My additional hypotheses are:

- H3: AT is a stronger predictor of motivation in the far future than in the near future.
- H4: PBC is a stronger predictor of motivation in the near future than in the far future.

3.2.1 Study 1a: What Drives Motivation by Temporal Distance

To understand which factor is influential to temporal motivation, I tested the hypotheses through a field experiment, which helped examine the effect of temporal distance on motivation in the naturalistic setting, and increase the external validity of the study results.

3.2.1.1 Method

I invited participants to attend a free drop-in yoga class that I had set up for the study. Once participants expressed interest in participating in the study, they received information about the free drop-in yoga class, which was planned a month away (the far future condition), and were asked to report on their intentions to attend the yoga class. They were paid $5 for completing

each survey. 45 participants signed up for the study. 38 completed the first survey and out of those, 30 completed the second survey. Responses from the 30 participants who completed both surveys was used for our analysis. 80% of my participants were female (n=24), and participants' mean age was 24.87 (*SD*=6.85)

As a within-subject study (n=30), both questionnaires in the far and near future conditions were the same. The survey included three subsets: 1) a open-ended question, "why or why not are you willing to attend the yoga class?" 2) TPB measurements and 3) demographic questions. TPB measurements included BI, AT, SN, and PBC, all based on (Ajzen, 1991). BI was measured with 2 items: 1) I intend to participate in the yoga class; 2) I plan to participate in the yoga class. AT was measured with the following 4 items: For me, participating in the yoga class would be...1) bad-good; 2) useless-useful; 3) unpleasant-pleasant; 4) unenjoyable-enjoyable. SN was measured with 4 items: 1) People who are important to me would approve of my participating in the yoga class; 2) Most people who are close to me would think it is a good idea for me to attend the yoga class; 3) People close to me may think I should participate in the yoga class if they know about it; 4) People I care about would encourage me to attend yoga class. PBC was measured with 4 items: 1) I think I have personal control over participating in the yoga class; 2) It is up to me whether I attend the yoga class or not; 3) If I want, I could easily attend the yoga class; 4) I am confident I could attend the yoga class, if I wanted to. The reliability scale showed our measurements are reliable (Cronbach's α = .95(BI), .93(AT), .92(SN) and .63(PBC)[2].

[2] If Cronbach's α is larger than .60, the measurement is generally regarded as internally consistent

To test my hypotheses that different temporal distance affects the type of thoughts about the behavior (**H1** and **H2**), a researcher and I separately coded the open-ended responses following the definitions of TPB as coding scheme:

- AT: The degree to which a person has a favorable or unfavorable evaluation or appraisal of the behavior in question (e.g., *"I love yoga for strengthening and stretching my muscles!")*
- PBC: The perceived ease or difficulty of performing the behavior (e.g., *"It's free and on campus."*)

Then, we compared what we coded (the agreement rate was 87%), and resolved the discrepancies with a discussion. Once the qualitative coding was finalized, they were converted into quantitative data, using numerical values to statistically test the difference between the far and near future. Each thought was given a numeric value of "+1", and summed up as the total values of each category (AT, PBC). Following (Lutchyn & Yzer, 2011), each unique thought was considered as one unit. For example, the response "Yoga is a good way to de-stress. It is challenging yet fun. It's a good form of physical activity.", was regarded as "3" as the response contains three separate evaluations of performing the behavior: 2 of instrumental attitude (psychological and physical benefit) and 1 of affective attitude (fun). All were related to AT. So this participant had (AT: 3, PBC: 0).

To compare the number of thoughts (AT, PBC) between the far and the near future (**H1**, **H2**), a paired t-test was conducted by comparing the mean number of thoughts per person in two time frames. To compare the strengths of AT and PBC on behavior intention (**H3, H4)**, I used logistic regression. This is because BI in 7-scales was not normally distributed (u-shaped); I dichotomized it into the lower (BI<4) and the higher (BI>=4) intentions. Independent variables

were the TPB constructs (AT, SN, and PBC). As Post Hoc, I built another logistic regression models (Model 2), adding the interaction term of AT and PBC into Model 1.

3.2.1.2 Results

I present the analyses of the results. In sum, H1, H2 were supported, not H3 nor H4.

3.2.1.2.1 Thoughts About the Target at Different Time Frames

To examine H1 and H2, I counted the number of thought that is related to each TPB construct per person, and examines the difference between the far and near future. The descriptive statistics show that total 97 thoughts were generated (the far future: 53, the near future: 44). The average number of thoughts generated per person was 2 (the far future) and 1.53 (the near future). Results of the paired-samples t-test (Table 3) show that the mean of thoughts related to AT differs a month before the event (M=1.6, SD=1.00) and a few days before the event (M=.9, SD=1.06) at the .01 level of significance ($t(29)$=3.00, p<.01). PBC also differs a month before the event (M=.3, SD=.61) and a few days before the event (M=.6, SD=.50) at the .05 level of significance ($t(29)$=-2.07, p<.05). The results indicate that people have more thoughts related to AT in the far future, compare to the near future; and people have more thoughts related to PBC in the near future, compared to the far future. Both H1 and H2 were supported.

Thoughts related to	Far Future	Near Future	Far Future - Near Future (Difference)
Attitude	1.6	.9	.7 **
Perceived Behavioral Control	.3	.6	-.3 *

*p < .05, **p < .01, ***p < .001

Table 3. The Number of Thoughts Related to the TPB Variables per Person

3.2.1.2.2 Salience of TPB Constructs at Different Time Frames

I hypothesized that AT is a stronger predictor of behavior intention in the far future than in the near future (H3) while PBC is a stronger predictor of behavior intention in the near future than in the far future (H4). To do so, I analyzed the prediction of intention at the two time frames separately. Logistic regression models were statistically significant for both time frames (the far future: $\chi^2(3)= 13.52$, $p<.01$; the near future: $\chi^2(3)= 10.90$, $p<.05$). TPB constructs explained 86.7% of intention (Nagelkerke $R^2=.57$) in the far future, and, they explained 73.3% of intention (Nagelkerke $R^2=.42$) in the near future (Model 1 in Table 4).

Examining the coefficients of AT and PBC suggests that H3 was supported (Model 1 in Table 4). AT negatively predicts BI for the planned behavior in the far future (β=-1.37, odd ratio=.26, p=.08); but its statistical significance drops in the near future (β=.24, odd ratio=1.27, p=.66). It indicates that attitude strongly predicts intention to perform the behavior in the further future, but its predictive power gets much weaker in the near future. On the other hand, H4 was not supported. For the behavior in the far future, PBC predicts BI 3.01 times more than other constructs (AT, SN) in the far future (β=1.10, odd ratio=3.01, p=.07). However, it is not much different from PBC in the near future (β= 1.15, odd ratio=3.17, $p<.05$), indicating that PBC predicts BI 3.17 times more than other constructs (AT, SN) in the near future.

	Model 1						**Model 2** (with an interaction term of AT and PBC)					
	Far Future			**Near Future**			**Far Future**			**Near Future**		
	B	*S.E.*	*Exp(B)*	*B*	*S.E.*	*Exp(B)*	*B*	*S.E.*	*Exp(B)*	*B*	*S.E.*	*Exp(B)*
AT	-1.37†	.77	.26	.24	.54	1.27	5.83	4.26	339.02	-3.10	2.25	.05
SN	1.84†	1.00	6.28	.98	.63	2.66	2.35	1.63	10.45	1.33	.82	3.77
PBC	1.10†	.60	3.01	**1.15***	.54	3.17	**11.55**†	6.62	10373.78	-2.52	2.42	.08
AT by PBC							**-1.61**†	.98	.20	.67	.46	1.96
Model χ^2	13.52 (df=3, p<.01)			10.90 (df=3, p<.05)			17.41 (df=4, p<.01)			13.00 (df=4, n.s.)		
Nagelkerke R^2	.57			.42			.70			.46		
Model Accuracy	86.7			73.3			93.3			70.0		

† $p<.1$, *$p < .05$., n.s.=not significant

Table 4. Logistic Regression on Behavioral Intention to Participate in the Yoga Class

However, while H3 seemed to be supported, one concern arose that AT negatively predicts an intention to perform the behavior in the far future, which is contrary to the body of prior work that suggests a positive relation between AT and intention. This led us to further explore on the result of the qualitative study to understand what may have caused this. Connecting these ratings with the belief responses, I found that people who hold the most positive attitude towards participating in the yoga class (AT >6) in far future), actually described more feasibility-related issues. And they are also likely to give a low intention rating (Table 5). For example, one participant (AT= 6.5, BI = 1) wrote: "I have a meeting 3-5 on Friday. That sounds cool and otherwise I would like to do it, though!". Another participant (AT = 7, BI = 1) wrote: "I will be out of town on that date. I would love to attend a free class on a different date."

Reading these results suggested that there may be a possible interaction between AT and PBC. Those with higher AT are perhaps more likely to factor in PBC in their assessment of BI. Thus, I tested a version of the model with the interaction terms included (Model 2 in Table 4). For the far future, there was a significant interaction effect between PBC and AT in (β=-1.61, odd ratio=.20, p=.10); the Omnibus Tests of Model Coefficients showed that including the interaction term improved the model (Δ^2 =3.9, p<.05). Graphing the relationships between PBC, AT and BI by grouping participants into higher AT (AT>6.00) and lower AT groups confirmed

Attitude	Reasons
7	Time conflict.
7	I've never taken an actual yoga class. I'd love to experience it. I've heard great things about yoga.
7	Yoga is good exercise and relaxing.
7	I have work then.
7	I will not be a student on campus this spring.
6.8	I want to begin attending classes at the IMA
6.8	I am always trying to incorporate more yoga into my fitness routine because I find it to be an important and satisfying way to work out I usually just end up going for a run instead.
6.8	Get to experience a different teacher and potentially a different style of yoga

Table 5. Thoughts of People with More Positive Attitude toward Events in Far in Advance

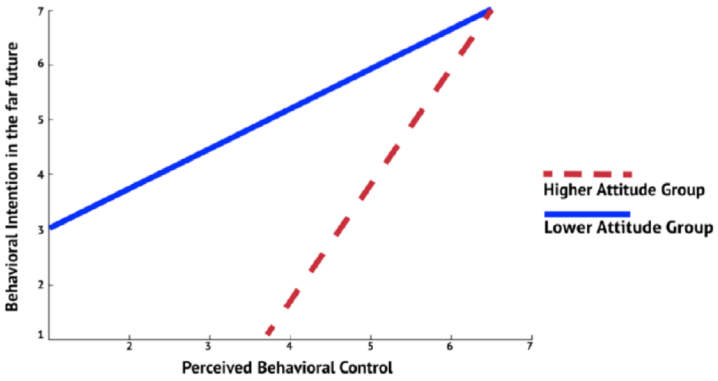


Figure 3. The Interaction Effect between Attitude and Perceived Behavioral Control

that indeed those with higher AT are more likely to factor in PBC in their judgement of BI (Figure 3). If their rated PBC is low, they are significantly less likely to say they will attend. On the other hand, for the near future, including the interaction effect did not improve the model fit significantly (Δ^2= 2.11, p=.15).

In Study 1a, I found that people's focus on their attitudes towards a behavior decreases as temporal distance to the behavior decreases, while their focus on perceived behavior control increases. This change in salience of belief affects their judgements on motivation.

The effects on AT and PBC on behavior, however, is more nuanced than I had hypothesized. I had expected that AT to have a stronger influence in the far future and PBC to have a stronger influence in the near future, as people transition from the why (high level construal) to the how (low level construal). However, what I found is that there is an interaction effect. In the near future, PBC is a significant predictor of intention as people focus on the *how* of behaviors. But in the far future, PBC may not be completely ignored and AT itself may not be the dominant factor. Those who hold higher positive attitudes toward the behavior seemed to be also considering PBC in their judgements of motivation.

This finding does not necessarily contradict CLT. As discussed earlier, Trope & Lieberman (2003) explained that the levels of CLT change due to people being less likely to have the motivation to be informed about the situational context of the far future. They also postulate that high-level construal consists of general, superordinate, and essential features of events, compared to low-level construal. The low-level construal related aspects are dependent on the change of the high-level construal related considerations, whereas the inverse relationship might not be the case (Liberman, Sagristano, & Trope, 2002), creating a hierarchical relationship. It could explain that when a person has higher positive attitudes (high-level construal activated), they might be able to activate lower-level construal as well (PBC), subordinated to AT. The finding is also explainable by research on dual-process models (Barta & Stacy, 2005; Fishbein, Triandis, Kanfer, Becker, & Middlestadt, 2001; Parker, Stradling, & Manstead, 1996), which suggests that there are two types of information processing: systematic (central) vs. heuristic (peripheral) process. The former is more detailed and elaborate, which is effortful, whereas the latter uses simple rules and heuristics and uses less deliberation. Findings have shown that when a person is motivated to think about an object, he or she tends to process information more systematically and logically, to elaborate on the message, to estimate the missing details, and therefore to eventually predict the future more accurately. Those who hold stronger AT toward the behavior may be more intrinsically interested in the behavior—and are thus more motivated to consider the planned behavior. Thus an alternative hypothesis to our H5 would be:

H5. In the far future, PBC would predict behavior intention more strongly for those who report high AT.

3.2.2 Study 1b: How Temporal Motivation is Nuanced

Building on Study 1a, I conducted additional online experiment to study how temporal motivation might be nuanced, as I observed the interaction effect between AT and PBC. Study 1b examined H5 and replicated the findings of Study 1a (H1 and H2) in the broader context. Using this opportunity, I also expanded on the generalizability of this work by studying three different behavioral contexts instead of one**:** eating five servings of fruits and vegetables (health), going camping (recreation), donating to a thrift store (donation).

There are a couple of key differences between Study 1a and Study 1b that I want to clarify. First, unlike Study 1a where participants were invited to and could attend a real yoga event, Study1b asked about hypothetical future behaviors. This was to enable us to study a wide range of behavior which was harder for us to coordinate (e.g., eating fruits and vegetables) for experimental research. Also, I used a between-subjects design to minimize problems associated with participant dropout (In Study 1a, 8 out of 38 participants dropped out in between two surveys of Study 1a). I also tested three different time frames (tomorrow, a week from now, a month from now). Thus there were 9 conditions (3 behaviors x 3 time frames).

3.2.2.1 Method

Participants were recruited from Amazon's Mechanical Turk (AMT). They received $1 for their participation. Workers were restricted to those residing in the US to ensure their basic English proficiency. 457 participants completed the questionnaire, titled "Survey about Intention to Perform an Action." Our manipulation check showed that 34 participants were unable to recall the time frame and behavior they were assigned; they were removed from our analyses. In total, I included the remaining 423 participants (233 males, 189 females, 1 other), who ranged in age

from 19 to 68 years (*M*= 33.89 years, *SD*=10.9). The questionnaire used was similar to the one used in Study 1a, but slightly modified for the different conditions of Study 1b (Appendix). Again, the questions have three subsets: 1) thoughts toward behavior performance in a certain time frame with an open-ended prompt, "Please generate any positive or negative thoughts of performing the given behavior"; 2) TPB questionnaires (BI, AT, SN, and PBC); and 3) demographic questions. All questionnaires were internally consistent (Cronbach's α: BI=.98, AT=.91, SN=.77, and PBC=.83). Following the same coding scheme used in Study 1a, a researcher and I coded the responses separately. Then, we compared the results (the agreement rate was 90%), and resolved the discrepancy with a discussion. Similar logistic regression models used in Study 1a were used here to study the effects of AT, SN and PBC on BI. Interaction between AT and PBC was included to test H5. As a control, I included the type of behavior: health, donation or recreation.

To test **H5**, I conducted a one-way analysis of variance to compare the difference in intention between time frames. While I had initially planned to compare the 3 time frames, I found that there was no significant difference between the groups of a week from now and a month from now in terms of intention (Tukey HSD test, mean difference = .05, p=.55). Thus I collapsed those cells together, and focused on the contrast between near future (tomorrow) and far future (a week to a month from now).

3.2.2.2 Results

I present the results of our analyses. Our hypotheses, H1, H2 and H5 were supported.

3.2.2.2.1 Thoughts about the Target at Different Time Frames

Thoughts related to	Far Future	Near Future	Far Future - Near Future (Difference)
Attitude	4.4	3.8	0.56**
Perceived Behavioral Control	1.2	1.7	-0.5***

*$p < .05$, **$p < .01$, ***$p < .001$.

Table 6. The Number of Thoughts Related to the TPB Variables per Person

The descriptive statistics show that total 2517 thoughts were generated (the far future: 1680, the near future: 837). The average number of thoughts generated per person was 5.98 (the far future) and 5.89 (the near future). Results of a one-way analysis of variance (Table 6) revealed that the mean of thoughts related to AT differs in the far future (M=4.4, SD=2.30) and in the near future (M=3.8, SD=2.20), and the difference between two time frames is statistically significant (F(2,422)=3.411, p<.05). PBC also differs in the far future (M=1.2, SD=1.33) and in the near future (M=1.7, SD=1.72), and the difference is statistically significant (F(2,420)= 6.51,p<.01). The result is same as Study 1. Both H1 and H2 were supported.

3.2.2.2.2 Salience of TPB Constructs at Different Time Frames

To test H5, I built two sets of logistic regression models: Model 1 is with TPB constructs, and Model 2 has an additional interaction term of AT and PBC in Model 1 (Table 7). Comparing the two sets of models, I found that in the far future, including the interaction term resulted in a better fit (Omnibus Test of Model Coefficients: $\Delta\chi^2$=3.92, p<.05). On the other hand, including the interaction term did not improve the model in the near future (Omnibus Test of Model Coefficients: $\Delta\chi^2$= 1.25, p=.27). These results are similar to what I found in study 1. Thus, I focus our interpretations of finding using the model with the interaction (Model 2) for the far future, while using the model without the interaction (Model 1) for the near future (although they

	Model 1						Model 2 (with an interaction term of AT and PBC)					
	Far future			Near future			Far future			Near future		
	B	*S.E.*	*Exp (B)*	*B*	*S.E.*	*Exp (B)*	*B*	*S.E.*	*Exp (B)*	*B*	*S.E.*	*Exp (B)*
AT	.36*	.17	1.44	.12	.28	1.12	-.92	.70	.40	-.53	.62	.59
SN	1.00***	.22	2.70	.73**	.28	2.07	.89***	.23	2.43	.65*	.29	1.92
PBC	.71***	.18	2.04	.62**	.24	1.86	-.76	.78	.47	-.29	.84	.75
Behavior (Health)	***			***			***			***		
Behavior (Donation)	2.21***	.60	9.12	2.47**	.91	11.81	2.28***	.62	9.75	2.49*	.93	12.04
Behavior (Camping)	.60	.59	1.81	-.60	1.01	.55	.64	.60	1.90	-.52	1.03	.60
AT by PBC							.27*	.14	1.31	.16	.14	1.17
Model χ^2	201.24 (df = 5, p<.001)			75.64 (df = 5, p<.001)			205.16 (df=6, p<.05)			76.89 (df = 6, n.s.)		
Nagelkerke R^2			.70			.62			.71			.63
Model Accuracy			85.1			88.7			86.1			89.4

*p < .05, **p < .01, ***p < .001., n.s.=not significant

Table 7. Logistic Regression on Behavioral Intention to Perform Behaviors

are presented in full in Table 7). In the far future, the factors explain 85.1% of intention to perform a behavior (Model 2: Nagelkerke R^2= .71) ; in the near future, the factors explain 88.7% of intention to perform a behavior (Model 1: Nagelkerke R^2= .62).

Supporting findings from study 1a, again I found that PBC is a significant positive predictor in the near future (B=.62, odd ratio=1.86, p<.01) Also that the interaction term was significant in the far future, supporting H5 (Figure 4 & Model 2 in Table 7). There was a significant interaction effect between PBC and AT in the far future (β=.27, odd ratio=1.31, p<.05), suggesting that PBC moderates the relation between AT and BI when a behavior is planned in the far future.

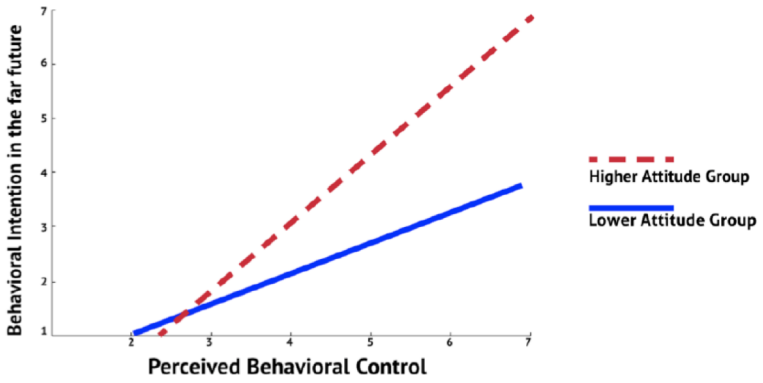


Figure 4. The Interaction Effect between Attitude and Perceived Behavioral Control

We should note that the two interaction graphs are slightly different. For Study 1a (Figure 3), BI is similar for participants at higher PBC and differs at lower PBC, whereas in study 1b (Figure 4), BI is similar for participants at low PBC and differs at high PBC. This suggests that making PBC more salient may have differing effects for those with high attitude—sometimes thinking about the details may reduce intention, other times improve intention. The specific differences I observed, may have been due to the different target activities or participant sample.

The findings informed in what ways people change their motivation as temporal distance from the goals/plans, providing the focal point of tailoring design strategies in consideration of temporal distance (RQ1). This enabled me to suggest design guidelines for behavior goals at different time frames, which were further examined in the next study (Study 1b).

3.2.3 Discussion

In Study 1, I sought to explore a simple, yet extremely important question: whether and how do the factors that influence behavior intention change as the temporal distance from the planned behavior changes. I found that indeed the salience of different factors that influence motivation (e.g., AT, PBC) changes, depending on time. As shown by the belief responses collected in both studies, the salience of AT decreases as temporal distance decreases (H1). At the same time, the focus on PBC increases as temporal distance decreases (H2). But my results are more nuanced than simply AT is dominant in the distal and PBC in the proximal. In both studies, my results indicate an interaction effect between these two factors (H5). This interaction effect suggests that in the near future, PBC is a significant predictor of intention, as people focus on the feasibility of the event. But that in the far future, PBC may still be an important predictor of intention, especially for those who hold higher AT towards the planned behavior.

These results offer several contributions to theory. First, they extend the TPB(Ajzen, 1985)—one of the most often cited and used behavior change theories—by incorporating the temporal perspective. Many researchers have noted the limitations of TPB when it is used to understand behavior intentions that are not in the proximal (Conner, Sheeran, Norman, & Armitage, 2000). Others have also noted that incorporating time into TPB is a critical and open challenge (Collins & Mullan, 2011). Using CLT, I was able to link the different factors that influence intention as proposed by TPB, with the high and low level construals as used in CLT. Specifically, I showed the potential connection between AT component of PBC with high level construals, used to represent distal events, and PBC component of TPB with low level construals, used to represent proximal events. AT is more about the why, or the desirability of an event, while PBC is more about the how, or the feasibility of an event. Incorporating concepts from CLT into TPB enables to better understand how the proposed factors influence future behavioral intention.

In addition, the interaction effect I found also provides important insights about the relationship between TPB, CLT, and dual-process models (Chaiken, 1980; Fazio & Towles-Schwen, 1999; R. E. Petty & Cacioppo, 1986) that need further exploration. Ajzen posits that AT, SN, and PBC are conceptually separate (1985), and lots of prior works have examined the different predictive power of each construct (Armitage & Conner, 2001; Mark Conner & Armitage, 1998). However, others have suggested that some of the factors may interact with each other to influence behavior (Conner & Armitage, 1998). Our research suggest that what information people use to base their judgements on is both influenced by time (CLT) and by motivation to process, as suggested by dual-process theories. According to dual theories, when a person is motivated and also has the ability, one uses the central path to process the information,

elaborate on the content, estimate the missing details, and eventually predict more accurately. Conversely, when the motivation or ability to think about the information is missing, one uses the peripheral path to process the content, and use heuristics. People's attitude towards a behavior can make them more motivated about the target and use the central route of processing (Kunda, 1990). Thus, in the distal, those who hold strong attitudes may not just consider desirability, but also take the additional step to think about feasibility (PBC). To use an example: imagine if you were asked to participate in an event in the future. You are probably more likely to take out your calendar and check if the event has a conflict (PBC) if you care about the event (high AT). If you do not care about the event (low AT), you will not take the effort to find and process the additional information related to the how. These relationships are important consider. If I did not include this type of interaction effect in the models, it may even be possible to erroneously conclude that AT has a negative influence on behavior, as I had found in Study 1a.

While not part of our hypothesis, I do also want to make a note about the SN component of TPB. Unlike the other factors, SN appears to be a stable predictor of the intentions regardless of temporal distance. This is different from the hypothesis in (Lutchyn & Yzer, 2011), which argues that SN is closer to desirability and thus should be influenced temporally like AT. I hypothesize, based on the findings, that SN may be both related to desirability and feasibility. The qualitative analyses provide some supporting evidence. For example, when considering eating five servings of fruits and vegetables tomorrow, one respondent mentioned, "I could easily be a vegetarian but my husband prefers all meat." In this case, the normative pressure may be more about PBC (hard to do it). Future research should explore this hypothesis as the influence of SN on intention may also be time-dependent in subtler ways.

3.2.3.1 Designing for Motivation by Temporal Distance

From a practical perspective, the results hold important implications for designing interventions to support behavior change. As highlighted in the findings, people's intention to perform a target behavior decreases as the date to perform the behavior approaches. I found a 15-20% decrease in intention when the target is a few weeks away compared to a few days away. A lot of existing research has talked about nudging and encouraging behavior change, but have ignored the issue of time. The same strategy that works to encourage immediate participation may not be as effective in helping encourage people to make their initial commitments (e.g., RSVP). How might we better design to support behavior change goals at different time frames? Here I outline some strategies.

3.2.3.1.1 To Encourage Proximal Participation or Stick to Plans

If one aims to encourage people to participate in a proximal behavior, or stick to their plans in the near-term, my findings suggest that designs need to make salient and support the belief of feasibility of the behavior. It includes reducing the cost of participation (e.g., providing transportation to the event), and highlighting the ease of doing it (e.g., "you just need to show up!"). To help stick to behaviors for something individuals have already committed to, scheduling systems (e.g., virtual assistant services, calendar systems) or event organizing systems (e.g., RSVP, e-invitation) can also provide tailored notifications, based on temporal distance from planned behaviors. When the planned date gets closer, the notifications could offer more information that support the *how* of performing the behavior (e.g., showing videos of others performing the tasks, discuss other related performance accomplishments), to help improve users' self-efficacy.

3.2.3.1.2 To Get Widespread Attention from People

When marketing a new event, or when promoting campaigns, or when introducing new functions in the system, designers and event organizers may need to gain early, and widespread attention from people. These suggest that in these scenarios, one should focus on increasing positive attitudes toward events or activities. One way to encourage people to have positive attitude toward activities is to present the multiple reasons why they should perform the behaviors, focusing on instrumental (e.g., how important or useful the behavior could be) and affective anticipations (e.g., how pleasant or fun the behavior could be) that they may have. For example, if an organizer aims to publicize volunteering events a month in advance, the advertisement should focus on the fun aspects they could have. The high RSVP count and social media shares, can then help generate buzz towards an event. Further, research on public commitments has also shown getting people to make those commitments can strengthen behavioral compliance (Abrahamse, Steg, Vlek, & Rothengatter, 2005).

Due to the potential interaction between AT and PBC, if the target behavior is hard to perform (i.e., low behavior control), the designers or organizers may want to reserve the above strategy to those who are not already vested or motivated to attend (e.g., not on the members' mailing-list or the secondary target market). This might help prevent the set of people who already hold a strong positive attitude towards the target from thinking even more deeply about it and decide not to participate right away due to feasibility concerns, undermining the goal of garnering widespread attention.

3.2.3.1.3 To Improve RSVP Accuracy

One of the drawback from the above scenario, is that while that strategy may work to get more people to care and sign up early, there is may still be a problem of a high dropout rate due to the

decrease in intention over time. There are scenarios where designers and organizers may not care how many people sign up initially, but want a better assessment of people who will actually attend. Not showing up to an event may disappoint others who would expect him/her to do so (e.g., family), and hamper the best utilization of staff and resources (e.g., over/understaffing) (Macharia, Leon, Rowe, Stephenson, & Haynes, 1992). Based on these, what one could do is to motivate people to consider feasibility when making their intention judgements. One strategy to increase processing motivation, as we have discussed, is to encourage positive attitude towards the event. But another way to encourage more detailed considerations, is by providing people the "ability." For example, when designing the RSVP, designer could include and highlight additional information related to the *how* of the event, such as actual distance (projected time to travel) to an event, weather forecast, and other costs. The RSVP can also point out potentially conflicting events. Encouraging people to think more and spend more time on the decision, may also enable them to make more accurate assessments of their future behaviors.

As any other research studies, Study 1a and 1b are not free from its limitations. In Study 1a, as a field study, I focused on one behavior, attending the yoga class. The within-subjects nature of the study also made it hard for us to account for potential confounds that may occur from the dropouts. To address these issues, we replicated the findings in study 2 with additional hypothetical behaviors and using a between-subjects design. However, this came at the tradeoff of reducing the realism of the study. While results from both studies, using these different approaches, supported each other, more research is needed to replicate and build on these findings.

Taken together Study 1a and 1b, the findings informed in what ways people change their motivation as temporal distance from the goals/plans, providing the focal point of tailoring

design strategies in consideration of temporal distance (RQ1). This enabled me to suggest design guidelines for behavior goals at different time frames, which were further examined in Study 2.

3.3 Study 2: Designing Tailored Strategy for Temporal Distance

In Study 1, I found that when temporal distance is large, attitude (a focus on the desirability of behaviors, high-level construal related) is likely to be salient in mind, and affect motivation. However, when temporal distance is small, their perceived behavioral control (a focus on feasibility of behaviors, low-level construal related) is more salient (Suh & Hsieh, 2015). Building on this, I proposed and tested three temporal- distance based design strategies for events on social media. Previously, in the section 2.1.2.2, I discussed how matching the construal fit —a congruity between an individual's temporal representation and the construal level of information concerning the behavior could make the same behavior more appealing and hence more persuasive. However, it remains unclear whether and how matching the construal fit could be applied in practice. Many studies created stylized interventions, which limits the ability of designers and practitioners to use temporal distance-based tailoring strategies for events on social media. How might the idea of construal fit be applied to event page designs to increase engagement? Which of the design features of event platforms can and should be tailored, and how might they look like? To address these questions, I created three design alternatives and evaluated them to generate the tailored design guidelines for temporal motivation with regards to temporal distance.

In this section, I explore the construal fit strategies by three separate experimental studies. Study 2a tests how to pair the framing of event descriptions in text; Study 2b examines the time-dependent effect of adding an image in event description; Study 2c explores the effect

of image types that are congruent with the event date in increasing event engagement on social media.

3.3.1 Study 2a: Focus on 'Why' Far in Advance, but 'How' Near in Advance

A critical component of events presented on social media is the text describing the events. One way to increase user engagement may be to tweak the focus of the event description text. On social media, the event description includes various information on why one should attend the event, what activities are involved, how to get to the location, things to prepare, etc. I argue that tweaking the focus of the event descriptions will help increase user engagement. Freitas, Gollwitzer, and Trope (2004) found that an abstract (or concrete) mindset moderates one's anticipation for others: an abstract mindset leads one to both expect and suggest that the other pursue accurate, realistic information, as such information would provide the greatest abstract, long-term benefits, whereas a concrete mindset leads one to both expect and suggest that the other pursue positive feedback, as such information would provide the greatest immediate, concrete benefits. Similarly, Fujita, Eyal, Chaiken, Trope and Liberman (2008) found that when objects are temporally distant vs. near, arguments emphasizing primary vs. secondary features, desirability (why-related) vs. feasibility (how-related) features, and general classes vs. specific cases are more persuasive. Building on these studies, Kim et al. (2009) examined the effectiveness of a construal fit strategy, why-(or how-) focused appeals, through a series of experiments. They found that abstract why-focused appeals (a political candidate's statements of why s/he launches a campaign) lead to the more favorable attitude toward the politician candidate when the event, the election campaign starting date, is temporally distant, rather than proximal. On the other hand, concrete how-focused appeals (e.g., explaining how s/he launches a

campaign) are more impactful when the event is in the near future, rather than the far future. Such a construal fit strategy could also work in events on social media to increase event engagement. I hypothesize:

- H1. People will have higher intention to participate in the event when temporal construal level is congruent with the construal level of the event information, rather than the incongruent case.
- H1a. The why-focused design will attract a higher intention to participate when the event is far instead of near.
- H1b. The how-focused design will attract a higher intention to participate when the event is near instead of far.

3.3.1.1 Method

In Study 2a, I examined the first design strategy I propose, framing design for a construal fit, either the why- or the how-focused design (high-or low-construal level, respectively) level construal, to temporal distance from the event (far vs. near future). I conducted an experiment using a 2 (information design: the why- vs. the how-focused design) x 2 (temporal distance: far vs. near) between-subjects design.

Facebook Events was used as the context of the study, which I chose due to its wide adoption. For example, 700 million people use Facebook Events each month to market their events, and 35 million people view a public event on Facebook each day (Facebook, 2018). In the study, participants are presented with a social event called 7 Day Healthy Eating Challenge. I chose 7 Day Healthy Eating Challenge as an example of a social event for two reasons. First, these types of online social events are commonly hosted as actual public events within Facebook

Groups (e.g.,"30 Day Plank Challenge"), or Events (e.g., "Clean Eating Challenge"). Second, participants, AMT, may easily situate themselves in the study setting as the event is hosted online, while controlling potentially confounding factors (e.g., location). The event was announced as starting either near or far in the future (the temporal distance condition), and introduced via the how- or why-focused design (the construal level condition). Each participant was randomly assigned in one of the four groups.

AMT participated in the study. Past studies have demonstrated that samples from this extensive online panel are relatively stable, reliable, and more representative of the U.S. population than other traditional convenience and college student samples (Bentley, Daskalova, & White, 2017). Initially, 220 participants were recruited, estimated from the prior work (Fujita et al., 2008, Cohen's $d = 0.54$), but I excluded data from participants who did not complete the survey or who had failed to complete an attention check (e.g., if you read this question, please choose "strongly disagree"). A total of 181 participants (56.4% males, 43.6% females) were included for the analyses (age: 37.6 % of participants were in their 20s, 37% were in their 30s, 16.7% were in their 40s, 7.5% in their 50s, and 1.2% were 60 or over, M = 34.25 years old, SD=10.2; ethnic composition: 71.8% Caucasian, 8.8% Asian, 8.3% African American, 5.5% Hispanic and 5.6% other).

To manipulate information design orientation for Study 2a, I drew upon prior research (Kim et al., 2009; Trope & Liberman, 2003; Vallacher & Wegner, 2011) and varied the contents as well as the font styles of the message for our stimuli (construal level condition: the why vs. how-focused). Why-focused design emphasized the why of the event by content and font style, in both the post and event page (e.g., "enjoy real food and feel more energetic"). Emphasis, using bold and colored fonts, was also placed on words such as "great," "enjoy," "healthier," and

"happier." In contrast, how-focused design emphasized the *how* of the event by content (e.g., detailed steps the potential participants could follow to join the event) and font style (concrete terms such as "free," "simple," and "quick" were bolded and colored). The stimuli had two stages: a post of the event to the Facebook timeline and the event page; both were consistent in design (construal level condition). Manipulation-check questions were also asked to indicate the extent to which the event page focused on "why I should take the challenge" or "how I could take the challenge" for two items on a 7-point scale (1 = strongly disagree, 7 = strongly agree). As expected, participants presented with the why-focused design indicated that the event page illustrated more about the why of the event (M=3.87, SD=.94), than the *how* of the event (M=3.29, SD=1.04) [$t(179)$=3.93, p<.001, d[3]=.58], whereas those presented with the how-focused design indicated that the event page emphasized the *how* of the event (M=3.78, SD=.92), compared to the why of the event (M=3.24, SD=1.13) [t(179)=-3.15, p<.001]. Moreover, participants felt further in the future for the next year event (M=4.87, SD=.49) compared to the event tomorrow (M=2.02, SD=.15) [$t(1,179)$=51.88, p<.001, d=7.8]. These showed that manipulations of the event pages were successful. (Figure 5)

Once agreeing to participate in the study, participants were presented stimuli of timeline posts about the social event, shared by a "Taylor Wilson" (a gender-neutral name). Then they answered an open-ended question about the event, "what comes to your mind?" ensuring that they had read the event introduction, and situating themselves in the context of the study. Then, on the next page, participants read more about the same event from the Facebook event page (as if they clicked on the event link from the timeline post).

[3] Cohen's *d* is an appropriate effect size for the comparison between two means. It is often used to accompany the reporting of t-test results. Cohen-*d* indicates the small (>0.2), medium (>0.5), and large (>0.8) effects (Cohen, 1988; Sawilowsky, 2009).

After reading about the event, participants were asked about their intentions to participate in the event, which was used as a proxy of event engagement in this study. Participants indicated their agreement to the five statements using 7-point Likert scales (1=strongly disagree, 7=strongly agree). The statements were "I intend to participate in the event"; "I plan to participate in the event"; "I am willing to participate in the event"; "I am inclined to participate in the event"; and "I am likely to participate in the event", similar to prior work (Cunningham & Kwon, 2003; Suh & Hsieh, 2016). The measures showed high internal consistency of intentions to participate in the event (Cronbach's alpha = .98).

The answers from the five questions were averaged and used as a dependent variable in each study. At the end of the study, I also asked demographic questions regarding gender, age, race, education, general interest in health, and prior experience of any kinds of short-term challenges. The study took approximately 10 minutes to complete.

3.3.1.2 Results

To test H1, I conducted an independent samples t-test after coding the fit/non-fit conditions as binary: 1 was given to the congruent conditions (near and how-focused design; far and why-focused design) and 0 was given to the incongruent conditions (near and why-focused design; far and how-focused design). As hypothesized, participants in the congruent conditions showed a higher intention to participate in the event (M=4.28, SD=2.30) compared to those in the not-congruent conditions (M=3.60, SD=2.31), and the difference (M-$diff$=.67) was significant [t(172.49)=1.96, p=.05, d=.14]. (H1 supported)

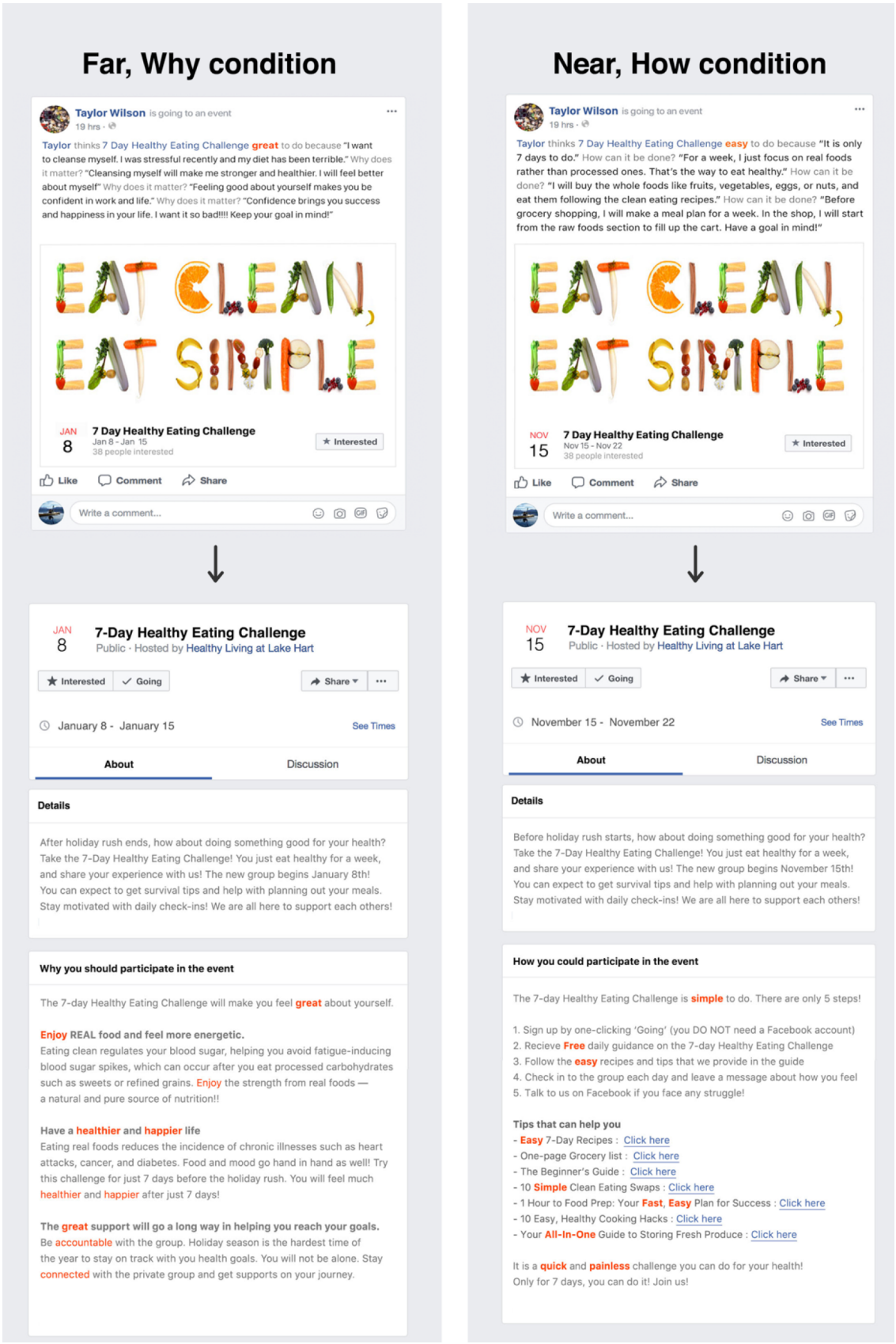


Figure 5. Post & Event Page: Why, Far (Left) How, Near (Right)

To test H1a and H1b, I conducted a two-way Analysis of Variance (ANOVA). I found an interaction effect between temporal distance and construal level [$F(1,177)=4.05$, $p<.05$, $\eta p^2=.02$]. In detail, if the event is introduced through a why-focused design, participants had a higher intention to participate when an event is in the far future ($M=4.36$, $SD=2.32$), compared to the same event in the near future ($M=3.02$, $SD=2.26$) [$t(85.10)=2.77$, $p<.01$, $d=.58$]. (H1a supported) On the other hand, if the event is introduced through a how-focused design, people had a higher intention to participate when an event is in the near future ($M=4.19$ $SD=2.30$), compared to the same event in the far future ($M=4.15$, $SD=2.28$), but the difference was not significant [$t(87.10)=-.08$, *n.s.*]. (H1b not supported). The main effects of each condition were not significant: information design focus [$F(1, 177)=1.97$, *n.s.*] and temporal distance [$F(1, 177)=3.60$, *n.s.*].

The results show the effect of congruency between temporal distance and the information appeals focusing on construal levels on behavioral intention to participate in the event. The why-focused design can be effective for distal events in attracting engagement, but its effect diminishes for proximal events. In particular, as shown in Figure 6, the mean of intention in the why-focused design condition drops down (*M-diff*=1.24) as the event date is nearer, but the how-focused condition did not show much difference (*M-diff* =-.04) as temporal distance changes. The results suggest that when promoting an event on social media, marketing designs focused on the why are more effective when the event is far away than when it is near. On the other hand, we did not observe a difference between time points for how-focused design designs. As we will show, this seems to be a consistent finding across the studies and raises some interesting questions about the construal fit hypothesis.

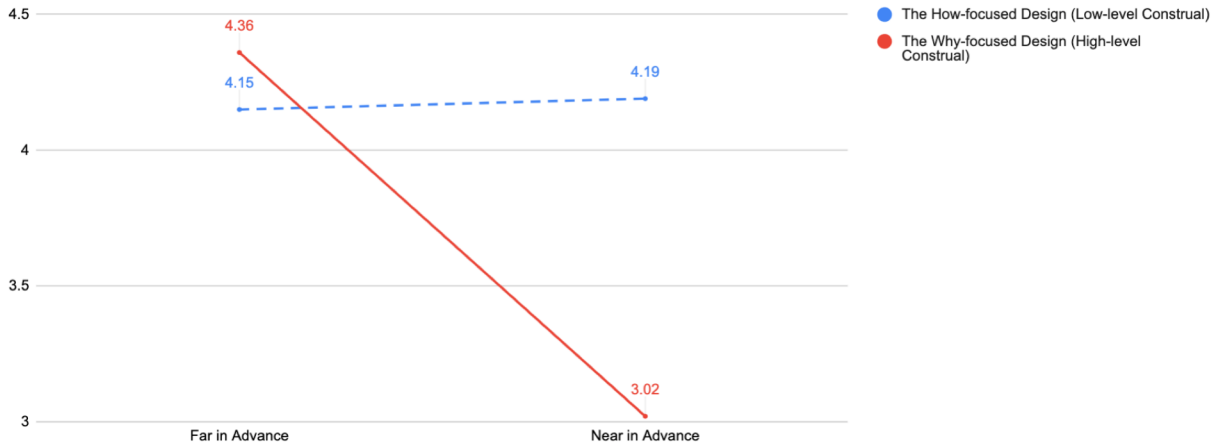


Figure 6. The Interaction Effect between Temporal Distance and the Information Appeals

3.3.2 Study 2b: Depict the Event with Text Far in Advance, but Add Images Near in Advance

Aside from text, event information also often includes image content. Prior work in advertising argues that visual content is an immediate appeal, attracting more attention than text (Bateman, 2014) and is more likely to provoke emotion, and is thus more memorable than textual content (David, 1998; Levie & Lentz, 1982; Messaris, 1997). This 'picture-superiority effect' has been widely applied in the design of print or digital advertisements to affect customer perceptions towards a product (Tang, Fryxell, & Chow, 2004). Social media sites (for example, Facebook) also recommend event organizers to use images to make their own events stand out as a promotion strategy (Facebook, 2018).

Research suggests, however, that the picture-superiority effect is often conditional. For example, Kim and Lennon examined the effects of visual and verbal information on attitudes and purchase intentions in internet shopping, and found that only the verbal information in an ad had a significant effect on purchase intention, indicating verbal superiority in product presentation in Internet shopping (Kim & Lennon, 2008). They speculate that verbal information makes explicit, specific claims about product attributes, which facilitate inferences about unknown information

about a product, whereas claims made using visual information tend to be less explicit and less specific, which is likely to highlight the uncertainty of inferences. In another study on online shopping presentation, Blanco, Sarasa and Sanclemente found that textual only information about a product (without a product picture) is as important as visual information for the presentation of electronic product because online customers allocate more resources to process paragraph information and therefore recall more information and perceive it as easier to recall (Blanco, Sarasa, & Sanclemente, 2010).

In particular, CLT raises a question of whether it is always desirable to have images in event promotion. Prior work in CLT argues that visual content is more concrete, as it bears a physical resemblance to the referent objects, whereas words are abstract. Thus, textual presentation is more associated with a higher level of construal than pictures (Amit, Algom, & Trope, 2009; Amit, Algom, Trope, & Liberman, 2009). In their experiments, Amit, Algom, & Trope (2009) presented two objects from the same domain, one temporally near and one far (e.g., a car and a carriage) in a random sequence as a picture or as a word, and tested the impact of temporal distance and information medium (text and image) on response speed. They found that people respond faster to pictures when they were thinking about the temporally near objects; however, words led to faster responses when participants were thinking about the temporally far objects, indicating the potential association between pictures (vs. words) and low- (vs. high-) level construal. Although not grounded in CLT, David (1998) found that concrete news items benefited more from the addition of a picture than did abstract news items as concrete news itself lends to visual portrayal, and thus has a greater association than abstract news items. However, it has not been examined whether text and image can be congruent with temporal distance to influence attitudes and behaviors differentially. Especially in the context of social media events,

a pure image-based advertisement with no text is unrealistic, as people need basic event information. Thus, in our work, we tested text-only condition compared to a text-plus-image condition. I expected that construal fit would increase event engagement. I anticipated that when the event is in the far future, people's engagement in the event would increase if it is introduced via only textual information (high-level construal). However, it would reverse when temporal distance is closer—when the event is in the near future, user engagement will increase when the event is depicted with images (low-level construal) as people may construe the event more vividly in their mind. I hypothesized:

- H2. People will have a higher intention to participate in the event when temporal construal level is congruent with the construal level of the medium the event is depicted with, rather than the incongruent case.
- H2a. The text-only design will attract a higher intention to participate when the event is far instead of near.
- H2b. The text-plus-image design will attract a higher intention to participate when the event is near instead of far.

3.3.2.1 Method

Study 2b examined the second design strategy I propose, matching the way of depicting events, either text-only (low-level construal) or text and image (high-level construal), to temporal distance (near and far future, respectively). To do so, I conducted an experiment in a 2 (temporal distance: far vs. near) x 2 (construal level: high vs. low) between-subjects design.

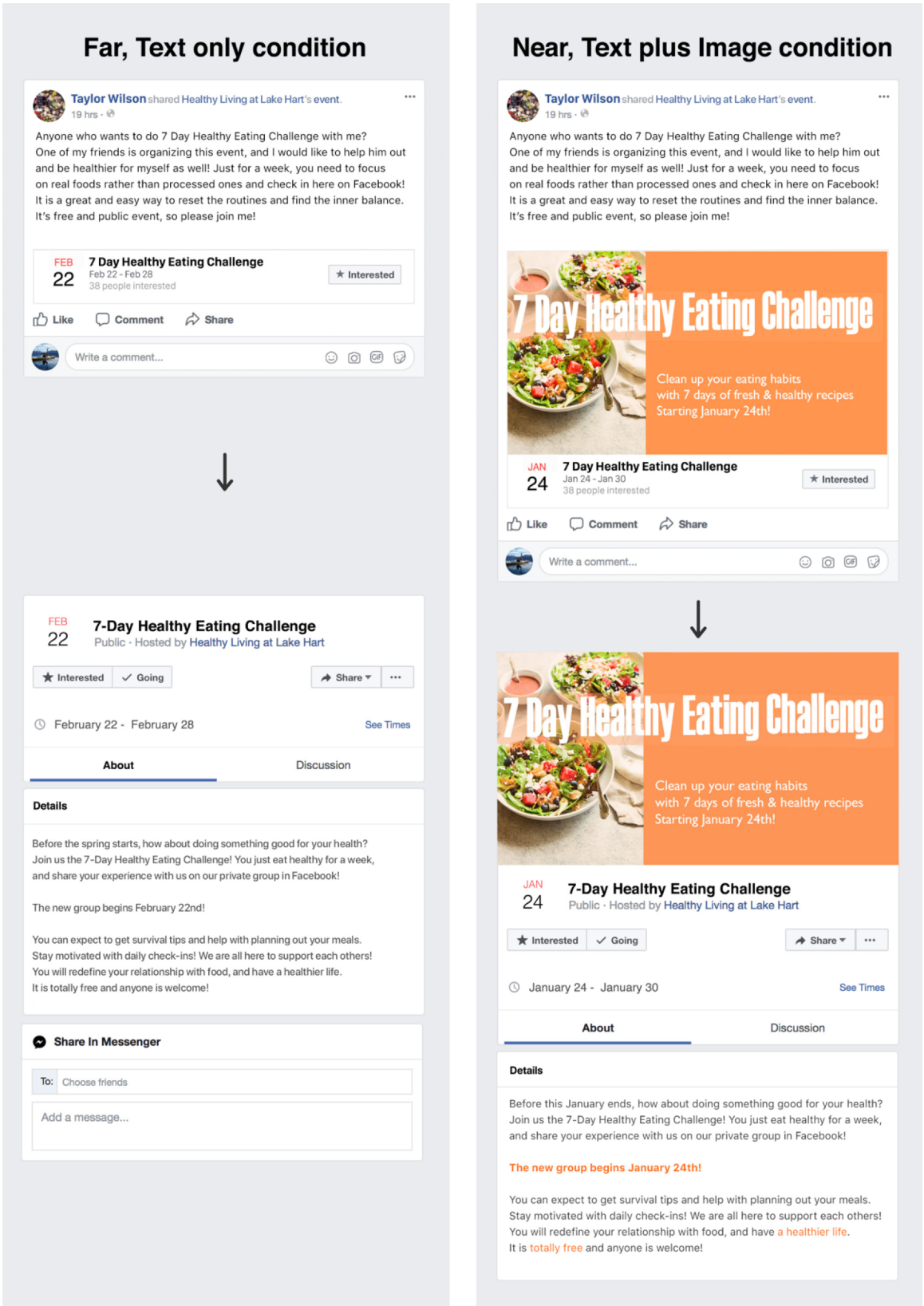


Figure 7. Post & Event Page: Text-only, Far (Left) Text-plus-image, Near (Right)

In total, 176 participants from AMT (50% females, 48.9% males, 1.1% other) were included for the analyses (Age: 35.2% of participants were in their 20s, 45.5% were in their 30s, 10.2% were in their 40s, 6.8% in their 50s, and 2.3% were 60 or over, *M*= 33.81 years old, *SD*=9.78; Ethnic composition: 69.1% Caucasian, 10.7% African-American, 8.4% Asian, 6.7% Hispanic and 5% other), reduced from initial 218 participants, estimated from the prior work (Fujita et al., 2008, Cohen's $d = 0.54$), after cleaning data with the same standard as Study 2a.

The study context, set-up, procedure and questionnaires were same as Study 2a, except stimuli. In stimuli (both a post of the event to the Facebook timeline and the event page), the event was depicted by either of low-(text and image) or high-(text only) level construal focused design, and was planned in either of the near (tomorrow) or far future (1 month later). (Figure 7, Appendix) The measures of intentions were reliable (Cronbach's alpha = . 99).

3.3.2.2 Results

To test H2, I followed the same procedure to dichotomously code the congruent and incongruent conditions, and conducted a series of an independent-samples t-test. The results show that participants showed a higher intention to participate in the event in the congruent construal conditions (*M*=3.98, *SD*=2.43), compared to those in the incongruent conditions (*M*=3.35, *SD*=2.29), and the difference (*M-diff*=.63) was marginally significant [t(174)=1.78, p=.07, *d*=.26].

To examine H2a and H2b, I conducted a two-way Analysis of Variance (ANOVA) and found a marginally significant interaction effect between temporal distance and construal level

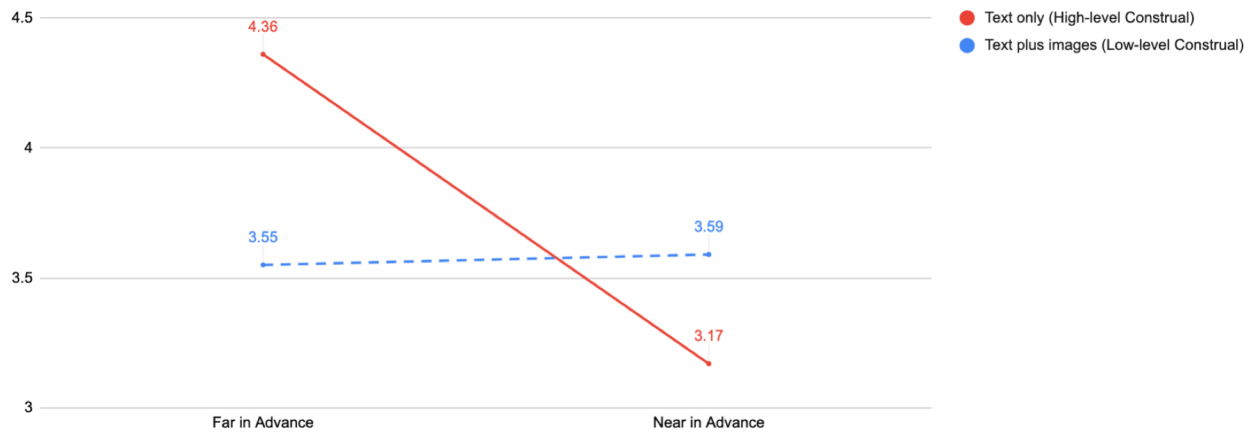


Figure 8. The Interaction Effect between Temporal Distance and the Information Medium

[$F(1,172)=3.01$, $p=.08$, $\eta_p^2=.02$[4]]. In detail, when a distal event is depicted by only text, participants showed significantly higher intention to participate in the event ($M=4.36$, $SD=2.42$), but the effect of textual event introduction does not hold for proximal event ($M=3.17$, $SD=2.38$) [$t(90)=2.41$, $p<.05$, $d=.5$] (H2a supported) (Figure 8). However, the effects of text-plus-image condition were not significantly varied between proximal ($M=3.59$, $SD=2.40$) and distal future events ($M=3.55$, $SD=2.26$) [$t(82)=-.08$, *n.s.*] (H2b not supported). The main effects of each condition were not significant: information medium [$F(1, 172)=.32$, *n.s.*] and temporal distance [$F(1, 172)=2.62$, *n.s.*].

The results show the effect of congruency between temporal distance and the manner of event depiction on behavioral intention to participate in the event. The text-only design can be effective for distal events in attracting engagement, but its effect diminishes for proximal events. On the other hand, the effect of text-and-image design was not significantly different between time points. Here, I found that the effect of high-level construal driven condition (text-only) was more time-dependent, compared to low-level construal driven condition (text-plus-image). As

[4] The partial eta-squared (η_p^2) is used with analysis of variance (ANOVA) to describe the proportion of variability associated with an effect. η_p^2 indicates the small the small (>.01), medium (>.06), and large (>.14) effects.

shown in Figure 8, the mean of intention in the text-only condition drops down (*M-diff*=2.19) as the event date is nearer, but the text-plus-image condition did not show much difference (*M-diff* =-.04) as temporal distance changes.

3.3.3 Study 2c: Use Illustration for Event Image Far in Advance, but Photo Near in Advance

Aside from whether or not images should be used, another important design consideration is what types of images should be used to increase user engagement, when the event approaches.

I argue that concreteness of event images would be differentially persuasive depending on temporal distance toward an event, as suggested by CLT. Images could vary the degree of its abstractness. For example, Svakhine, Jang, Ebert, & Gaither (2005) claim that illustrations lower-dimensional visual cues focusing on the abstract, essential, and structural features of the object, and so are often used to express themes and concepts and engage the imagination in fun, weird, even impossible ways. Illustrators often aim to convey information to the viewer, not recreate reality (Svakhine et al., 2005). On the other hand, photographs are more concrete representations of specific objects, more grounded in reality than illustrations by virtue of depicting a physical object in a literal way (Svakhine et al., 2005). In CLT, hypotheticality, one dimension of psychological distance, is known to influence psychological distance. For example, when an event happens at low-probability rather that high, people tend to think more broadly and are more successful at abstracting visual information, indicating the association between hypotheticality and high-level construal (Wakslak, Trope, Liberman, & Alony, 2006). Hypotheticality also affects the perception of other distances, such that people expect unlikely events, compared with likely events, to occur in situations that are relatively more distant in time,

space, and social distance (Wakslak & Trope, 2008). This could mean that people map probability (e.g., abstractness of image) onto other distance dimensions and thus expect improbable events to happen in distant times. I expected that people could be more drawn to illustrations, or more abstract and less realistic representations of the event, when the events are in the far future, whereas, when the event approaches, they may be more likely to be affected by photos, as they are more realistic and detailed representations of the event. Understanding how the abstractness of the image is differentially engaging by temporal distance will help organizers choose which image to use depending on time of promotion. Thus, I examined the subject by hypothesizing the following:

- H3. People will have a higher intention to participate in the event when temporal construal level is congruent with the construal level framed by the event image, rather than the incongruent case.
- H3a. The *abstract-image* design will attract a higher intention to participate when the event is far instead of near.
- H3b. The *concrete-image* design will attract a higher intention to participate when the event is near instead of far.

3.3.3.1 Method

In total, 176 participants from AMT (48.9% males, 51.1% females) were included (age: 34.7% were in 20s, 36.3% were in 30s, 12% were in 40s, 8% in 50s, and 4.5% were 60 or over, M=36.06 years old, SD=11.79; Ethnicity: 76.7% Caucasian, 3.4% Asian, 14.2% African American, 6.3% Hispanic and 2. 9% other), after cleaning data, similar to Study 2a and Study 2b.

The study followed the same set up as the other two. The answers from the five questions to ask intentions to participate in the event were internally consistent (Cronbach's alpha = . 98).

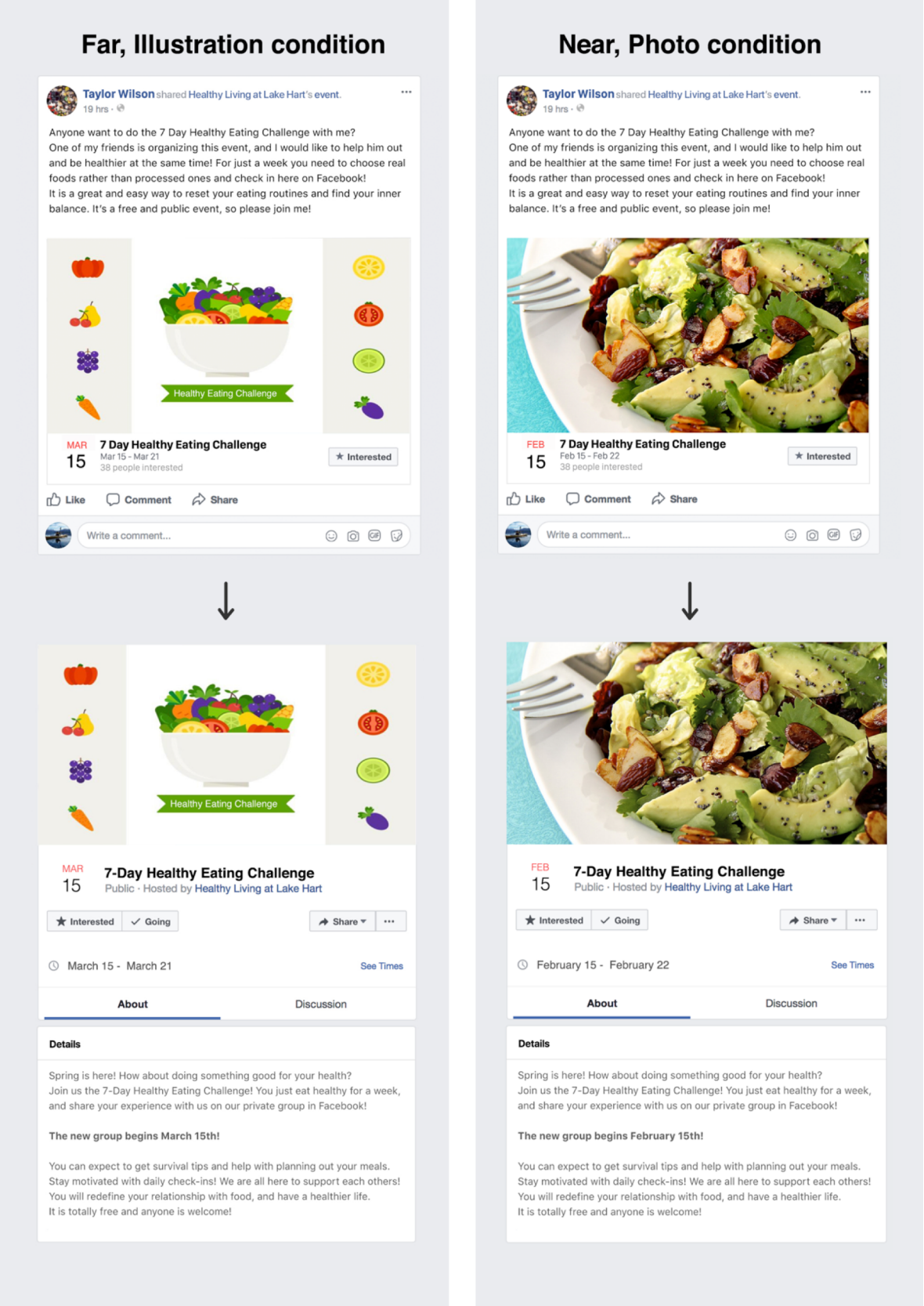


Figure 9. Post & Event Page: Illustration, Far (Left) Photo, Near (Right)

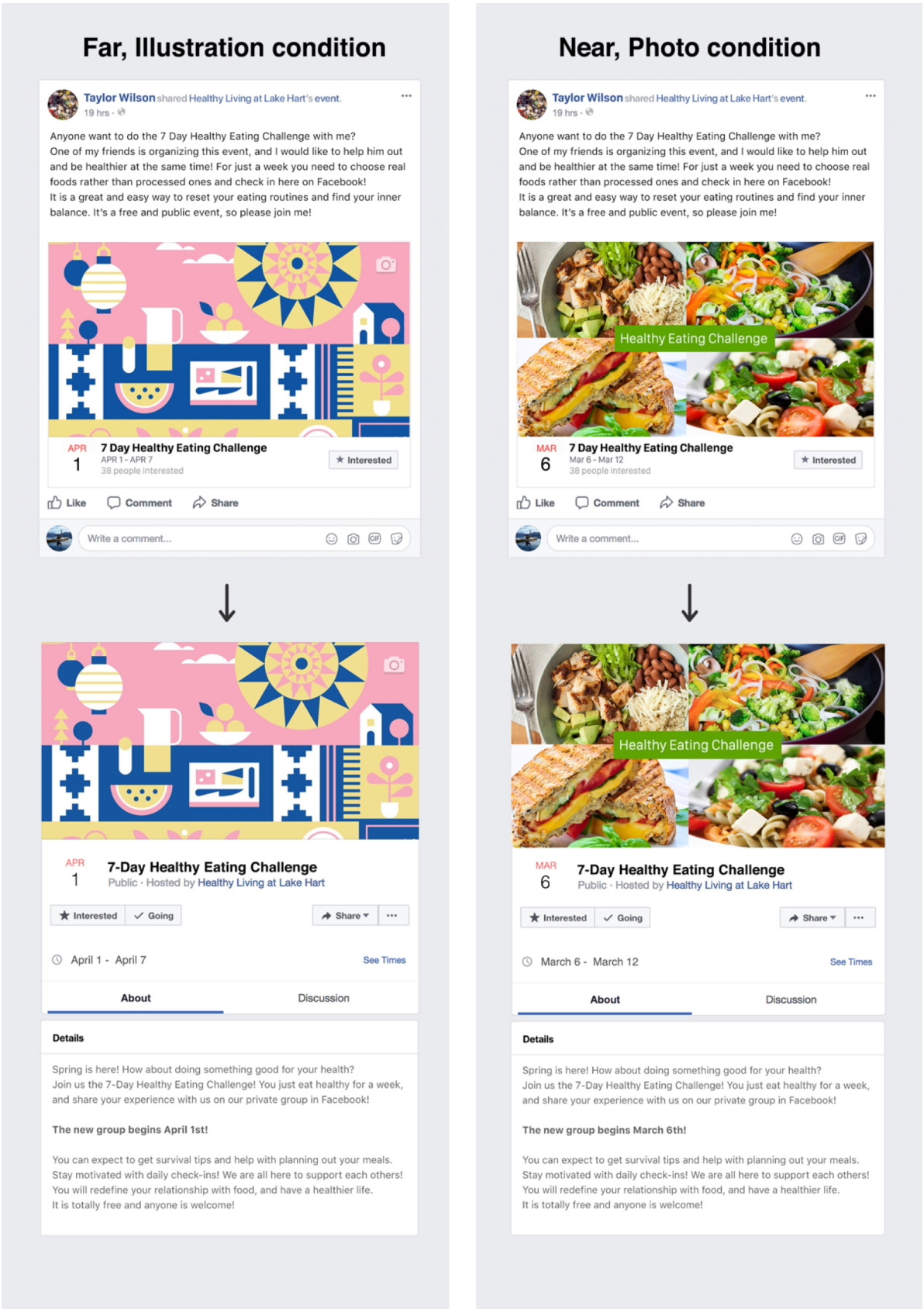


Figure 10. Post & Event Page: Illustration, Far (Left) Photo, Near (Right)

For stimuli, both of the post and the event page were depicted with either an illustration or a photo related to the event. (see Figure 9, Figure 10, Appendix). Although I used two different images per the design condition, there were no statistical differences within the condition in terms of manipulation check, so I just treat them as the same groups.

To assess the efficacy of each manipulation, participants were asked to describe the images they saw on the event page using two separate 7-point semantic differential scales (1=abstract, 7=concrete; 1=illustration-like, minimize the confounding effect of a specific date, I had two dates for the study setting, but maintained the identical temporal distances within the condition (near: a day, far: a month) in order to treat them as the same groups. As expected, illustrations were rated as more abstract (M = 5.03) and illustrative (M=2.81), whereas photos were considered more concrete (M=5.54) [t(174)=-2.014, p<.05] and life-like (M=6.09) [t(90)=-9.087, p<.001]. It showed that manipulations were successful. To minimize the confounding effect of a specific date, I had two dates for the study setting, but maintained the identical temporal distances within the condition (near: a day, far: a month) in order to treat them as the same groups.

3.3.3.2 Results

I followed the same procedure to dichotomously code the congruent and incongruent conditions, and conducted an independent-samples t-test to test H3. The results show that participants showed higher intention to participate in the event in the construal fit conditions (M=4.31, SD=2.24), compared to the construal non-fit conditions (M=3.69, SD=2.33) [t(174)=2.08, p<.05, d=.32] (H3 supported). To examine H3a and H3b, I conducted a two-way Analysis of Variance (ANOVA) and found a significant interaction effect between temporal distance and construal level [F(1,172)=4.17, p<.05, η_p^2=.02]. Specifically, for distal events, if the event is introduced

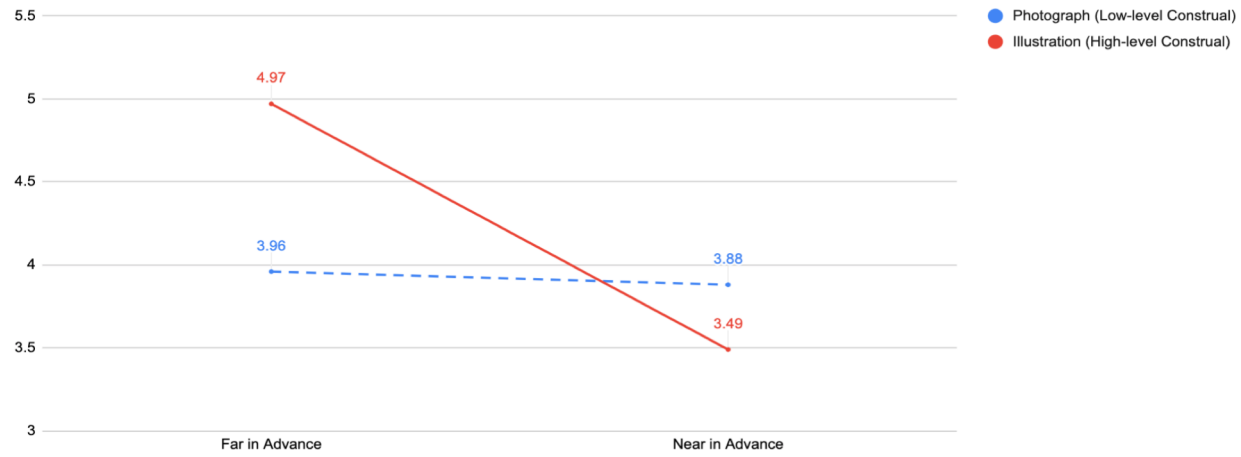


Figure 11. The Interaction Effect between Temporal Distance and Image Abstractness

with the more abstract image (illustration), participants showed significantly higher intention to participate in the event (M=4.97, SD=2.16), but its effect does not hold for proximal events (M=3.49, SD=2.31) [$t(91)$=3.14, p<.01, d=.66] (H3a supported).

However, if the event is introduced with the more concrete image (photo), people did not show much difference in intention to join the event between the proximal (M=3.88, SD=2.22) or distal future (M=3.96, SD=2.37) [$t(81)$=.15, *n.s.*] (H3b not supported). The main effect of construal level design was not significant [$F(1, 172)$=.79, *n.s.*], whereas, temporal distance: [$F(1, 172)$=5.09, p<.05, η_p^2=.03]. The results indicate the effect of a construal fit between construal levels (activated by abstractness of images) and temporal distance on intention to participate in the event. Again, I found that this effect is due to a construal fit for the high-level construal, rather than for the low-level construal. The effect of congruency for high-level construal is more time-dependent, compared to that for low-level construal (Figure 8, 11). It indicates that high-level construal significantly drops in its impact on intention to participate in the event when the date approaches (M-*diff*=1.48), whereas low-level construal's impact remains relatively stable. In fact, low-level construal design (photo) does not show much difference on

intentions between the near and far future conditions (*M-diff*=-.08). The image abstractness is differently influential depending on temporal distance from the event.

3.3.4 Discussion

In Study2, I proposed and examined three time-based design strategies, extending research on CLT, to increase events engagement on social media. Through experiments, I demonstrated the efficacy of the construal fit design strategies that I proposed: congruency between the construal fit design and the temporal distance resulted in higher intention to participate. However, in further analyses, I also found that while the effectiveness of the high-construal strategies is time-dependent, the low-construal strategies are not. In Study 2a, I found that people report higher intention to join an event in the far future when the why aspect of an event is highlighted. However, the same why-focused design was not as effective for the same event in the near future. In Study 2b, I found that introducing the event without an image is engaging more far in advance of an event, rather than near in advance of an event. In Study 2c, I found that the persuasiveness of the image used can also depend on time—abstract images are more effective than concrete images in increasing user engagement for the social event far in advance, but not near in advance. Throughout three experiments, I consistently noted that the effect of the low-level construal strategies was not affected by temporal distance from the event. In the next section, I discuss the theoretical and practical implications of the findings.

3.3.4.1 Theoretical Implications

This work contributes to existing research on CLT. I offer empirical evidence of the effectiveness of tailoring designs based on CLT in the context of promoting events on social

media. Further, I extend on this body of research by suggesting that certain dimensions of image concreteness may also map onto the different levels of construal.

The findings provide empirical evidence for the importance of temporal-based construal fit strategies. All the three studies consistently show that high-level construal driven designs (why-focused design, text-only, and illustrations) are more effective in encouraging event engagement for far future events than for events in the near future, whereas the low-level construal-driven designs (how-focused design, text-plus-image, and photos) are better in encouraging event engagement for near-future events than for far-future ones. In particular, these effects are fairly strong in cases of fit for high-level construal. For example, high-level construal-driven designs had a medium to large effect size as temporal distance changes: why-focused design (d=.91), text-only (d =.50), and illustrations (d =.55). This means that the high-level construal-driven designs can increase user engagement by 32.3% (why-focused design), 18.4%(text-only) and 20.5% (illustration) if they are used for the far future events as opposed to near future events.

Specifically, Study 2a tested the strategy that has been suggested in prior work on political voting (Kim et al., 2009). Here, I extended it into the context of social events and demonstrated how one could tweak the presentation of information to highlight the why or how to increase event engagement on social media. Study 2b builds on prior findings that text-based content is perceived to be more abstract, whereas image-based content is seen as more concrete. I utilized this insight and proposed that social events described by only text versus social events described by both text and image would be differentially effective in relation to the amount of time between the advertisement and the event. Study 2c tested a new dimension that has yet to be proposed by prior work. It explored how different types of image can be appropriately congruent with the different levels of construal. I proposed that abstract images, such as illustrations, are

more engaging for the event in the far future. However, more concrete images such as photographs are more engaging for near-future events. Our results, supporting our hypothesis, demonstrate the link between illustrations and high-level construal and between photos and low-level construal. It also highlights the need for more research to study additional dimensions of images, such as colors, filters, size, focus location, contrast, shape, interactivity, image content, etc., and their relationship with construal levels.

One thing that is interesting to note from our results is that in comparison to the high-level construal designs, the low-level construal designs (how-focused design, text-plus-image, and photos) did not vary much in effectiveness between the proximal and distal (see Figure 6, 8, 11). Although prior work tended to presume the symmetrical strength of effectiveness between low-level construal fit (e.g., how-focused design when an event is near in advance) and high-level construal fit (e.g., why-focused design when an event is far in advance), I found that as temporal distance changes, the effect of high-level construal fit tends to be discounted more compared to that of low-level construal fit. In fact, there seems to be the asymmetric pattern of the effectiveness between low- and high-level construal fit in prior work. For example, Kim et al., (2009, Study 3), which our Study 1 built upon, also showed that the low-level construal fit strategy (action-oriented campaign message from a political candidate) is less time-dependent in encouraging intention to vote (*M-diff* between near and far future: 0.53 on 7-likert scale), compared to the high-level construal strategy (values-oriented message from the candidate) (*M-diff* between near and far future: 1.19). Another study also showed that the high-level construal congruency (a black and white image) differs in its effect on the donation amount by the time of donation (*M-diff* between near and far future: $21.36), more than the low-level construal strategy (a color image) (*M-diff* between near and far future: $4.01) (Study 6A, Lee, Fujita, Deng, &

Unnava, 2016). One explanation is possible from some recent findings (Suh & Hsieh, 2016). In their study, Suh & Hsieh found that for the far-future events, people considered both the why and how of behavior—attitude and perceived behavioral control—in their decision making. However, when the date approaches, the *how* of behavior becomes the primary consideration (Suh & Hsieh, 2016, Study 1). This would mean that the low-construal designs may be stable across time, whereas high-construal designs are more time-dependent. Another explanation is plausible that low-level construal fit strategies might be relatively more common in reality (e.g., using both image and text in marketing an event) and so, perceived familiarity with low-level construal designs may play a significant role and hence lessen time-dependent effects, compared with high-level construal designs. Additional research is needed to test the relative strength of construal fit strategies by time, and to explore how to strengthen the effect of the low-level construal strategies that could be useful for the proximal future.

3.3.4.2 Practical Implications

This work calls attention to the temporal dynamics of the event promotion process. The findings offer several practical implications for both event organizers and designers of social media.

Based on the findings, I recommend several ways for event organizers to tailor their event marketing strategies, depending on the number of days until the event. At the beginning of event promotion, when the event is still far away, one strategy would be for event organizers to emphasize the why. They could move why-focused messages to the top of the event description page, where it will be most visible. Another strategy could be that they also highlight the words that are related to the potential benefits from event participation and use quotations or other supporting evidence to highlight the importance of the event. Lastly, if images are needed, organizers should choose more abstract images, such as illustrations.

Then, as the event date approaches, event organizers should change their focus of promotion to the feasibility of event participation. They should modify the content and the messaging around the events and focus on practical information such as free parking, flexibility in the schedule of events, and details of the activities that will be available during the event. Further, this may also be the time for them to use more and more concrete images about the event, such as photos about the location, the activities, or the people who will be participating. In doing so, these strategies create a more concrete image of the event in potential participants' minds, encouraging them to be more engaged.

Designers should also utilize the findings in the design of promotions for events on social media. For example, they could offer different event templates depending on the temporal distance from the event. If the planner is planning for an event in the near future, the template prompts should guide users to select more concrete content, whereas if it is still a long time away, the template should guide users to use more abstract content. But this type of tailoring of event pages can also be handled directly by the system to minimize users' work. When the event is far away, the system can foreground more abstract content, such as textual information describing the purpose of the events. When the time for the event approaches, the page can change its layout to emphasize concrete details of the events: location, how-tos, etc. Social media events can be designed to ask for different types of images and show them at different time points, or there may also be ways to use different filters, which may potentially alter the perceived abstractness or concreteness of the event. The system should also leverage similar strategies when promoting events. The default texts and images for users to share on their social media can be tailored in the same way.

While the focus of this work is on supporting event engagement in the context of promoting events on social media, it is also likely that our results and strategies can be generalized to broader contexts, as CLT has been widely explored. For example, the design strategies proposed could also be applied to tools to support online marketing and promotion, as well as behavior change technologies that try to nudge short-term and long-term behaviors.

I used a hypothetical scenario of a Facebook event being shown in the participants' newsfeed. While our manipulation checks suggest that participants paid sufficient attention to the designs, future research should seek to replicate these findings in a more ecologically valid setting. Similarly, I used study participants from AMT. While a number of prior works that validate their adequacy as study participants (e.g., Bentley, Daskalova, & White, 2017; Paolacci, Chandler, & Ipeirotis, 2010), future research is needed to test the generalizability of the findings beyond this group of participants.

3.4 Summary of Contribution

In this chapter, I examined temporal motivation focusing on temporal distance as a tailoring strategy to increase user engagement in social media event platform. Specifically, I understood what drives the changes of motivation as the event becomes temporarily nearer: attitude about the target is more salient the further away the event, as people focus on the why of a behavior. On the other hand, perceived behavior control can influence intention in both near and far future. When the target is in the near future, people generally focus on the feasibility, or the *how* of the behavior. In the far future, people may also consider factors related to behavior control, if they are motivated to do so (i.e., hold a strong attitude towards the action). From this, I proposed and tested three time-based design strategies to utilize temporal distance from an event increase user engagement in social events. It builds upon and expands research on CLT by demonstrating the

applicability of Construal Matching strategies in the context of event on social media and by proposing a new construal matching strategy of "image concreteness" (Study 2c). Designers or practitioners could also use the design strategies proposed in their work. Finally, this work highlights time-dependent technology designs as an important area for future research, which the HCI and CSCW communities can use to shift their perspectives on how to design for temporal motivation and to apply the matching construal strategies in technology design.

CHAPTER 4. DURATION OF FINANCIAL WELLNESS GOAL

To address my second research question concerning whether and how duration could be utilized as a tailoring strategy, I studied people's financial wellness goals with a focus on the durations and examined the potential of goal duration as part of a tailoring strategy to better support individuals to achieve financial wellness. By applying the lens of CLT to the context of short- and long-term personal finance goals, I took an exploratory approach by conducting a series of interviews to understand peoples' thoughts and practices around financial wellness goals with different durations.

In this chapter, I discuss related work on financial wellness goals and present my Study 3 results on how people differ in their motivation toward a goal by duration and whether and how I might better address duration-based temporal motivation in technology design to support behavioral goals. I also further discuss whether and to what extent the theoretical premise of CLT might be applicable to the context of goal durations, beyond temporal distance from a target, thereby providing broader theoretical and design implications.

4.1 Financial Wellness Goals

Personal finance is an area of study focusing on the planning and management of personal and family resources, such as how people spend, save, protect, and invest their monetary resources (Garman & Forgue, 2011). Financial wellness is a common goal in personal finance, which is a state of being financially healthy, happy, and free from financial worries (Joo, 2008). Financial wellness is a comprehensive, multidimensional concept incorporating financial satisfaction (e.g., subjective satisfaction about financial situations), the objective status of a financial situation (e.g., having sufficient income and assets), and financial attitudes and behavior that cannot be

assessed through one measure (Joo, 2008). Understanding how individuals acquire, develop, and allocate money to meet their current and future financial needs has required interdisciplinary approaches, including business research (Brüggen, Hogreve, Holmlund, Kabadayi, & Löfgren, 2017), consumer research (Devaney, Anong, & Whirl, 2007; Joo, 2008), financial education (Peng, Bartholomae, Fox, & Cravener, 2007; Prawitz & Cohart, 2014), and economic psychology (Canova, Rattazzi, & Webley, 2005; Fisher & Montalto, 2010).

With a growing interest in technology related to personal finance, HCI researchers have explored the design space of new digital systems and services that support everyday financial practices. Areas of interest range from understanding how people interact with certain financial tools (e.g., tracking systems: Kaye, McCuistion, Gulotta, & Shamma, 2014; a new form of currency: Ferreira, Perry, & Subramanian, 2015) and with others (e.g., social relationships via transactions: Caraway, Epstein, & Munson, 2017), to conceptualizing the large set of financial activities consisting of physical and social interactions that users make individually and collectively to enable transactions, called "Moneywork" (Perry & Ferreira, 2018).

Within the HCI and CSCW communities, research has sought to understand how to support people in obtaining financial wellness, especially in the area of personal informatics by focusing on understanding personal finance behaviors, such as how people track and manage transactions (Caraway et al., 2017; Epstein, Ping, Fogarty, & Munson, 2015; Kaye et al., 2014; Lewis & Perry, 2019). A few studies remarked how goals play a role in the ways people interact with tools to manage their personal finances. For example, Epstein et al. (2015) studied how self-trackers, including people with financial wellness goals, select and use specific tools that best serve their goals and modeled their cyclical engagement with the tools. When investigating how people track their money, Kaye et al. (2014) found that people divided both assets and expenses

according to different intentions, managed different "pots of money", and siloed allocations to which money could be added and removed (e.g., money for a child's college fund). These studies help shape our understanding of how people use tools for managing personal finances and their goals; however, none of these studies paid attention to what actually makes people commit to and work toward goals to achieve financial wellness.

Goals are critical in planning for financial well-being (Joo, 2008). Goals can range from saving for an emergency fund to paying off a mortgage and are often set with different target dates and amounts (Garman & Forgue, 2011; Kapoor, Dlabay, & Hughes, 2009). Working toward these goals help people balance between spending and saving so that they can stay committed to their financial plans (Garman & Forgue, 2011). With a solid understanding of their goals, people can take control of their financial behaviors and thereby increase their financial satisfaction and happiness (Kapoor et al., 2009). Setting financial goals is counted as one of the fundamental steps in the financial planning process (Garman & Forgue, 2011). Research examining how goals lead to financial health have focused on its predictors (e.g., financial literacy; Babiarz & Robb, 2014), living in households in which the head is married (Friedline, Elliott, & Nam, 2011), attitude toward credit scores (Livingstone & Lunt, 1992), number of credit cards (Norvilitis et al., 2006), or various motivators (a hierarchy of saving motivations (Canova et al., 2005) and household characteristics (Devaney et al., 2007).

In acknowledging the benefits of financial wellness goals, the question becomes how we might better help encourage goals that will lead to financial well-being. Many people already use financial tools to seek financial wellness. As of 2019, 60% of smartphone users had at least one financial app, 70% of whom used them daily (Barba, 2018), and global downloads of financial apps reached 3.4 billion in 2018, up 75% from 3 years earlier (Belton, 2019). However, recently

the media has raised concerns that current financial technologies often lack a realistic picture of users' expenses and do not effectively direct them to reach their financial goals (Kuh, 2019), leading them to fall short of goals and even spend more (Belton, 2019). Although personal finance technology use is expected to continue increasing (Barba, 2018; Belton, 2019; DeJong, 2017), it is timely and critical to understand how to better motivate and support financial wellness goals.

4.2 Study 3: Understanding How Duration Affects Goal-related Behaviors

To understand how to motivate and support financial wellness goals, one approach I suggest is to consider the duration of personal finance goals or the deadline that an individual or family sets to achieve a financial goal. Often remarked as short- or long-term goals, the duration of personal finance goals serves different functions in overall financial planning (Garman & Forgue, 2011). For example, short-term goals are financial targets or ends that can be achieved in less than 1 year, such as paying off an auto loan, purchasing assets, or attending a wedding, whereas long-term goals may target more than 5 years in the future, providing direction for overall financial planning as well as shorter-term budgeting (Garman & Forgue, 2011). Financial coaches stress the importance to pursue multiple financial goals with varying durations while balancing motives, needs, and plans toward them (Buechner, 2011; Lawrence, 2011; Remund, 2010).

I argue that these different durations of goals could be useful for tailoring a strategy to promote engagement with different financial wellness goals. From the theoretical premise of CLT, it is plausible that long-term goals may activate high-level construals, whereas short-term goals may activate low-level construals. There are two possible reasons. First, similar to temporal distance, the end date of a goal duration could act as a reference point from the self,

here and now, in which goals are represented at different levels of construal. People may be less likely to have low-level contextual information about the further future (Trope & Lieberman, 2003), indicating that they may have fewer ideas about the long-term goal outcome or its contexts compared to a shorter-term goal.

Second, various saving goals could constitute hierarchical structures, differing in the level of abstractness, activating different levels of construal. For example, Canova, Manganelli, and Webley (2005) examined a hierarchy of various saving goals and calculated the degrees of how often a goal is the object or origin of another goal by network analysis. The researchers found that more concrete goals addressing short-term basic financial needs (e.g., "purchase", "money availability") were located at the bottom of the hierarchy of saving, whereas more abstract goals for self-actualization needs (e.g., "self-esteem", "self-gratification") were located at the top. In the intermediate position are goals that channel the more concrete toward the more abstract (Canova et al., 2005). Similarly, Lindqvist (1981) proposed a structure of reasons for saving where the need to handle cash to deal with short-term financial goals is at the lowest level and the need to have a precautionary reserve of money is at the second level. The third level includes a large amount of money to buy something expensive and the need to manage accumulated wealth over the long term is at the top level. Taken together, studies collectively suggest that people may have various saving goals with different durations, and hence how they approach these goals may differ. It is also plausible that people use increasingly higher levels of construal to represent a goal as the goal duration gets longer, indicating the potentials of goal durations for a tailoring strategy.

However, no studies yet focused on the duration of financial goals or whether and to what extent the theoretical premise of CLT might be applicable to duration beyond its only focus on

temporal distance. Therefore, I examined how people perceive different financial wellness goals with different durations, what challenges people face when pursuing short- or long-term goals, and how technology could support them better. To do so, I employed a CLT lens and an exploratory and qualitative approach to conduct interview studies.

In this chapter, I describe how people pursue personal finance goals with a focus on different durations, informing efforts in supporting personal finance goals, reducing the gap between what current technology offers and what support people need, and examining the potential applicability of a construal fit strategy considering duration.

4.2.1 Methods

To gain insights on whether and how the duration of goals could be utilized as a tailoring strategy, I conducted a series of interviews with financial coaches and people who have used digital and/or analog personal finance tools to support their personal finance goals.

4.2.1.1 Expert Interview

I conducted interviews with five financial coaches who responded to our recruiting emails sent to 18 local nonprofit organizations that focus on financial empowerment. These individuals provide one-on-one financial coaching services in four different organizations. Community development financial institutions (CDFI) provide free financial coaching sessions, during which they work with clients to identify financial goals and design an action plan to help reach those goals. The interviewees have coached for 6.3 years on average (ranging from 1 to 20 years), covering topics on financial health, budgeting, credit, and financial vision and specialize in basic money management, behavior issues, couple/families, education, housing, and retirement (Table 8). The coaches focus on providing education and training aids to those who need support, which range

from increasing financial literacy to resolving behavioral issues. I asked them questions about the types of financial goals that they help clients set up, as well as their financial coaching practices. From the interviews, I learned how they view various financial goals, how they help clients to set and pursue financial goals, and how certain tools may or may not help their clients with financial goal-related behaviors. I initially decided to interview financial coaches to learn from their knowledge and practices around setting financial goals, and I surveyed tool users to help inform the interview guide. Clients seen by the coaches had a wide range of incomes, which enabled them to speak of the variety of financial situations, nicely complementing our data from tool users. Their experiences let us learn about many aspects of personal finance goal-related behaviors. The interviews lasted 59 minutes on average, ranging from 42 minutes to 1 hour 19 minutes.

4.2.1.2 User Interview

To understand people's personal finance goals and tool use, I also interviewed people who have used digital and/or analog personal finance tools to support their goals. I strived to recruit participants from a wide range of channels, including mailing lists of a large university, Facebook groups, Craigslist, Reddit, and paper flyers in the public bulletins at local libraries and cafés. People who were interested in the study filled out a screener survey comprised of open-ended questions on their past and present goals and what tools they have used.

In total, 78 completed the survey. Of those, I contacted 25 people based on diversity of demographics (e.g., income, age, the presence of financial relationships with partners, housemates, etc. and dependents), tool use, and financial goals, although we did not aim for statistical representation.

Coach ID	Gender	Age	Race	Job Title	Focused Population	Career
C1	F	35 - 45	White	Financial Capability Manager	"People with disabilities"	1.5 yrs
C2	F	45 - 54	White	Financial Counselor	"People with un- or under-employed"	6 yrs
C3	M	45 - 54	Black	Director of Financial Inclusion	"Anyone who needs financial mobility"	20 yrs
C4	F	35 - 44	White	Financial Coach & Counselor	"Economically venerable populations"	3 yrs
C5	F	25 - 34	Asian	Financial Counselor	"Anyone who needs financial counseling"	1 yr

Coach Participant Information

ID	Gender	Age	Race	Income	Cohabitant	Tool Use (duration)		Short-term Goals	Long-term Goals
P1	M	25 - 34	Asian	>$100k	Spouse	Personal Capital	2 yrs	Save for piano	Save for retirement; Pay off student loans, mortgage
P2	F	25 - 34	White	$50k - $74k	Partner	Mint, spreadsheets, Fidelity	1 yr	Save for rent, food, grad school	Save for future kids, house, car, retirement
P3	F	25 - 34	Hispanic	$35k - $49k	Roommates	Mint, eMoney	7yrs	Save for trip; Pay off credit card debt	Save for retirement, emergency
P4	F	25 - 34	White	$75k - $99k	Partner	Mint, RobinHood	9 mos	Save $10k; Pay off debt	Save for house ($100k)
P5	F	25 - 34	Asian	<$25k	Alone	YNAB, spreadsheets	1 yr	Save for trip; Pay off debt	Save for house, retirement, emergency
P6	M	18 - 24	White	$75k - $99k	Spouse	Mint	3 mos	Pay off credit card debt	Save for house; Pay off student loans
P7	M	25 - 34	Asian	$35k - $49k	Roommates	Spreadsheets	2 yrs	Support mom	Save for grad school, house
P8	M	25 - 34	White	$75k - $99k	Roommates	Mint	3 mos	Save for emergency	Save for retirement; Pay off student loans
P9	F	18 - 24	Black	<$25k	Alone	Mint, paper, notes online banking	6 mos	Save for short trip	Save for long trip, emergency
P10	F	25 - 34	White	<$25k	Sibling	Spreadsheets, Mint, Vanguard	5 yrs	Save for building a cabin, emergency	Save for retirement, investment
P11	F	35 - 44	Black	$75k - $99k	Spouse, Two kids	Notebook, online banking	17 yrs	Save for trip, emergency	Save for retirement, kid's college
P12	F	35 - 44	White	$35k - $49k	Spouse	Quicken	7 yrs	Save for emergency	Save for retirement
P13	M	18 - 24	Hispanic	<$25k	Parents	Spreadsheets, Robinhood, Instant Pay, spreadsheets, M1	2 yrs	Save for emergency	Save for retirement
P14	N	25 - 34	Asian	<$25k	Partner	Spreadsheets, Simple	2 yrs	Pay rent, tax; Save for emergency	Save for house
P15	M	25 - 34	White	$50k - $74k	Spouse	Mint, Personal Capital, Spreadsheets	5 yrs	Save for scooter	Save for retirement, kid's college
P16	F	25 - 34	Asian	$35k - $49k	Alone	Spreadsheets, online banking	4 mos	Pay of student loans	Move to abroad
P17	F	25 - 34	White	$50k - $ 75k	Roommates	Mint, spreadsheets, Charles Schwab	6 yrs	Save for tattoos, trip	Save for retirement, house
P18	F	55 +	White	<$25k	Alone	Spreadsheets, check books, paper	8 yrs	Pay off medical debt	Save for trip
P19	F	45 - 54	Hispanic	>$100k	Spouse, Two kids	Online banking	3 yrs	Support kid's college; pay off car	Save for retirement

Tool User Participant Information

Table 8. Interview Participants Information

Nineteen participants (12 females, 6 males, 1 non-binary) joined us for a follow-up interview. Their demographic information is presented in Table 8. A collaborator or I conducted interviews over a video-chat platform or in person, and each was audio-recorded. Each interview lasted 55 minutes on average. Questions focused primarily on their personal finance goals and their tool use practices in terms of how tools helped or hindered meeting those goals.

The data set included transcribed interviews with both financial coaches and potential users, which provided diverse perspectives and experiences regarding personal finance goals. After completing the interviews, I analyzed the qualitative data through a closed-coding process focusing on the relationships between short- and long-term goals and related practices. The analysis process was done iteratively until I finally created three overarching themes, reflecting the meanings of the data as a whole, and refined the names of themes, which are presented next.

4.2.2 Results

Participants reported a wide range of financial wellness goals (Table 8). To understand how participants perceive the duration of their goals, I prompted them with a set of the open-ended questions: "What comes to your mind when you hear the terms, short- or long-term goals?" and "How would you categorize your financial goals into two types?", without providing any definitions of either short- or long-term goals. Despite this, participants had clear understandings of the concept of short- and long-term goals and easily mapped their financial goals into these two types. For example, P10 said:

> The emergency fund and personal project were definitely short-term [goals]. The early retirement/financial independence is very much a long-term [goal]. It might take a couple decades to get there … I would probably call short term less than 5 years.

Each defined the threshold between short- and long-term goals differently, however, the median duration of participants' goals was 3–5 years. This means that most people considered personal finance goals as short-term if the goals were to be completed within 3–5 years, otherwise, the goals were considered long-term. Through the interviews, I found a complicated relationship between short- and long-term financial wellness goals. Participants reported the distinctive characteristics of either short- and long-term financial goals, but I also observed that these goals have tradeoffs with each other, which is described in more detail below. Finally, I describe participants' technology use to support their effort to attain financial wellness and the challenges that they faced while navigating between short- and long-term financial wellness goals.

4.2.2.1 Short-term vs. Long-term Financial Wellness Goals

Participants perceived their short- and long-term financial goals as different—as aforementioned, participants that used financial tools were able to easily map their financial wellness goals into the two categories. P7 explained, "I don't wanna say that one is more important than the other, it's just they're in a different spectrum." Financial coach participants also remarked on the difference between short- and long-term financial goals. For example, in coaching, C5 often helped their clients acknowledge various goals (e.g., emergency funds, student loans, retirement plans) with different durations and recommended them to pursue those goals separately, but recognized, "There are different parallels [of goal needs] happening at the same time ... you should have all of them [different goals with varied durations] at the same time." In this section, I further describe how participants' short- and long-term goals were differentiated in more detail.

Concreteness of goals. Short-term goals tend to have specific purposes for which the money is allocated in the future (e.g., pay monthly rent), whereas long-term goals target a larger amount of

money but with less specified expectations about when the money will be used (e.g., retirement). Participants described the less specified nature of long-term goals by using terms that were more uncertain. For example, P2 used a less specific term to describe their long-term goals:

> Short-term would be like saving up for *school [tuition],* which starts in the *fall* ... Long term would be the house, owning a car *someday*, and like retirement, really making sure I have that set and putting *enough* money away to retire *at a reasonable age*.

P16 also contrasted their short-term goals with long-term goals by specifying the numeric value of financial wellness goals and clear deadlines, "I guess I have timelines for the short-term goals. My timeline was in *the next 3 years* to move, and then to make up that *$20,000*. The long-term goal, it *doesn't really have a due date*." C2 also added, "with long-term goals, it's so far-reaching that I can't see it in front of me," suggesting the more abstract nature of long-term goals in contrast with short-term ones.

Goals and affect. I observed that stronger emotions, both positive and negative, were associated with short-term rather than long-term goals. For example, P15 described short-term goals as "fun" and "*immature,*" like "a vacation," whereas long-term goals envisioned stability, such as "*thoughtful*, things like retirement, education, giving." P7's response was also similar, "The long term is very much dependent on the *core values* that I hold into myself. And the short-term value is what makes me *happy* now." P13 also noted that short-term goals feel more stressful as they are meant to be completed sooner than later and are riskier by their nature. Sometimes, the instant emotional gratification obtained from short-term goals led one to feel even guilty. For instance, P3 had debt from her impromptu trip, for which she felt bad and P7 had a goal to stay within his monthly budget on items such as Lyft or clothes, which they described as "luxury

expenditures." I noted that motivators for short-term goals could be also more emotional, playing a role as an intrinsic motivator, as described by P14, "For short-term goals, autonomy motivates me ... shame motivates me. I shame myself for not being able to afford something that I need. That's a big motivator ... for long-term goals, it's more of like my partner motivates me ... more like external motivation."

Socially oriented goals. I noted that participants felt more bound by perceived social norms when it came to their long-term goals, but to a lesser extent for short-term goals. They often thought about what they wanted at the moment (which was more likely to turn into short-term goals in their own right), whereas it takes social pressure to take a longer-term perspective. Family or friends inspired or recommended them to begin planning for retirement (P2, P10). P17 also said, "I see my dad retiring and I want to make sure that I'm in a better position than he is." Perceived social norms encouraged them to set long-term goals that are expected at a certain age. P2, P3, and P10 started to work on their long-term goals when reaching their 30s, as they felt like it was expected of them. On the other hand, short-term goals "have to do with my immediate needs" (P14) or "what makes me *happy* now" (P7). P9 teased out the separate values of goals with different goal durations:

> My short-term goals' value is ... mostly, I guess spontaneity, and I think my long-term goals' value is stability ... I think that spontaneity is interesting, it's fascinating, it's fun, and it's thrilling ... And stability is stability, it's something that you can count on, especially in a world where it seems like there's less and less of the opportunities to count on when it comes to money and when it comes to being able to take care of yourself.

	Long-term Goals	Short-term Goals
Concreteness of Goals		
Specified Purpose	How money is used remains to be determined (e.g., retirement)	Where money is allocated is specified (e.g., pay monthly rent)
Expressed (un)certainty	"enough" "someday"	"$20,000" "in 3 years"
Goals and Affect		
Intensity of Emotion	More rational than emotional "thoughtful" "core-values"	Stronger positive and negative emotion due to instant gratification "fascinating, fun, thrilling" "luxury" (more guilt) "more stressful" "shame motivates me"
Socially Oriented Goals		
Social Norm-oriented	What I *should* do "looking at dad's retirement" "at my 30s' birthday"	What I *need* or *want to* do "my immediate needs" "what makes me happy now"
Different Values-related	"stability", "core values"	"duty", "spontaneity"

Table 9. The Summary of Characteristics of Financial Wellness Goals by Durations

Taken together, I observed that short-term financial wellness goals may differ from long-term goals (Table 9), indicating the potential for different strategies based on goal duration. However, I also noted that the relationship between short- and long-term goals is too complex to merely contrast with each other, which I further describe in the next section.

4.2.2.2 Relationships Between Short- and Long-term Financial Wellness Goals

Although participants remarked on the different nature of short- and long-term financial wellness goals, I observed that these goals are not necessarily discrete but rather become interrelated while people are pursuing them, which presents additional challenges. In this section, I detail the interrelated aspects of short- and long-term financial goals.

Tradeoffs between short- and long-term goals. Pursuing a particular goal could affect participants' efforts to work toward another goal, especially when income is limited. Participants noted the tradeoff between short- and long-term goals. For example, P13 thought their short-term goals "take away funds from my long-term goals". They further explained:

> The money that I'm gonna need for this project [a short-term goal], I could've invested a good amount of it a year or two ago into those investment accounts and it could be making money on itself … it [short-term goal] definitely takes away money from those other goals.

When participants are working toward long- and short-term goals, they often needed to prioritize either goal, leading them to lapse on their pursuit of the other goal. For example, P10 remarked, "the long-term goals kinda take the back burner to the short-term" and often prioritized short-term goals:

> If I've got extra money after I'm done with the short-term goal, I'll put it into the long-term. But, for now, the long-term goal, the only money that is going into it is money coming from the stock market … Definitely rent is always a priority ... once I get a job, I think savings is the next priority.

P7 attributed the timing of gratification as why they prioritized short-term goals, "It feels like a more immediate. Going to the dance festival. So I want to go there, and I need to save up for that." P14 also similarly noted that the short-term goals are more related to their day-to-day life:

> I'm just more attune to short-term goals because they come up in my everyday life of paying bills and having savings and having peace of mind and thinking about needing some extra money to pay for an unexpected expense ... I'm not a long-term planner, and I

think that I will probably have to do more of that if I want those things that I said I wanted in the long term.

P9 also prioritized their short-term goal (saving for travels) over their long-term goal (emergency funds); however, they found it negative or problematic:

> I definitely have those issues, and at the moment my long-term savings goals tend to be the one that suffers. I tend to rationalize it that I'm young and I can afford to not have a ton saved up for emergencies.

When feeling like their long-term personal finance goals (e.g., saving for a mortgage) are sacrificed by their short-term goals (e.g., paying rent, shopping 'necessities'), P5 had to cope with negative emotions and struggled with not getting enough support:

> I need something, somebody telling me I'm not alone in this ridiculous shopping habit and that there are ways to break yourself of this cycle ... But it just feels like, I feel very alone in having this problem when I feel poor.

To summarize, participants found it challenging to pursue both short- and long-term goals as they are closely interrelated and, in general, money is a finite resource.

Insights from the financial coaches' practices that identify and connect clients' values to their goals to help resolve negative emotions may prove valuable. All coaches advised clients to understand their values first, as it is these values that should be the goal and motivator for personal finance goals. As C4 stated, "Having clients attach their values to their goals. It's more motivational that way." C2 remarked that it is particularly important, "If you're not aware of your values, your values are always going to override your goals." C5 said that values could help tease out a need from a want, reducing one's guilt.

Goal duration is not static but dynamic. I also noted that durations for personal finance goals are not constant, rather they are dynamic, which affects the way participants envisioned their short- and long-term goals over time. For example, as a goal is progressed or gets older (i.e., the goal has been pursed for a significant amount of time), long-term goals often become short-term. For example, participants often considered saving for their child's college as a long-term goal (P2, P11, P19); however, as they (and their children) grew older, the same goal became more imminent (P19), transitioning from a long-term to a short-term goal. P16 also had 10 years of student loan debt from their master course but at the time of the interview was about to pay it off, which turned this into a short-term priority. Sometimes, the pace of working toward a goal changed over time:

> It changed after I finally had an emergency fund. Like, so many months' worth of income saved, I felt like less urgent to save. So now I can focus on other goals that are less important than an emergency fund … credit cards, that kind of stuff. (P11)

When one's situation changes, their expectations toward financial goals were also altered accordingly. As P2's romantic relationship with their partner became more serious, they considered the long-term goal of buying a house was more concrete and feasible:

> Now that I'm in a new relationship, it changes the mindset a little bit…I was never gonna buy a house by myself, but, now that I have a partner, it's like, 'Oh, now, a house is more of an option or more of a necessity.'

Sometimes unexpected situational factors led participants to push back their short-term goals, so these goals became longer-term ones. Although P18 wanted to buy a car in the near future, they had to put off this desire due to an unexpected loan for their emergency surgery, "Of course you don't predict emergency surgery, um, that was an exorbitant interest rate, 17% … and then I had

to pay all of those off too. So those [dreams for a car] are gone." For P7, financial support for their family suddenly became a more imminent goal:

> I had a different kind of financial goal … and that has changed because my mother just arrived in America and I need to support her … I'm saving up for possibly a house or possibly going to Argentina or, those were my goals, and then they're kind of like, 'Goodbye! Here's something else I need to work on' [to support his mother].

These examples collectively indicate that what is initially planned as either short- or long-term goals may not remain static over time—due to a variety of circumstances, the goal duration may shift from long to short or short to long, or anywhere in-between.

4.2.2.3 Technology Use to Manage Short- and Long-term Financial Wellness Goals

While pursuing financial wellness goals, participants often used a variety of tools concurrently. These tools include third-party managers that aggregate information (e.g., Mint), banking apps from financial institutions that held their accounts (e.g., BECU), spreadsheets (e.g., Microsoft Excel), and an analog system (e.g., notebook). Many participants used more than one tool, indicating that at present there is not a single system available that can meet all their needs. In this section, I describe how participants used tools for their short- and long-term goals and the challenges they faced in doing so.

Different practices for short- and long-term financial wellness goals. Participants reported different practices to manage either short- or long-term financial wellness goals. Overall, they tended to have more specific strategies for short-term goals compared to long-term goals. As P12 said, "I don't have a strategy for the long-term goal. There's a bit more strategy for the short-term goal … it's because everything's broken down into numbers, so it was a bit easier for me."

P14 explained, “it [long-term goal] is less in my mind because ... it’s longer out there so I don’t have to focus on it right now.”

This mindset was reflected in how participants used tools for managing financial wellness goals. Participants engaged with their short-term goals frequently by recording/checking their spending daily or tracking cash flow on tools a few times per week. They also used tools to refer to their own records to adjust the goals to be more achievable. As P3 described, “[I] see about how much I was spending and then based on that, build a grocery budget. And then over the months, I would tweak it so it would be a more realistic representation of what I was spending.” The tools also guided them to make preemptive action plans for their short-term goals:

> I’m also just seeing where I am on the barometer. I am about halfway through the month and I’ve spent $50 out of $100, or am I at $75? What do I need to make sure that I’m doing in the next few weeks to maintain that $100 budget? (P17)

The concrete nature of short-term financial wellness goals (e.g., target amounts, fixed end date) helped users to create detailed action plans accordingly and encouraged them to frequently engage with the goals:

> By this day, I’m gonna look back and I’m gonna have paid off my credit card debt and whatever. I think that if I was just like, ‘Oh, I’m just gonna set aside $500 a month to my credit card debt or whatever’, then it wouldn’t really be as motivating … We check it [the progress of paying off credit card debt] every day and we see the money growing.

The specific indication of action items provided by tools helped users more actively pursue their short-term goals. P4 elaborated upon what she found most helpful about using Mint:

> If I am running out of money, I’ll use it [Mint] just to see like, ‘Okay. How much did I spend on clothes or restaurants? How much is frivolous spending versus necessary

> spending?' Then, I'll be really diligent about cutting back in those categories and Mint is really helpful for that.

On the other hand, participants' engagement with long-term goals was relatively less frequent and less active because long-term goals are often less in one's mind and more emotionally detached when compared with short-term goals. For example, P8 said, "I don't track my investments on Mint just cause I'm more concerned with my day-to-day finances. I think my retirement planning is fine and I don't need to be frequently monitoring that through Mint." P13's response was similar, "I don't think about it too much. You'll get by through baby steps you don't even know is doing in your everyday life." P10 also paid less attention to long-term goals and explained, "I really like to focus on the short-term stuff and let the long-term stuff kind of play out as it happens." P2 explained that her day-to-day efforts often feel too marginal to achieve long-term goals, and she got to focus on her short-term goals in her daily life:

> A house just feels like I need so many savings for that, that skipping one lunch out won't help … for a house [money] will come from me putting like a big chunk of my salary directly into savings, rather than, 'Oh, I'm not going to go out to lunch today so that $10 will go toward my house.'

Similarly, in pursuit of their long-term goals through investment, P15 did not find it useful to track on Personal Capital every day, as such tracking is less likely to lead them to take action when compared to Mint, which they used for a short-term goal:

> [I use Personal Capital] not as frequently as Mint. Maybe once a month. Again, my retirement accounts are more set it and forget it. I don't actively trade currently, and I don't have any plans too … I don't typically change my investment strategy based on what I see … so, I will see the graph that the market took a downturn, but it's not going

> to change how much I contribute or when I contribute or what stocks I contribute to. The only actionable data is really the day-to-day transaction data in Mint.

Navigating between short- and long-term financial wellness goals. In managing various financial wellness goals, some participants used different tools simultaneously—they selected tools by goal (e.g., Simple for budgeting, spreadsheet for long-term tracking: P14) or duration (e.g., Mint for paying monthly expenses, Fidelity for a retirement goal: P2). They felt the tools have different strengths that better serve goals with varying durations. For example, P2 used Mint for their short-term goals, finding its notification feature useful, whereas they used the Fidelity app for long-term goals because personalized feedback was more beneficial than the notification feature:

> [I use Mint when] they do notify me when a certain bill is due and how much is due … I look probably every two weeks to see my personal 401K to see how that's doing … [Fidelity app says], 'Okay if you want to retire at 65 then this is the amount that you need to put from your salary into your 401K and these are the investments that you should focus on' since I'm 30-years-old and I have that many years to wait for retirement. So, just often going to those [Fidelity app] and checking to make sure I have a balanced plan for the retirement … there's no reminders; that's just my own personal remembering that I want to check that every few weeks just to keep track.

P15 found it easier to track different goals separately:

> I appreciate having all of my bank accounts separate and having all of my accounts stand alone, and they interact with each other when I want them to interact with each other, but not before or after. I do that on purpose because I find that it helps me track things better.

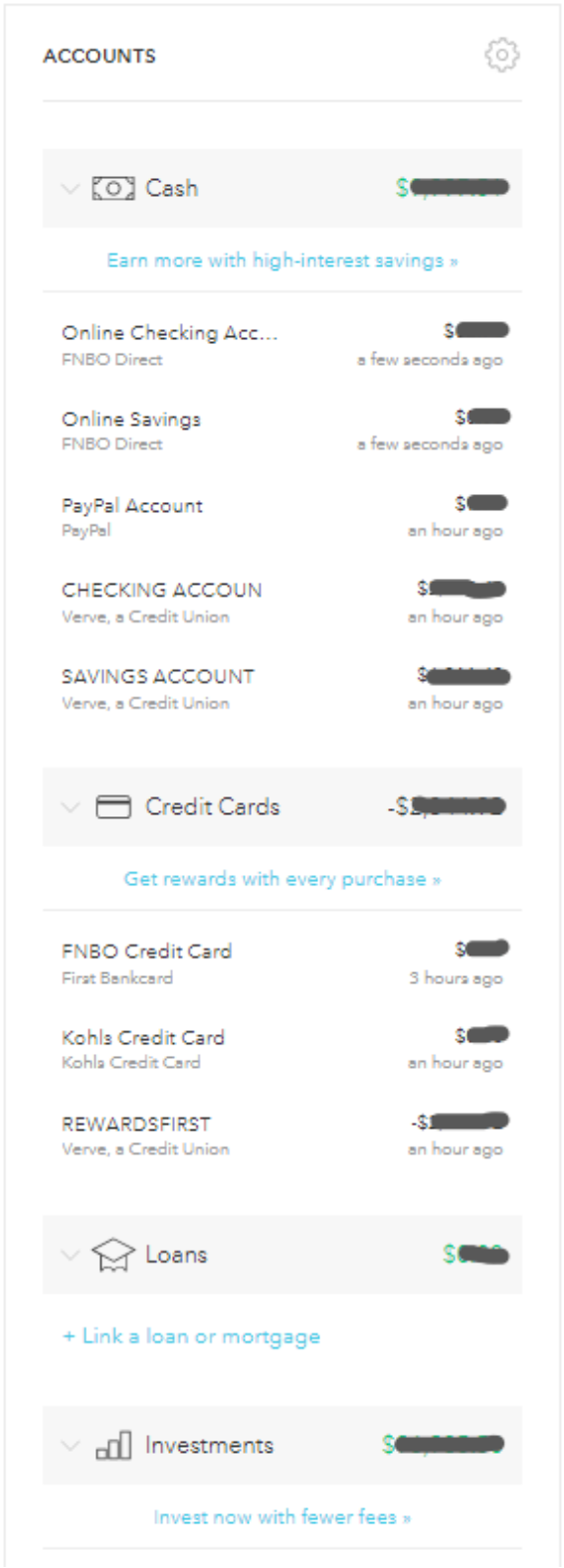
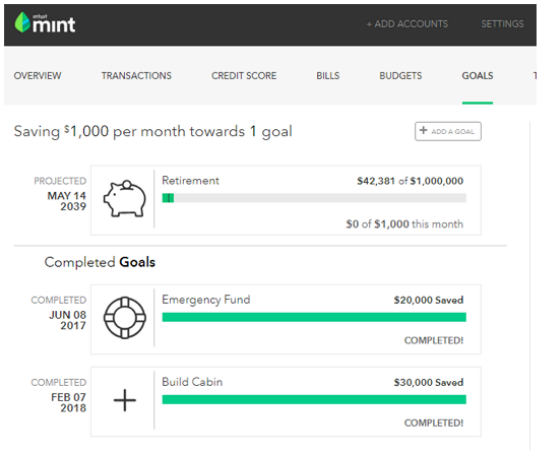
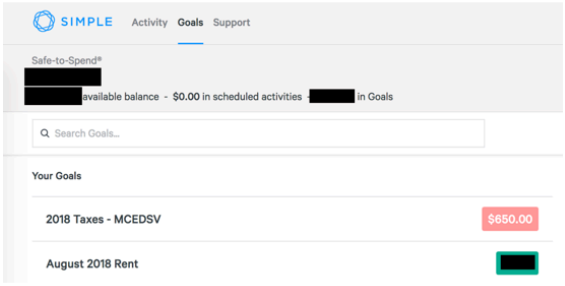


Figure 12. The Screenshots of Participants' Tools

To manage their financial wellness goals. P15 used Mint that collapses all the accounts and recent transactions on to one mobile page. (Left) P17 also used Mint to manage multiple goals with different durations, but she found all different goals are mixed and presented on the same page (Top Right). P14 used Simple to manage multiple goals collapsed into one dimension (Bottom Right)





On the other hand, other participants used a single tool that aggregates different accounts and goals to manage multiple goals with different durations. For example, Mint enables users to connect all their accounts and goals, which collapses different goals into one dimension of day-to-day management (Figure 13). P16 remarked on the benefits of managing multiple goals using one tool:

> I think it's really overwhelming when you have multiple banks, or multiple student loans, or multiple types of investments. Multiple bills, and that sort of stuff. Then you have to keep track of it. It was nice to have everything in one.

While managing multiple financial goals together or separately, participants acknowledged the limitations of the current tools to support their efforts to balance different goals. One example is a lack of support to manage their impulsivity in pursuing multiple goals at the same time:

> There are times when I move money from different accounts in order to cover unexpected expenses … that I need to cover, and then there are unexpected expenses that I'm just being frivolous about ... I'm gonna take that from this other fund, like my savings fund or something like that, then it doesn't stop me, it doesn't correct me, it doesn't push back or resist it. (P9)

When falling off from pursuing certain goals, some tools inform users about their financial activities (e.g., highlighting with different colors: P14; providing the graph of trends: P4); however, participants wanted tools to encourage them to be more actionable. As P8 noted, "It's just a visual representation and that's it. I think there's room to go above ... Maybe some trend analysis or some sort of analytics." P12 added:

> If I spend over what I want to spend, then the total would just turn red, and ... it just tells me that I spent over my budget … it's just information, it doesn't trigger anything or stop anything. I don't feel like, 'Oh, I can't drive anymore this month' or something like that.

When participants deprioritized goals there was a tendency to not resume them in the absence of a trigger or nudge. Recalling their previous financial wellness goals, P16 remembered a goal that they lapsed on and never resumed, "I think they just kind of went away, it wasn't a priority anymore. They just kind of disappeared."

To summarize, participants' tool use reflected the complex relationships between short- and long-term financial wellness goals, surfacing the need for improved support to help manage all types of goals.

4.3 Discussion

In this chapter, I presented the results of my investigation into how goal duration plays a role in influencing people's motivations toward financial wellness goals. I also sought to answer the question of how we might utilize a duration-based tailoring strategy in technology design. I found that participants' long- and short-term financial wellness goals are different, affecting how they use tools for their personal finance. Participants think short-term goals relate to practical needs (e.g. paying the rent) or a desired reality that they want to have (e.g. a vacation), and have concrete ideas on the context of the goal achievement. In contrast, they tended to commit to long-term goals that serve their core values or better align with socially desirable behaviors or expectations, even though they do not necessarily have concrete ideas of the context after the goal achievement. These differences were reflected in how participants used the tools for their financial goals – the concrete and affective nature of short-term goals helped them make specific action plans (e.g., changing budget based on personal data) and have frequent engagement (e.g.,

daily or weekly check up) with both tools and their financial wellness goals, whereas, the abstract and less predictable nature of long-term goals led them to be less active to engage with tools (e.g., monthly check up) and goals (e.g., not changing plans frequently). However, I also found that short- and long-term goals are intertwined and inseparable, creating challenges for users to manage both long- and short-term financial wellness goals. In this section, I describe the theoretical and practical contributions of this study.

4.3.1 Theoretical Contribution

The findings of this study contribute to Construal Level Theory by confirming its theoretical premise in the context of financial wellness goals with regards to goal durations, and by elucidating its theoretical limitations to capture the dynamics between financial goals with different durations.

I uncovered that when people think about and describe short- and long-term goals, they differ in many ways (e.g., how concrete, affective, and socially-oriented the goals are). Some of these findings align with the core premise of CLT (Trope & Liberman, 2003) in terms that participants viewed their long term goals more abstractly and vaguely, compared to their short term goals that were more concrete and contextualized. Studies of CLT also found that people tend to perceive near events more affectively, feeling closer to them (Trope & Liberman, 2011), whereas they make a more rational (Fujita, Trope, Liberman, & Levin-Sagi, 2006) or morality-concerned (Eyal & Liberman, 2012) decision for the distant future. This may suggest that participants' aspirations toward short- and long-term financial goals could be mapped on to low- and high-level construal respectively, and a construal fit strategy could be useful to promote either short- or long-term financial goals.

In the meantime, I found that participants' personal finance goal durations are not constant, rather they are dynamic, which affects the way they envisioned their short- and long-term goals over time. Work on CLT tended to overlook these transitions of the levels of construals. Established on the basis of theories of categorization (Rosch, 1975), concept formation (Medin & Smith, 1984), and action identification (Vallacher & Wegner, 1987), the majority of studies on CLT examined its theoretical propositions by dichotomizing and often contrasting the high-level construal to the low-level construal (see Trope & Liberman, 2011), and matching either level of construal across different references (e.g., regulatory focus, message cue, message topics : Katz & Byrne, 2013). It may be worthwhile to revisit Trope and Liberman (2003), which remarked that the level of construal may appear at multiple levels (i.e. not a dichotomy) as people could construct increasingly more inclusive categories of objects (e.g., poodle, dog, mammal, animal), relative to other levels of construal, rather than treating them as an absolute binary. Noting the theoretical gap, future research should explore the dynamic relationships between different levels of construal beyond the dichotomized perspectives, contributing to CLT.

Furthermore, I surfaced the tradeoffs and tensions that arose when participants needed to juggle multiple financial wellness goals at the same time, noting that CLT does not provide any theoretical evidence for multiple and potentially conflicting construal levels. The studies on goal-setting theory remarked that multiple goals could be in conflict and create problems due to hierarchical arrangements of goals (Fried et al., 2004). In particular, it may be more complicated when two goals are mutually exclusive or invoke incompatible behaviors (e.g., saving for entertainment versus spending out of necessity). Future studies should investigate what happens to levels of construal when values or attributes of multiple goals with different durations align or

conflict with one other, and whether and how each goal could be supported by a duration-based strategy.

To summarize, my findings suggest that CLT and a construal fit strategy may provide insights to account for financial wellness goals with different durations, indicating the potential for duration-based temporal motivation. However, the theoretical basis is insufficient to account for the dynamics of goal durations and related practices, calling for future research into how we might better help balance and manage multiple financial wellness goals with varied durations that manifest different values and attributes.

4.3.2 Design Implications

The findings offer several practical implications for service or system designers as well as financial practitioners to better encourage individuals' personal finance goal-setting and goal-pursuing behaviors in day-to-day life.

When aiming to support individuals' financial wellness goals with a specific duration, designers and practitioners should note that either high- or low-level construal-focused strategies could be useful. Studies on CLT, although not tested in the personal finance goal context, inform various ways for a construal fit (e.g., gain/loss frame: White, MacDonnell, & Dahl, 2011; independent/interdependent self-view: Spassova & Lee, 2013; image types: Study 2 in this thesis; different structural features of a system, such as News Feed/Timeline Page on Facebook: Kim, Sung, Lee, Choi, & Sung, 2016; black and white/color image: Lee et al., 2014). Systems or services serving long-term financial goals (e.g., mortgage pay-off tracking systems, apps for retirement plans) could reap benefits from high-level construal-focused strategies that connect users with their core values of the financial goals (having them describe why it is important for

them to achieve certain goals). Alternatively, if mainly serving short-term goals, designers and practitioners can encourage users through low-level construal-focused strategies. For example, users could be nudged to specify the details of their goals (e.g., having them decide the precise target date and amounts) and to actively check the progress toward the goals (e.g., providing daily analytics of one's cash flow).

However, more importantly, my findings highlight the necessity to acknowledge and leverage the fluidity between the different levels of construals associated with the change of duration of goals. When a goal is progressed or a situation is changed, the duration of long- (short-) term financial wellness goals can be altered. Practitioners and designers should address the dynamics in their practice to support various financial goals of varying duration—the effectiveness of one strategy to promote a certain goal may decrease as the goal duration changes, and thus it may be worthwhile to consider changing their strategy to better address goal duration dynamics.

Furthermore, my findings highlight the challenges of managing multiple financial wellness goals with varied durations—one example was the participants' mixed reactions toward aggregated information of different accounts or goals, and another was the negative emotions toward their lapse from certain goals at the expense of others. These examples illustrate a need for supporting users to manage multiple goals or accounts. One approach might be to enable users to customize how to manage multiple accounts or goals at the same time (e.g., locating multiple goals on different pages, hierarchies, or timelines). Various tactics to help regulate oneself could be also useful, such as restrictions, limits, or hiding of certain transactions from dashboards, which would help to manage impulsivity. It may also be worthwhile to remind users that not all lapses from goals should be perceived as negative (Epstein et al., 2015). My findings

uncovered participants facing times of unexpected or unavoidable financial crisis, for example, losing a job (P11) or an illness (P18), when someone might have to pause their effort toward long-term goals. In these cases, design opportunities around managing these lapses and resuming the goal later on and reminding users about their underlying values, envisioned futures, and reasons for wanting to achieve long-term goals exist. Similarly, acknowledging values could resolve negative emotions (e.g., regret) that people may face in the pursuit of financial goals, especially for short-term ones. Kaye et al. (2014) noted that feelings of fear and concerns about the future affect people's financial decisions, often leading them into inaction. I further observed that emotions could motivate or hamper one's efforts, which needs to be considered in supporting personal finance goals. As our financial coach participants used a varied set of questions and paper-based worksheet materials (e.g., worksheet or quiz) to probe clients' values, so too should tools encourage users to surface their values first and then connect them with financial goals to keep them motivated for their financial well-being.

4.4 Summary of Contribution

In this chapter, I examined temporal motivation focusing on goal durations in financial wellness goals contexts. While gaining an understanding of individuals' various personal finance goals and their practices, I also examined whether and how CLT might be useful to support individuals' journeys of personal finance goal achievement when considering goal durations. Through the interviews with financial coaches and tool users, I learned that short- and long-term financial wellness goals are different regarding concreteness and the levels of entailed perception of emotion and social norms. However, I also found that these different aspects of financial wellness goals with different durations tend to become less distinctive as goals progress,

suggesting a construal fit strategy might not be appropriate to apply to support personal finance goals. This work assessed the boundary of the applicability of CLT in the context of financial wellness goals and highlighted its theoretical limitation that undermines the interrelated and dynamic relationships between different levels of construal. I also suggest various design implications that system designers and finance practitioners could use to support an individual's journey of personal finance goal achievement. This work further articulates the need for approaches that are more nuanced concerning duration-based tailored strategies within HCI and CSCW.

CHAPTER 5. UNCERTAIN DEADLINES FOR DISASTER PREPAREDNESS

To address my third research question *(RQ3: How can we tailor designs for tasks or activities for which deadlines do not exist?),* I examined how individuals perceive a task that does not have a fixed deadline (in this case, earthquakes) and explored how their own psychological distance toward an earthquake could be leveraged as a tailoring strategy to promote earthquake preparedness behaviors. As it is unknown when exactly an earthquake might occur, when earthquake preparedness behaviors should be completed by remains unfixed, which may not create a sense of urgency (Paton, 2003). Using the lens of CLT, I postulate that what is salient in an individual's mind may differ by their psychological distance toward a potential earthquake, and examine whether and how their psychosocial distance could be leveraged to promote earthquake preparedness behaviors to which deadlines are inevitably uncertain.

In this chapter, I review the related work on disaster preparedness and present the results of Study 4 that examined how people perceive earthquake preparedness behavior (Study 4a) and how we might tailor information design for tasks with uncertain deadlines (earthquake preparedness behaviors) as well as what we might consider when applying a construal fit strategy (Study 4b). I also discuss the contributions Study 4 and provide theoretical and design implications for designing for tasks with uncertain deadlines.

5.1 Earthquake Preparedness

Earthquakes pose a serious threat to human health and well-being (Department of Homeland Security, 2018), and thus it is critical for people to be well prepared for such disastrous events. Earthquake preparedness, which refers to the measures taken to minimize the effects of an earthquake (Meyer & Kunreuther, 2017a), could improve the quality of response, prepare people

for an influx of activity, and design a coordinated plan that reduces the waste of resources, time, and efforts, which helps them return to their normalcy as quickly as possible (Becker, Paton, Johnston, Ronan, & McClure, 2017; Kohn et al., 2012; Meyer & Kunreuther, 2017a). Various efforts are made to promote disaster preparedness (Kohn et al., 2012), and undoubtedly, technology plays a critical role in these endeavors (Becker et al., 2017; Verrucci et al., 2016). A growing number of organizations working in the earthquake management field utilize technology including websites (e.g., Federal Emergency Management Agency[5]), mobile applications (e.g., Red Cross[6]), and social media (Chavez, Repas, & Stefaniak, 2010). Online communities (e.g., Facebook Group[7]) also provide venues for individuals to facilitate awareness toward earthquakes among themselves. Despite these efforts, the levels of earthquake preparedness remain very low, even among those for who awareness of earthquake risk is high (Verrucci et al., 2016).

In the search for understanding how to improve disaster preparedness, a set of studies examined how practical preparedness strategies can be developed. These include face-to-face (Perez-Fuentes & Joffe, 2015) and digital campaign materials and interventions (Verrucci et al., 2016). Sometimes, preparedness interventions target certain population groups (Smith & Notaro, 2009) or individuals with different needs, vulnerabilities (Eisenman et al., 2006), and locations (Kirschenbaum, Rapaport, & Canetti, 2017) where past seismic activities have occurred (Becker et al., 2017). However, research indicates that current preparedness campaigns and interventions for natural hazards are not as effective as they aim to be (Meyer & Kunreuther, 2017a; Verrucci et al., 2016). The reason might be that most of the natural disaster preparedness campaigns rely on the delivery of information, despite studies consistently showing that simply providing the

[5] https://www.fema.gov/
[6] https://www.redcross.org/
[7] https://www.facebook.com/groups/DisasterPreparedness/

public with information about risk and safety skills is not sufficient to affect preparedness behaviors (Verrucci et al., 2016). This emphasizes the need for better approaches to increase the level of preparedness.

5.2 Study 4a: Leveraging Psychological Distance to Promote Earthquake Preparedness

Assuming that individuals' psychological distance toward an earthquake varies, I hypothesize that changing the focus of disaster preparation information will help increase willingness to prepare for a disaster. A critical component of promotion or campaign includes information about the target (earthquake preparedness), such as what earthquake preparedness means, why it is necessary, and how to do it. According to CLT, information appeals could be persuasive once they are congruent with individuals' psychological distance. Aligning with prior work (Fujita, et al., 2008; Kim et al., 2009), my findings in Study 2 showed that an abstract why-focused design led to a higher intention to participate in an event when it is temporally distant, rather than proximal. On the other hand, a how-focused design was more impactful when an event is in the near future, rather than the far future. Such a construal fit strategy could also work in the context of disaster preparedness even though its objective temporal boundary remains uncertain. I therefore hypothesize:

> H1. If people feel that earthquakes are far away (vs. near) from themselves, they are more likely to take actions of earthquake preparedness when reading about "why (vs. how)" of earthquake preparedness, rather than "how (vs. why)" of the behavior.

5.2.1 A Pilot Study

Before testing H1, I conducted a pilot study for two reasons. First, I sought to develop a scale with 16 items to measure individuals' psychological distance toward earthquakes and another scale with 3 items to measure their intention to perform an action for earthquake preparedness, which were adapted from prior work on climate change (Jones, Hine, & Marks, 2017; McDonald, Chai, & Newell, 2015; Spence, Poortinga, & Pidgeon, 2012). Second, I wanted to test and confirm the underlying association between individuals' psychological distance from earthquakes and their levels of construal, as no prior study examined their relationship beforehand. Similar types of pilot studies have been conducted in work on CLT (Lee, Deng, Unnava, & Fujita, 2014; Lee, Keller, & Sternthal, 2009)

To measure psychological distance toward an earthquake, I asked 16 questions covering four dimensions, including temporal (e.g., "When I think about the recent instances of

Measures for Psychological Distance from an Earthquake
Geographic Distance
When I think about the effects of an earthquake, I usually think of the countries that are far away.
My first thoughts about an earthquake are about how it will impact where I currently live.
An earthquake will mostly affect areas that are far away from where I live.
My neighborhood is likely to be affected by an earthquake.
Temporal Distance
I think an earthquake is harming people all over the world even at this point.
I think an earthquake has an immediate threat affecting people now.
I think that the future generations are more likely to have the impact of an earthquake.
When I think about the recent instances of an earthquake, I think we must take an action now to prepare for that.
Social Distance
When an earthquake happens, it will be people like me who will experience the biggest aspect.
If an earthquake happens, it will definitely affect me and my family.
I think an earthquake is likely to have a big impact on people like me
When I think about the effects of an earthquake, I think an earthquake will significantly impact people I know
Hypotheticality Distance
I am uncertain that an earthquake is really happening in my life.
I think an earthquake occurring in my life is very unlikely.
It is actually uncertain that what an earthquake would affect my life.
A lot of scientists agree that an earthquake is likely to happen in my area sometime soon.

Table 10. The Measurements for Psychological Distance from an Earthquake

earthquakes, I think we must take action now to prepare for that"), geographic (e.g., "When I think about the effects of an earthquake, my town is likely to be affected by an earthquake"), social (e.g., "When I think about the effects of an earthquake, I think an earthquake will significantly impact people I know"), and hypothetical (e.g., "A lot of scientists agree that an earthquake is likely to happen in my area sometime soon") distance (Table 10). The answers were averaged for analysis and their inter-reliability was high (Cronbach's alpha = .89).

To understand the level of construal associated with psychological distance, I asked participants to imagine a potential earthquake that might affect them and to write what came to their mind as an open-ended question. In total, 108 AMT workers generated 501 unique thoughts (4.64 ideas per person). Following Lieberman and Trope (1998), two independent researchers coded participants' responses as high-level construal thoughts, low-level construal thoughts, or other thoughts. Abstract construals are related to the predominance of why thoughts and concrete construals are related to the predominance of how thoughts (Liberman & Trope, 1998). High-level thoughts refer to the outcome or benefits of performing an activity, including the degree to which a person has a favorable or unfavorable evaluation or appraisal of earthquake preparedness (e.g., "Chances of death from earthquake are probably less if you are prepared" [P12]). Low-level thoughts refer to the means or ways to prepare for a potential earthquake, including the means of performing the behavior (e.g., "Battery-operated radio for extreme emergency situation" [P103]). Once two researchers separately coded, they compared what they coded (agreement rate = 84.6%) and resolved discrepancies with a discussion until the agreement reached 100%. Once the qualitative coding was finalized, the codes converted into quantitative data, using numerical values to statistically test the difference across psychological distances. Each thought was given a numeric value of "+1" and summed up as the total values of each

category (high-level thoughts = 200; low-level thoughts = 243). The average number of thoughts generated per person was 1.85 (high-level construal) and 2.25 (low-level construal). However, 58 thoughts were not included in the dataset as they were not directly related to the reasons or ways to take action for disaster preparedness, for example, "it creates the seismic waves" (P63), which describes what would happen in case of an earthquake.

Results of the independent-samples t-test show that the mean of thoughts related to high-level construal differs between individuals whose psychological distance is far (M = 2.19, SD = 1.76) and those who psychological distance is close (M = 1.52, SD = 1.60) at the .05 level of significance [$t(106) = 2.06$, $p < .05$]. Participants also had differing amounts of low-level construal related thoughts depending on their psychological distance toward the potential earthquake—people who feel closer to an earthquake generated a greater number of low-level construal related thoughts (M = 2.85, SD = 2.64) compared to those who feel further from an earthquake (M = 1.65, SD = 1.34) and the difference was significant [$t(106) = -2.99$, $p < .01$]. The results indicate that if people tend to think an earthquake is far in the future, they are more likely to think, 'Why prepare for earthquakes?'; in contrast, if they think an earthquake is near in the future, they tend to think, 'How should I prepare for earthquakes?' The pilot study demonstrated the association between individuals' psychological distance toward an earthquake and what comes to their mind (the different levels of construal), confirming the applicability of a construal fit strategy and setting up Study 4a to examine H1.

5.2.2 Method

To test H1, I conducted a between-subjects experiment with a 2 (psychological distance: near vs. far) x 2 (design: how- vs. why-focused information). I recruited 220 participants via AMT, a

sample value estimated from related work (Fujita et al., 2008, Cohen's $d = 0.54$). After excluding data from participants who did not complete the survey or who had failed to complete an attention check (e.g., "If you read this question, please choose 'strongly disagree'"), 172 were included for the analyses (gender: 66.1% male, 33.3% female, 0.6% self-described as non-binary; age: 29.3% of participants were in their 20s, 36.2% were in their 30s, 14.9% were in their 40s, 13.2% in their 50s, and 6.3% were aged 60 years or over, $M = 37.95$, $SD = 12.30$; ethnic composition: 74.7% Caucasian, 4% Asian/Pacific Islander, 7.5% Black/African American, 10.3% Hispanic, and 0.6% other; education: 39.1% college graduate, 34.5% some college, 6.9% graduate school, 13.8% high school, 3.4% vocational training, and 2.3% others).

Once agreeing to participate in the study, participants indicated their psychological distance from earthquakes by answering the measures (16 items; Cronbach's alpha = .93). They were then randomly assigned to either of the manipulations (why-/how-focused information, Figure 13). The information in the manipulations was crafted to induce either high-level construal, by asking higher-level reasons of earthquake preparedness, or low-level construal, by asking the specific means of the related actions, adapted from Freitas et al. (2004). The number of words was similar in both groups (high-level thoughts = 167; low-level thoughts = 168). The study purpose was introduced to obtain feedback on the brochure content for promoting earthquake preparedness, similar to Freitas et al. (2004), and participants were guided to read it through the manipulation. Next, the definition of earthquake preparedness was introduced and participants indicated whether they were willing to take any actions to prepare for earthquakes by answering the three items, adapted from Liberman and Trope (1998): "Reading the brochure, I am interested in taking necessary actions to prepare for an earthquake," "After reading this brochure, I would like to take an action for earthquake preparedness," and "Based on this

brochure, it is appealing for me to prepare for an earthquake" (Cronbach's alpha = .95). I also asked an open-ended question, "Why or why are you NOT willing to take actions to prepare for an earthquake? Please describe it in detail."

A manipulation check question was also asked, "How would you describe the focus of the brochure?", which was measured on a 7-point scale ('how/why' focused; methods/reasons for earthquake preparedness in each end). As expected, participants found the why-focused design to be concerned with the reasons for earthquake preparedness (M = 2.17) and the how-focused design to be more concerned with the means of earthquake preparedness (M = -1.13), and the difference was statistically significant [$t(171) = -15.80$, $p < .001$]. These results showed that manipulations were successful. Finally, they answered the demographic questions, were debriefed, and compensated ($1).

5.2.3 Results

I conducted a two-way analysis of variances (ANOVA) to test H1: when one's psychological distance is congruent with the construal level that an intervention targets, people will show a higher level of intention to act upon disaster preparedness. To do so, I first dichotomized psychological distance by its mean (M = 3.25) and tested the interaction effect of each group with either a why- or how-focused design. However, the result did not show a significant interaction between psychological distance and construal levels, while showing only the main effect of why-focused manipulation. In detail, participants showed a higher level of willingness to take actions for earthquake preparedness when they read why-focused information, regardless of whether their psychological distance toward an earthquake is close (M = 3.87, SD = .79) or far (M = 2.9, SD = 1.17), compared with how-focused information (close: M = 3.67, SD = .97; far:

$M = 2.67$, $SD = 1.06$). The interaction effect was not statistically significant [$F(1, 170) = .011$, $p = .92$]. This indicates that there is no clear evidence that matching construal levels and psychological distance is effective to promote earthquake preparedness. Therefore, H1 was not supported.

5.2.4 Discussion

Since H1 was not supported; therefore, to gain further insights, I analyzed the qualitative data collected by an open-ended question about participants' explanations on why they are/are not willing to take action to prepare for an earthquake. I observed that many participants considered their own personal experience of earthquakes when deciding whether they are willing to act for earthquake preparedness. For example, P147 noted:

> I also experienced the Nisqually quake as well as another earlier quake, which cracked the foundation of the old farmhouse where I used to live. The Nisqually quake was impressive and actually 'rolled' the saturated soil off a nearby field as if it were liquid waves. I witnessed this and will not forget it.

In fact, about half of the participants (52.3%) reported having prior experience of an earthquake, indicating the salience of personal experience of an earthquake in decision-making for earthquake preparedness.

I also observed that participants' attitudes toward taking action may diverge based on their personal experience of an earthquake. Some participants showed positive attitudes toward earthquake preparedness by focusing its benefits based on their prior experience:

> I have experienced multiple large earthquakes in the past because I live in Alaska, which is a region known for earthquakes. I know that it is important to be prepared, as I have seen the panic that happens after an earthquake. (P46)

In contrast, others undervalued the precautious actions toward an earthquake, also due to their experience. “I’ve lived through many. The worst one in San Francisco only killed a few people. I have much more risk of walking down the street from lightning” (P167). “We experience small earthquakes that don’t cause any damage” (P59). It is interesting to observe how the value individuals place on earthquake preparedness varies, although they are generally more likely to think of an earthquake concretely (low-level construal activated) compared with those without any prior experience of earthquakes. This may indicate that additional factors should be considered when thinking of a construal fit in the context of earthquake preparedness, such as a preformed attitude toward the target behavior.

In fact, researchers have reported that individuals are likely to have some degree of attitudinal ambivalence or mixed feelings toward events that are uncertain in terms of when, where, and how they will occur (e.g., climate change: Leiserowitz, Maibach, Roser-Renouf, & Smith, 2010; earthquakes: Becker, Paton, Johnston, Ronan, & McClure, 2017; floods: Hung, 2009) and may have difficulty in determining whether to take preparatory actions against low-probability, high-loss events (Hung, 2009). This may be partly because they are more uncertain when estimating the usefulness or importance of the action and, furthermore, preparedness behaviors often require changes in their current behaviors to attain potential but uncertain benefits.

Work on disaster preparedness suggests people often base their attitudes or decision-making on their prior experience (Becker et al., 2017), which sometimes creates negative

attitudes or biases toward the object (Meyer & Kunreuther, 2017a). These biases could lead individuals to be less concerned or unmotivated to prepare, to undervalue the importance or effectiveness of taking actions for preparedness, or to overestimate the potential costs of disaster preparedness (Becker et al., 2017). Researchers reported that negative attitudes significantly weaken the 'attitude-intention' relationship on crisis planning behaviors (Wang & Ritchie, 2012). For example, during the 2001 foot-and-mouth disease outbreak in the UK, few tourism organizations were interested in crisis planning, that is, they held negative attitudes toward its usefulness (Ritchie, Dorrell, Miller, & Miller, 2004). Other studies also suggest that biases toward disasters frequently lie at the root of why people are often under-prepared for potential disasters and that this could attenuate the effectiveness of promotional efforts (Meyer & Kunreuther, 2017a). The biased mindset on probability (negative attitude toward a target) estimates could counteract how people process information (Lermer, Streicher, Sachs, Raue, & Frey, 2015).

Taken together, studies highlight the role of the valence of attitudes in decision-making for an uncertain event, indicating that attitude toward earthquake preparedness could affect the effect of a construal fit strategy, which possibly explains why H1 was not supported. To further understand the relationship between attitude and a construal fit in the context of earthquake preparedness, I conducted an additional study, which is detailed in the next section.

5.3 Study 4b: Designing for Promoting Earthquake Preparedness

Study 4b aims to re-examine whether psychological distance could be leveraged to encourage one to undertake a task without a deadline and investigate the relationship between preformed attitudes and a construal fit strategy in the context of earthquake preparedness. I proposed that

the preformed attitude toward earthquake preparedness moderates the effectiveness of a construal fit: particularly, I postulated that a construal fit is more effective for those who have a more positive attitude to prepare for a potential earthquake, but not for those whose attitude is less positive.

I assume the above for two possible reasons. First, high-level construal might not be activated unless one perceives there is value associated with a target, which undermines the potential effectiveness of a construal fit. Concerning negative and positive attitudes of a certain target behavior, research on CLT suggests that a positive attitude (perceived benefits) is superordinate of the target, construed as high-level construal, whereas a negative attitude (perceived costs) is subordinate of the target, construed as low-level construal (Wang, Dacko, & Gad, 2008). The subordination of low-level construal to high-level construal aspects entails an asymmetry in their conditional importance (Eyal et al., 2004). This asymmetry suggests that the importance of such low-level aspects depends on the value of the high-level aspects more than the importance of the high-level aspects depends on the value of the low-level aspects. When considering the possible actions to prepare for an earthquake, feasibility considerations (e.g., building an emergency kit, practicing drills) are important only if the behavior is desirable (e.g., preparing for an earthquake is worthwhile), but desirability remains important whether feasibility is high or low. It could mean that high-level construal-focused design in a construal fit strategy would not work for those who perceive low value in earthquake preparedness, as they still construe an earthquake using low-level construal despite the fact that their psychological distance toward an earthquake is far.

Second, attitudinal or behavioral changes are less likely to happen if the target behavior does not align with individuals' beliefs, challenging the effectiveness of a construal fit strategy. Behavior is guided by various considerations and expectations or beliefs concerning the likely consequences of the behavior, which is important in forming one's attitude and intention (Ajzen, 1991). Although a construal fit results in more positive intentions and behaviors because it leads to greater fluency and perceived efficacy, which translates into perceptions of ease of engaging in the behavior (White et al., 2011), its effectiveness has not been examined when a person holds strong beliefs that negatively value the outcomes (e.g., the person does not think the behavior is worthwhile). Another well-established behavioral theory, TBP, postulates that a person's perception of the ease or difficulty of behavioral performance will affect their behavioral intention when holding attitude and subjective norm constant (Ajzen, 1991). This may mean that a construal fit strategy is more effective when individuals have a more positive attitude, compared with those with less positive attitudes. Therefore, I hypothesize:

H2. When one's psychological distance is matched with the construal level that an intervention targets, they will show a higher level of intention to act upon earthquake preparedness if they have a more positive attitude toward earthquake preparedness behavior.

H2a. If individuals think that an earthquake is far away, rather than near, they will have higher intentions to perform earthquake preparedness behavior when they read about 'why' aspects, but only if they have a more positive attitude toward earthquake preparedness behavior.

H2b. If individuals think that an earthquake is near, rather than far away, they will have higher intentions to perform earthquake preparedness behavior when they read about 'how'

aspects, but only if they have a more positive attitude toward earthquake preparedness behavior.

Assuming a construal level fit strategy may not be effective for those who have a less positive attitude toward earthquake preparedness because they are less likely to activate high-level construal while processing information, then, would it be plausible low-level construal focused appeals (e.g., 'how' aspect of the behavior) will be more persuasive compared with high-level construal focused appeals (e.g., 'why' aspect of the behavior) regardless their psychological distance? Would high-level construal appeals be perceived as more negative for those with negative attitudes toward earthquake preparedness? Prior studies provide inconsistent answers to these questions. For example, Katz and Byrne (2013) found that individuals use various parameters of construal (e.g., construal level orientation, construal level perception of choice, psychological distance to choice, and message cues) in their message processing and these parameters need to be congruent to create the effect of a construal fit. Further, message resistance may occur if individuals' parameters of construal are incongruent or do not match with each other, and individuals can have the opposite attitude or behavior than was originally intended or reject the incongruent or cue mismatching message (Byrne & Hart, 2009; Katz & Byrne, 2013). This could mean that when individuals are less positive toward earthquake preparedness, the low level construal-focused message might be more effective than the high-level construal focused message due to its congruency.

However, another study on CLT suggested the opposite effect of congruency. Cancino-Montecinos, Björklund,, and Lindholm (2018) studied CLT in cognitive conflicting (counter-attitudinal) situations and found that when people have a less positive attitude toward the target

with little sense of the action implications in mind (low-level construal) and are exposed to a conflicting or counter-attitudinal situation, they are sensitive to new action interpretations, priming them to reconstrue their mental representations in terms of higher-level meaning of the situation (high-level construal). This could mean that high-level construal focused messages might be more effective than low-level construal-focused messages when individuals have a negative attitude toward earthquake preparedness but read pro-earthquake preparedness behavior information. This inconsistency in prior work led me to examine the following research question, further exploring how to promote earthquake preparedness when individuals are less positive toward the behavior:

RQ1. If people have a less positive attitude toward earthquake preparedness behavior, would (and if so, how?) high- or low-level focused strategies be effective to increase intention to perform earthquake preparedness behaviors?

5.3.1 Method

To test H2, I conducted a between-subjects experiment with a 2 (psychological distance to a potential earthquake: near vs. far) x 2 (information design: how- vs. why-focused information) x 2 (positive attitude toward earthquake preparedness behavior: low vs. high). The study process and manipulation were similar to Study 4a. One difference was an additional question for attitude toward earthquake preparedness behavior with five items on a seven semantic differentials scale: "Based on my experience, I think earthquake preparedness is…1) worthless-worthwhile, 2) unimportant-important, 3) useless-useful, 4) unfavorable-favorable, and 5)

unpleasant-pleasant", given before showing the manipulation. Cronbach's alpha confirmed the internal consistency of the variables: psychological distance =.90; attitude = .86; intention =.93.

A manipulation check question was also asked: "How would you describe the focus of the brochure?", which was measured on a 7-point scales with two items ("This brochure focused on how (or why) I could (or should) prepare for earthquakes" and "This brochure focused on how feasible (or desirable) it is to take action for earthquake preparedness"). As expected, participants found the why-focused manipulation was more concerned with the desirability of taking action for earthquake preparedness (M = 4.12, SD = .80) compared with the how-focused manipulation (M = 3.19, SD = 1.16) ($F(248) = 52.63$, $p < .001$), and how-focused manipulation was more concerned with feasibility of taking action for earthquake preparedness (M = 4.39, SD = .62), compared with the low-level construal manipulation (M = 3.55, SD = 1.09) (F(248) = 57.30, $p < .001$). These results indicate that the manipulations were successful. Furthermore, to appropriately compare each condition (control potential compounding variables), I also measured perceived persuasiveness of manipulations by asking participants to indicate the degree of their agreement on three items (e.g., "The content in this brochure was believable/convincing/persuasive"). No statistical difference was found between why-focused (M

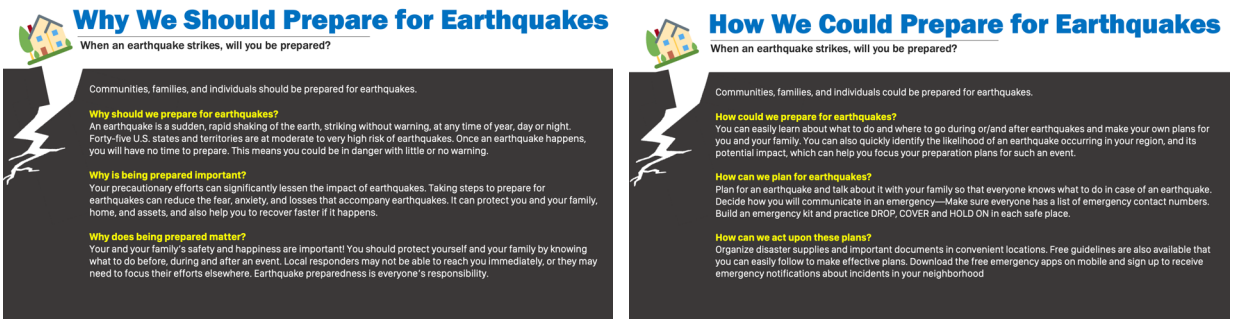


Figure 13. Information Design: Why-focused (Left) how-focused (Right)

= 4.00, *SD* = .79) and how-focused design (*M* = 4.12, *SD* = .67) for perceived persuasiveness (*F*(1, 248) = 1.53, *n.s.*), which is important to control to test their main effects for R1.

I targeted 250 participants, a sample number estimated from related work (Fujita et al., 2008, Cohen's *d* = 0.54), and initially recruited 267 participants from AMT. After cleaning the data with the same standards as applied in Study 4a, 250 were included for the analyses (gender: 56.7% male, 42.1% female, 1.2% self-described as non-binary or gender-fluid; M_{age} = 36.37, SD_{age} = 10.75; ethnic composition: 75.8% Caucasian, 8.7% Asian/Pacific Islander, 8.3% Black/African American, 5.6% Hispanic, and 1.6% other; education: 43.3% college graduate, 28.6% some college, 12.7% graduate school, 11.5% high school, 2.8% vocational training, and 1.2% others).

5.3.2 Results

To examine H2, H2a, and H2b, I conducted a three-way ANOVA. To do so, similar to Study 4a, I first assigned the dummy variables for grouping the participants by low/high attitude (*M* = 5.62, *SD* = 1.1) and close/far psychological distance toward an earthquake (*M* = 3.13, *SD* = .80), and tested a three-way interaction effect with attitude, psychological distance, and design focus.

The result shows the moderating effect of attitude on earthquake preparedness behaviors on the effect of a construal fit between psychological distance and information design (*F*(1, 248) = 4.90, $p < .05$, $\eta_p^2 = .02$). For people who have a more positive attitude toward earthquake preparedness behaviors, they are more willing to take actions for earthquake preparedness when their psychological distance from earthquakes are congruent with the persuasive information (*M* = 5.70, *SD* = 1.37) compared with the incongruent case (*M* = 5.22, *SD* = 1.38; Figure 14). However, the effect of congruency between psychological distance and the information design

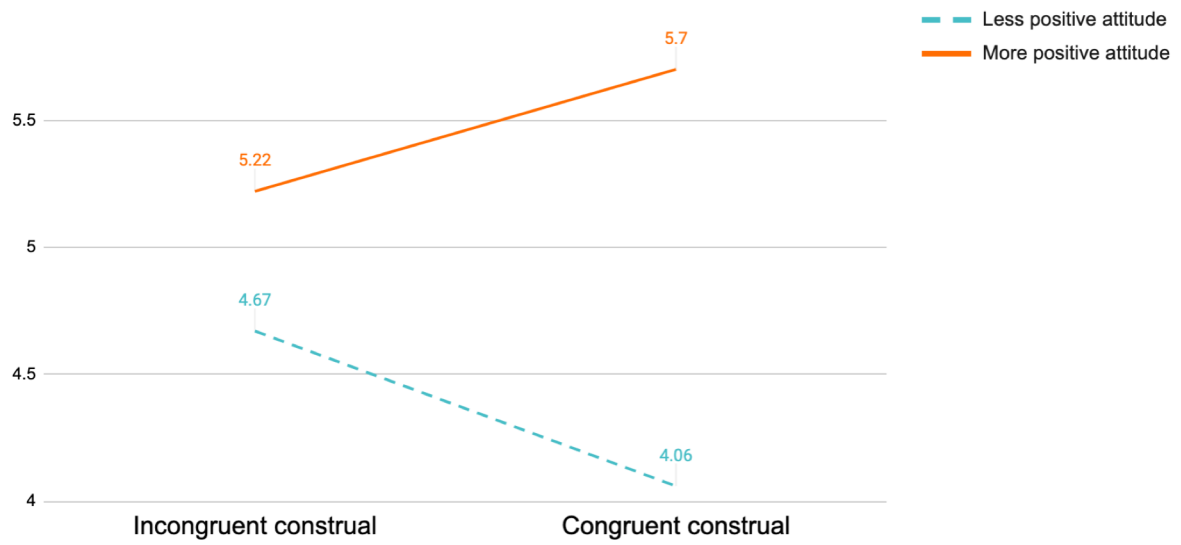


Figure 14. The Interaction Effect between Attitude toward Earthquake Preparedness and Congruency between Individual's Construal Level and Information Design

seems to be reversed for those who have a less positive attitude toward earthquake preparedness—the target behavior—as they were more willing to do something related to earthquake preparedness when they read the information incongruent with their psychological distance ($M = 4.67$, $SD = 1.24$), compared with the congruent case ($M = 4.06$, $SD = 1.45$). This indicates the effect of a construal fit strategy to increase individuals' intention to prepare for an earthquake depends on whether they have a more positive attitude toward the behavior itself (H2 supported).

To test H2a and H2b, I conducted a two-way ANOVA for those who have a more positive attitude toward earthquake preparedness behavior (Figure 15). The result shows that for those who have a more positive attitude toward earthquake preparedness behavior, the effect of how-focused information differed by individuals' psychological distance toward an earthquake. After reading how-focused information, participants who think an earthquake is near ($M = 5.92$, $SD = 1.15$) showed higher intention to perform earthquake preparedness behavior compared with

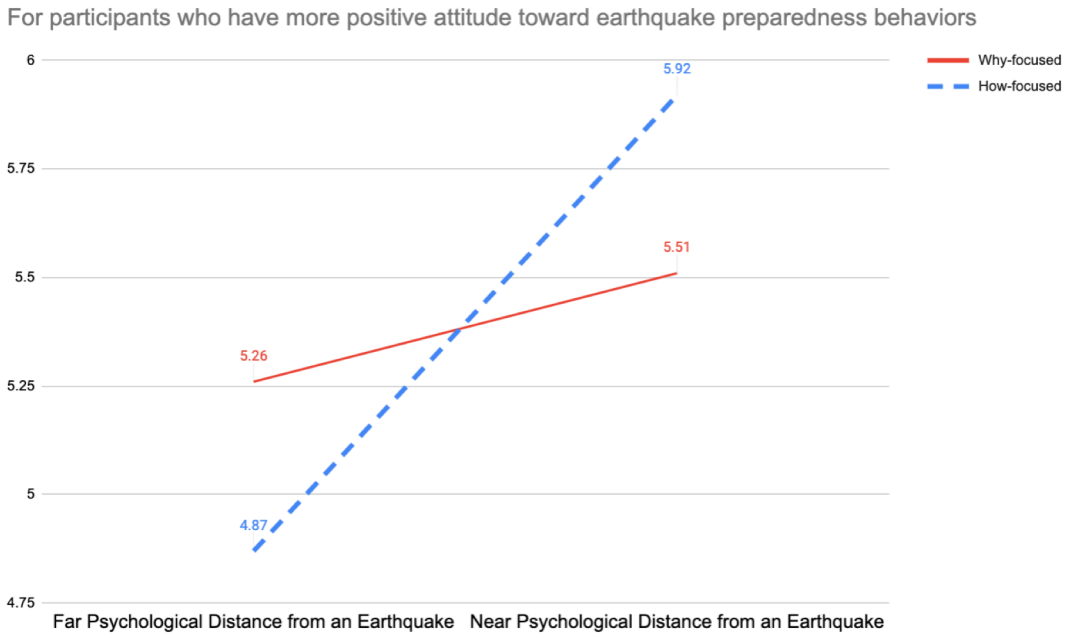


Figure 15. The Interaction Effect between Psychological Distance& Information Design (Why vs. How-focused) for Participants with *more* Positive Attitude toward an Earthquake Preparedness

those who think that an earthquake is far away ($M = 4.87$, $SD = 1.53$) ($F(1,78) = 12.05$, $p < .001$, $\eta_p^2 = .13$). Therefore, H2b was supported.

The results indicate that when people have a preformed positive attitude toward the behavior itself, the congruency between low-level construal focused (how) design and their 'close' psychological distance toward an earthquake is effective in increasing their intention to prepare for earthquake. On the other hand, for those who have a more positive attitude toward earthquake preparedness behavior, the effect of why-focused information to participants' intention to perform earthquake preparedness does not differ by whether they think earthquake is far away ($M = 5.26$, $SD = 1.67$) or near ($M = 5.51$, $SD = 1.18$) ($F(1,59) = .44$, *n.s*). Therefore, H2a was not supported. It remains unclear why H2a is not supported (I would assume why-focused design is relatively weak, although its perceived persuasiveness is comparable to the how-focused design), regardless, I did not find sufficient evidence that the effect of why-focused

design differs by individuals' psychological distance toward an earthquake. I further discuss this in the discussion section.

For participants who have a more positive attitude toward earthquake preparedness behavior, their psychological distance toward an earthquake had a significant main effect ($F(1, 141) = 7.62$, $p < .01$, $\eta_p^2 = .05$): participants who perceived an earthquake as near in the future ($M = 5.75$, $SD = 1.18$) had higher intentions to perform earthquake preparedness behavior than those who perceived an earthquake as far in the future *(*$M = 5.06$, $SD = 1.59$). However, information design does not show any main effect ($F(1, 141) = .001$, *n.s.*). Overall, these findings suggest that although the effect of a construal fit strategy to increase individuals' intention to prepare for an earthquake depends on whether they have a more positive attitude toward the behavior itself, this can be mainly attributed to the congruency between close psychological distance and how-focused design (low-level construals) rather than the congruency of high-level construals.

Although not hypothesized, I noted that a construal fit decreased intention to perform the target behavior for those who have a less favorable attitude toward earthquake preparedness behaviors (Figure 14). When investigating this further, I found that participants who have a less positive attitude toward preparedness behaviors and whose psychological distance toward an earthquake is far had a lower intention to perform the behavior ($M = 3.51$, $SD = 1.28$) even though they read about the behavior in the why-focused design, which should be congruent with their salient construal (Figure 17). This was much lower than the incongruent case for far psychological distance with the how-focused design ($M = 4.49$, $SD = 1.32$) ($F(1, 74) = 10.17$, $p < .01$, $\eta_p^2 = .01$; Figure 18). I also noted that for the participants whose psychological distance toward an earthquake is far, the effect of why-focused design actually differs by their preformed attitude toward earthquake preparedness behaviors: their intention to perform earthquake

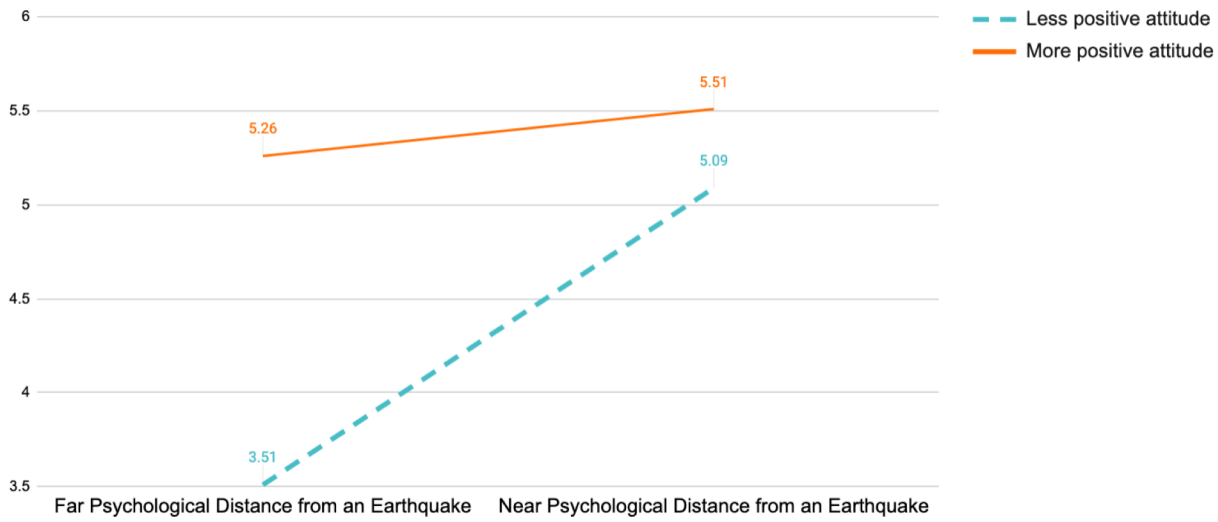


Figure 16. Interaction Effect between Psychological Distance and Attitude toward Earthquake Preparedness Behaviors on Why-focused Design

preparedness is much higher when they have a more positive attitude (M = 5.26, SD = 1.67), which is significantly higher than those who have less positive attitudes toward the behavior ($F(1, 113) = 6.74$, $p < .01$, $\eta_p^2 = .06$; Figure 16). The results of these post-hoc analyses indicate that the effect of 'why' design depends on the individuals' attitudes toward earthquake preparedness behavior, even if their psychological distance toward earthquake is congruent with the level of construals that the 'why' design activates (high-level construal). In other words, the same information, the 'why' of the behavior, could result in the lowered intention to perform the behavior for those who have a less positive attitude toward earthquake preparedness behavior.

When people have a less positive attitude toward earthquake preparedness, then, which design focus might be more effective (RQ1)? To understand, I tested the main effect of why- or how-focused information design through a two-way ANOVA for the population (Figure 17) after controlling for the effect of perceived persuasiveness of either design, as aforementioned. The result shows that for those who have a less positive attitude toward earthquake preparedness, the how design is more effective to promote earthquake preparedness (M = 4.71, SD = 1.28) than the

why design ($M = 4.06$, $SD = 1.39$) ($F(1, 107) = 5.46$, $p < .05$, $\eta_p^2 = 05$), regardless of individuals' psychological distance toward an earthquake. This means when individuals have a less positive attitude to earthquake preparedness behaviors, they are more likely to act upon the behaviors if they are described with a focus on its how aspect rather than its why aspect, regardless of whether they perceive an earthquake as close. The main effect of psychological distance was significant: when participants felt close to an earthquake ($M = 5.2$, $SD = .94$), their intention to perform earthquake preparedness behavior was higher than those who felt far away to an earthquake ($M = 4.05$, $SD = 1.39$) ($F(1, 107) = 22.07$, $p < .001$). However, there was no interaction effect between psychological distance and design focus ($F(1, 107) = 2.19$, *n.s.*).

To summarize, I found that a preformed positive attitude toward the behavior moderates the effect of the congruency of construal to increase individuals' intention to prepare for an earthquake. Specifically, for those who think an earthquake is proximal, the low-level construal focused (how) design is much more effective if they have more a positive attitude toward the behavior. Furthermore, for those who think an earthquake is distal, the high-level construal focused (why) design is effective only if they have a favorable attitude toward the behavior. On

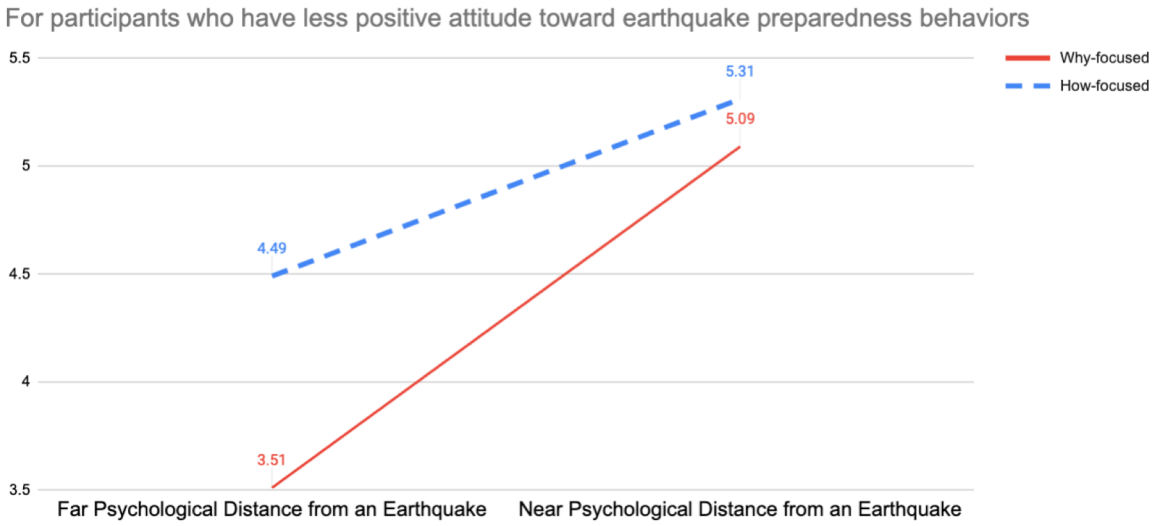


Figure 17. The Interaction Effect between Psychological Distance& Information Design (Why vs. How-focused) for Participants with *less* Positive Attitude toward an Earthquake Preparedness

the other hand, if people are less favorable to performing earthquake preparedness behaviors, the low-level construal focused design is better to promote the intention to prepare for an earthquake, rather than the high-level construal focused design.

5.4 Discussion

In this study, I explored how we could leverage CLT and a construal fit strategy to promote earthquake preparedness behaviors as a task without a deadline through a set of experiments. I demonstrated that a mere congruency between individuals' psychological distance and information design may not be as effective to promote earthquake preparedness behaviors as expected. Rather, the pre-established attitude toward earthquake preparedness behaviors can moderate the effect of a construal fit in increasing individuals' intention to perform earthquake preparedness behavior (H2). Specifically, for those with a more positive attitude toward earthquake preparedness behaviors, I found that how-focused design is effective to promote these behaviors when they perceive an earthquake is proximal (H2b), whereas the effect of why-focused design may not differ by individual's psychological distance (H2a). In the meantime, I also found that for those who have a less favorable attitude toward earthquake preparedness behaviors, the why-focused design could actually result in lowered intention to perform the behavior even when they perceive an earthquake is distal, which is the congruent construal with the why-focused design. Thus, for those who have a less positive attitude toward earthquake preparedness behaviors, in general, how-focused design might be effective to promote such behaviors compared with why-focused design (RQ1). To summarize, I found that utilizing the congruency of low-level construals (emphasizing how-focused information design for people who perceive an earthquake is proximal) could be a useful strategy to promote earthquake

preparedness, a task whose deadline is not clearly fixed. In the meantime, it may be worthwhile to refrain from using why-focused design to promote earthquake preparedness for those who perceive an earthquake is distal and do not value the behavior, as it could actually engender the opposite effect—demoting the behavior. Next, I further discuss the theoretical and practical contributions of this work.

5.4.1 Theoretical Contribution

I demonstrated the importance of considering attitude toward earthquake preparedness behaviors when promoting the behavior through a construal fit strategy, which highlights the moderating role of preformed attitudes in decision-making for tasks without a fixed deadline. This may align with Hoeffler (2003), who noted the greater importance of positive attitude (perceived usefulness) toward objects with uncertainty ('really new products' in their study). The study found that people are more uncertain when predicting the utility of a really new product, leading to problems when estimating the future utility of the product, and when mapping purported benefits onto their own usage situations (Hoeffler, 2003). Similarly, it is plausible that my participants may or may not be uncertain about the potential utility of preparedness behavior, which ultimately affects the effectiveness of the tailored intervention based on individuals' psychological distance toward an earthquake. In fact, their attitude had a relatively lower power to predict behavioral intentions of earthquake preparedness behaviors ($r = .43$), perhaps due to its ambivalent nature, compared with other behaviors, such as social event participation (Study 2a: $r = .50$; Study 2b: $r = .64$, Study 2c: $r = .56$). The findings emphasize a need for approaches that are more nuanced to promote earthquake preparedness, which considers the individuals' attitude toward the behavior itself and their psychological distance toward a potential earthquake.

How-focused design is effective to promote earthquake preparedness behaviors for those who think an earthquake may occur in the near future, which aligns with the theoretical premise of CLT. As aforementioned, work on CLT tends to examine the context of tasks with regards to distance from a clear temporal reference (e.g., a year from now, tomorrow). Broadening the theoretical scope of CLT, I demonstrated that a construal strategy (especially for low-level construal) is effective even in the context of earthquake preparedness behavior, a task for which a deadline remains unfixed due to the uncertainty of the event (an earthquake). This finding is similar to the results reported in Chapter 3, where I found that perceived behavioral control (PBC; low-level construal related) is a strong predictor of intention in the near future, as people focus on the feasibility of the event (Study 1) and that low-level construal driven designs (how-focused design, text-plus-image, and photos) are better in encouraging event engagement for near-future events than for far-future ones (Study 2). Similarly, the findings of this study suggest the congruency of low-level construals is useful to promote tasks without a fixed deadline.

However, I did not find sufficient evidence for the effectiveness of why-focused design to promote earthquake preparedness behaviors for those who think an earthquake may occur in the far future (H2a), as prior studies on CLT suggested. There may be two potential explanations. One is that the main effect of psychological distance is strong compared to the effect of interventions, which may attenuate the effect of why-focused design on the participants' intention to perform earthquake preparedness behaviors when they perceive an earthquake is far away. Another explanation is plausible based on the results of Study 1. In Study 1, I found that PBC (low-level construal focused) may also be an important predictor of intention to participate in the far-future event (high-level construal activated), especially for those who hold a higher attitude toward the planned behavior. This indicates that a low-level construal focused strategy

(how-focused design) could be effective even to promote the event far in advance if it targets individuals who have a stronger positive attitude toward the event. In this study, for those whose attitude toward the behavior is more positive, there is no statistical difference in the effectiveness between how- and why-focused design even though their psychosocial distance toward an earthquake is far ($F(1, 54) = .84$, *n.s.*). This may explain why the congruency between high-level construals was not effective to promote the behavior although people have positive attitude toward the behavior.

Furthermore, why-focused design is effective for people who think an earthquake may occur in the far future only if their attitude toward earthquake preparedness behavior is more positive. On the other hand, if they think the behavior is less worthwhile, the intervention could actually lower their intention to perform preparedness behaviors, even though the way individuals perceive an earthquake (far away in the future) is congruent with why-focused design. This may align with studies on the boomerang effect, which refers to the effects that move in the opposite direction of what was intended (Arvai & Rivers, 2013). Researchers explain that if an individual feels that freedom is restricted, they may engage in the opposite or less desired activity, motivated by their desire to restore the freedom as a form of psychological reactance (Dowd, Wise, & Steven, 1991). For example, if an individual believes that policy action in response to climate change is likely to restrict certain personal choices, the individual may respond by attacking both relevant climate science and the individuals discussing the risk that climate change may pose to society (Byrne & Hart, 2009). It would be plausible that when a participant was forced to read about the importance of taking action toward earthquake preparedness, which they may not agree with, they could feel less inclined to perform the activity as an unintentional reactance. Boomerang effects have been documented in multiple domains,

including health behavior modification, media literacy interventions, and environmental campaigns (Bryne & Hart, 2009). Similarly, I uncovered that although the information focus is congruent with individuals' psychological distance, the same information could create a boomerang effect among individuals who undervalue earthquake preparedness behaviors, especially for those who perceive an earthquake is far away.

Additionally, this work enabled me to take a step toward leveraging psychological distance in the context of earthquake preparedness, as a way of increasing motivation toward the tasks that do not have a specific deadline. I created a measurement of psychological distance toward an earthquake and examined its validity three times through a series of experiments. The measure was consistently reliable throughout different studies (Cronbach's alpha for the pilot test: .89; Study 4a: .93; Study 4b: .90). Using the measurement, I found that individuals have a wide range of psychological distances toward an earthquake (kurtosis = -.17, normally distributed) even though they do not have any objective reference of a potential earthquake on which to base their judgment. I also demonstrated that the varied psychological distances toward an earthquake can be associated with either high-level construals or low-level construals, which serves as an empirical basis of the effectiveness of CLT for tasks without fixed deadlines. To my knowledge, this is one of the first studies to examine CLT in the context of earthquake preparedness; future studies can utilize the measure of psychological distance and further explore how CLT could be theoretically and practically broadened to understand people's behaviors in the absence of specific deadlines.

Overall, this work contributes to existing research on CLT. I offer empirical evidence of the degree of effectiveness of tailoring designs based on CLT in the context of earthquake preparedness. Further, I extend on this body of research of CLT by highlighting the importance

to consider additional factors that affect the influence of a construal fit strategy (e.g., attitudes toward a target behavior) when applying a construal fit strategy. In the next section, I describe the practical implications of this work.

5.4.2 Practical Implications

The findings offer several practical implications for both practitioners and designers who support or promote earthquake preparedness behaviors. First, this work calls attention to individuals' preformed attitudes toward behaviors when designing information tailored to their psychological distance from targets that do not have clear deadlines. I recommend practitioners consider individuals' attitude toward earthquake preparedness and their perception toward a potential earthquake separately and also consider the moderating effect when working to promote earthquake preparedness. In a review of 244 web and mobile technologies for earthquake/fire preparedness behaviors, Verrucci et al. (2016) found the majority provide actionable information to the public as a set of guidelines or 'do/don't' lists for earthquake preparedness; however, the information provided does not take heed of the past experiences of their users or their preformed attitudes. Extending this study, I found that the same information could engender different impacts on individuals' intention to perform earthquake preparedness behaviors depending on what extent they value the behavior itself based on their prior experiences. It indicates that practitioners or designers should consider identifying individuals' preformed attitudes prior to providing adequate information. Similar to interventions for health behavior change (Fogg, 2002), web or mobile technologies could have users set their general attitude or experiences of an earthquake and provide tailored information to better encourage them to make actions for

earthquake preparedness. Interventions for earthquake preparedness could do something similar to improve its effectiveness.

When targeting people who think an earthquake is imminent and their preformed attitude is positive, one strategy would be to emphasize how to prepare for an earthquake when promoting earthquake preparedness behaviors. This could take the form of a list of actionable recommendations, such as creating a family plan, having a family earthquake kit with listed key supplies, or methods for securing or moving heavy appliances, in alignment with the common way of promoting earthquake preparedness (Verrucci et al., 2016). Similar to Chapter 4, the various ways of activating a certain level of construal examined in other CLT-related work (Burgoon, Henderson, & Markman, 2013) could be useful if targeting people who think an earthquake is imminent or inhabit an area where an earthquake is predicted to occur in the near future. On the other hand, when targeting people who think an earthquake is distal, my findings suggest to rather focus on further increasing positive attitudes toward earthquake preparedness and utilize this to boost the effect of why-focused interventions to promote earthquake preparedness. One way could be to help reconnect people with their previous experience of precautious activities (e.g., reminding of past personal experiences to increase subjective instrumental or affective values of the behavior). Making one's positive perception of preparedness behaviors (e.g., perceived usefulness, perceived ease of doing) salient in their mind could increase the effects of interventions that focus on the why aspect.

In the meantime, practitioners and designers should use different strategies for people whose attitude toward preparedness behaviors is rather negative. My findings illustrate that the how-focused (low-level construal) strategy might be better for those who do not see the value of doing the behavior. In this case, the strategies could focus on lowering perceived barriers of the

behavior, such as providing links to e-commerce sites where people could buy earthquake preparedness kits easily. More importantly, it might be worthwhile to help resolve individuals' biases toward a potential earthquake, if any. Although one might not find preparedness behaviors valuable based on their experience, there is no guarantee the upcoming earthquake will be similar to previous ones nor that the usefulness of precautionary behaviors would be similar. Practitioners and designers should help people separate their previous experience from the expected future experience, including informing them how a potential earthquake might be different from previous ones or helping to assess what worked or did not in their previous precautionary behaviors, so that they could correct their biases and prepare for a future disaster.

5.4 Summary of Contribution

In this chapter, I examined the temporal motivation of tasks without a certain deadline and explored how to increase motivation to perform earthquake preparedness behaviors. I sought to understand whether CLT is applicable to promote a task with uncertain deadline, and if so, to what extent a construal fit strategy might be effective. Through a series of online experiments, I learned that the congruency between low-level construals could increase individuals' motivation toward earthquake preparedness behaviors: emphasizing the *how* of a behavior in the intervention might be a good approach to promote earthquake preparedness, especially for those who perceive an earthquake is near in the future. On the other hand, I also found that congruency between high-level construals could actually lead to the unexpected opposite reaction—lowering individuals' intention to perform earthquake preparedness behavior—if they have a less favorable attitude toward the behavior itself, highlighting the importance of considering preformed attitudes when promoting a task without a clear deadline. Overall, this work builds

upon and expands research on CLT by demonstrating the applicability of construal fit strategies in the context of tasks without a deadline, earthquake preparedness behaviors, and by identifying an additional factor, the preformed attitude toward the behavior, which must be considered when applying a construal matching strategy. Designers or practitioners could also use the design strategies proposed in this work to better promote earthquake preparedness.

CHAPTER 6. THE KEY TAKEAWAYS: CROSS-STUDY ANALYSIS

Across the four different studies presented in this dissertation, I observed several cross-cutting themes that provide insights for those designing for temporal motivation (Table 11). In addition to applying the lens of CLT to each of the studies, I also used similar constructs of interest (or dependent, independent variables) and measurements such as motivation to perform the behavior, and attitude toward the behavior in each study (Table 12), which enabled me to compare the findings across the studies. Despite differences among the findings, in part due to the diverse study domains (Study1, Study2: social events; Study3: financial wellness goals; Study4: earthquake preparedness behaviors), I found consistent patterns of temporal motivation emerged from the studies, indicating the overarching implications of designing for temporal motivation. In this chapter, I summarize these major takeaways while identifying and discussing the similarities and differences among the studies.

Takeaway 1: A Time-based Strategy Could Increase User Engagement

All of my study findings indicate that a time-based tailoring strategy could be useful to increase user engagement. In Study 1, I found that the salience of different factors that influence

Main takeaways	Distance		Duration	Deadline
	Study 1	Study 2	Study 3	Study 4
Different strategies are effective to increase engagements depending on 'time'	X	X	X	X
It is critical to consider attitude toward the behavior when applying a time-based strategy		X		X
The Effectiveness of high-level construal fit strategy could be more sensitive to other factors	X	X		X
The Effectiveness of low-level construal fit strategy tends to be more stable than that of high-level construal ones	X	X		X
A time-based strategy may not be as effective as expected if a certain level of construal changes or conflicts with different levels of construal			X	

Table 11. The Main Takeaways from the Studies in the Thesis

motivation (i.e., AT, PBC) changes, depending on temporal distance toward an event. In Study 2, I found that a construal fit could increase motivation. Especially, high-level construal focused-design is more effective to increase motivation when temporal distance toward a target event is "far", rather than "near", which was much stronger than the effectiveness of a low-level construal fit (e.g., providing low-level construal focused design when a target event is near). In Study 3, I observed that financial wellness goals differ by their duration – what participants

Motivation to Perform the Behavior (Dependent Variable; Construct of Interest)	Construal		Attitude toward the Behavior (Independent or Moderating Variable)
	Low-level	High-level	
Study 1a & Study 1b *Motivation (Behavioral Intention) to participate in the event* • I intend to participate in [the event] • I plan to participate in [the event]	Near temporal distance to events	Far temporal distance to events	*The degree to which a person has a favorable or unfavorable evaluation of participating in the event* For me, participating in [the event] would be...1) bad-good, 2) useless-useful, 3) unpleasant-pleasant, 4) unenjoyable-enjoyable
Study 2a, Study 2b & Study 2c *Motivation (Behavioral Intention) to participate in the event* • I intend to participate in the event • I plan to participate in the event • I am willing to participate in the event • I am inclined to participate in the event • I am likely to participate in the event	Near temporal distance to events	Far temporal distance to events	*The degree to which a person has a favorable or unfavorable evaluation of participating in the event* For me, participating in the event would be...1) bad-good, 2) useless-useful, 3) unpleasant-pleasant, 4) unenjoyable-enjoyable
Study 3 *Motivation or behavior to commit & pursue financial wellness goals* • How would you think your short- and long-term goals are, if any? • How do you pursue either or both short- or/and long-term goals?	Short-term duration of goals	Long-term duration of goals	N/A
Study 4a & Study 4b *Motivation (Behavioral Intention) to perform preparedness behaviors for a potential earthquake* • Reading the brochure, I am interested in taking necessary actions to prepare for an earthquake • After reading this brochure, I would like to take an action for earthquake preparedness • Based on this brochure, it is appealing for me to prepare for an earthquake	Short psychological distance toward an earthquake	Long psychological distance toward an earthquake	*The degree to which a person has a favorable or unfavorable evaluation of the behaviors to take precautionary measures for a potential earthquake, based on their prior experience* Based on my experience, I think earthquake preparedness is...1) worthless-worthwhile, 2) unimportant- important, 3) useless-useful, 4) unfavorable-favorable, and 5) unpleasant-pleasant'

Table 12. The Summary of Major Constructs and Variables

expected, what motivated them to pursue a certain financial wellness goal, and how they use tools were different for short- and long-term financial goals, indicating the potential of duration-based strategies in the context of personal finance goals when goal durations are clearly defined. Lastly, in Study 4, I found that the effect of a construal fit (e.g., a fit between high-level construal design and individual's far psychological distance) increased individuals' motivation to perform earthquake preparedness behavior —as long as their attitude toward the behavior was positive. Collectively, these findings demonstrate that time-based strategies could increase user engagement in different contexts. In the meantime, I surfaced additional factors that should be considered when applying time-based tailoring strategies such as the change of goal durations (Study 3) and pre-formed attitude toward the behavior (Study 4).

Takeaway 2: It is critical to consider attitude toward the behavior when applying a time-based strategy

This work also highlights that attitude toward the behavior is an important factor when it comes to time-based strategies based on CLT. In Study 4, I found that the attitude toward earthquake preparedness behaviors can moderate the effectiveness of a construal fit strategy, highlighting the need to consider pre-formed attitudes in decision-making for tasks without a fixed deadline.

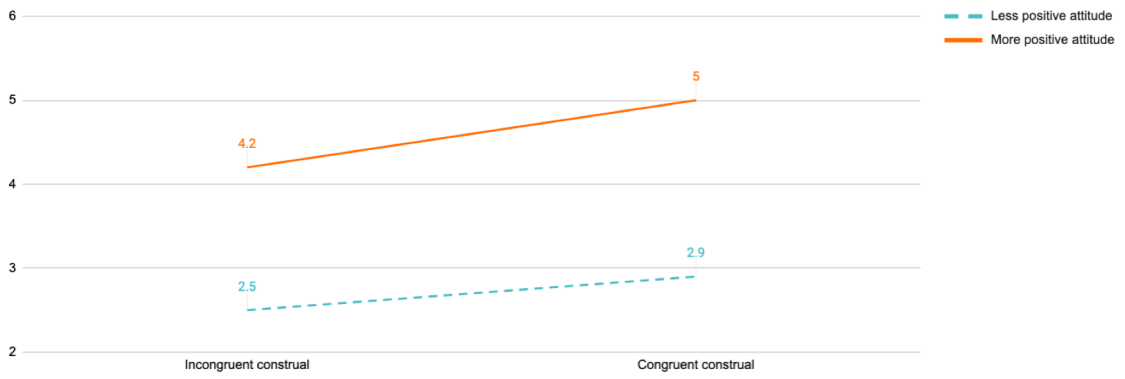


Figure 18. The Effect of Attitude on Congruency of Construal Levels (between event page design and temporal distance from an event) from Study 2a

I also found that this finding may hold in the context of social event participation when I revisited the data in Study 2a, in which I explored the fit between information (why/how-focused) design and temporal distance toward a social event, similar to Study 4. To do so, I dichotomized the Study 2a data set by the mean of the attitude toward the behavior (*M*=5.52), and teased out the effectiveness of a construal fit strategy by the group with more and less positive attitude. As shown in Figure 18, if participants had a more positive attitude toward participating in the event, they had higher motivation to do so, when the event description was congruent to the temporal distance to the event (i.e. why-(how-) focused information presented far (near) in advance of the event (*M-diff*=.79) ($F(1, 115) = 4.35$, $p<.05$)). On the other hand, if participants had less positive attitude toward the behavior, the congruency between information design and an individual's psychological distance was no longer effective (*M-diff*=.33) ($F(1, 66) = .04$, *n.s.*). In particular, for those whose attitude toward participating in the event is less positive, I also observed that the how-focused design (*M*=3.37, *SD*=2.26) is more effective than the why-focused design (*M*=2.37, *SD*=1.89) regardless temporal distance from the event ($F(1, 66) = 4.24$, $p<.05$)) (Figure 18-1), which is similar to H2b in Study 4b (Figure 15, and Figure

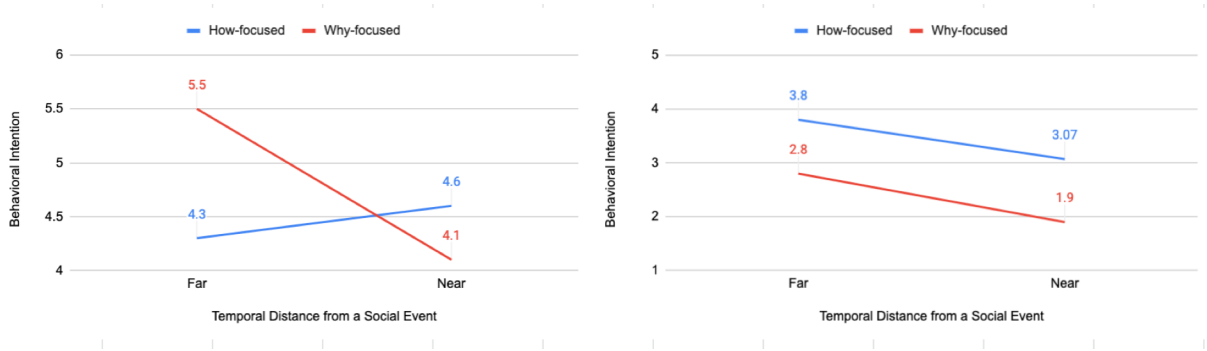


Figure 18-1. The Detailed Effect of Congruency of Construal Levels (between event page design and temporal distance from an event) from **Study 2a** by Attitude: a Construal Fit is effective to increase intention to participate in the event for those whose attitude is more positive (left), but not for those whose attitude is less positive (right)

17). To summarize, the findings from both Study 2a and Study 4b illustrate the moderating effect of attitude toward the behavior on a construal fit strategy.

Additionally, I also noted a difference between Study 2a and Study 4b: the overall directions of the graphs are opposite – in Study 2a (Figure 18-1) participants had higher motivation when an event is far in the future, compared to the event that is near in the future, whereas in Study 4b (Figure 15, and Figure 17), participants' motivation was higher when they perceive an earthquake is proximal, rather than distal. The difference may attribute to the nature of the behaviors (Study 2: event participation, Study 4: earthquake preparedness). Prior research found that people have opposite patterns of intertemporal choice for rewards and costs (Murphy, Vuchinich, & Simpson, 2001). It may indicate that participating social events is generally more rewarding than preparing for an earthquake, resulting in the directions of motivations to perform the behaviors being shifted. It therefore may be worthwhile to consider the type of the behavior (e.g. reward or cost) when applying a construal fit strategy.

Takeaway 3: The Effectiveness of a high-level construal fit strategy could be sensitive to other factors, whereas that of a low-level construal fit tends to be stable

Throughout the studies, I observed the relative strength of a low-level construal fit strategy, when compared to a high-level construal fit strategy.

I found that the effectiveness of a high-level construal fit strategy could be sensitive to other factors (Study 1 & 2: temporal distance; Study 1 & 4: attitude). In Study 2, I found that in comparison to the high-level construal designs, the effectiveness of low-level construal designs (how-focused design: Study 2a, text-plus-image: Study 2b, and photos: Study 2c) did not vary much between the proximal and distal (see Figure 6, 8, 11), indicating that high-construal

focused strategies are more *time*-dependent, compared to low-level construal designs. Furthermore, in Study 4, I found that why-focused design is effective for people who think an earthquake may occur in the far future only if their *attitude* toward earthquake preparedness behavior is positive. If not, the same intervention could actually *lower* their intention to perform preparedness behaviors, even though the way individuals perceive an earthquake (far away in the future) is congruent with why-focused design. Furthermore, when I conducted additional analysis on Study 2a, I found similar patterns with regards to attitude and why-focused design. In Study 2a, the people who valued the event less showed significantly lower intention to participate in the social event (M=2.80, SD=2.13), compared to those who valued it more (M=5.49, SD=1.74), and the difference was significant ($F(1, 48)=24.06$, $p<.001$). This may indicate a potential boomerang effect of a less positive attitude on the effectiveness of a construal fit strategy, at least in Study 2a, similar to Study 4b. However, I did not observe that the incongruence between information design and individual's psychological distance decreased their intention to participate in the social event even if they held a less favorable attitude to the event, like Study 4b ($F(1, 66) = .04$, *n.s.*) (Figure 18, the mint-colored dotted line). One possible explanation may be that the boomerang effect of individuals' attitude toward a social event is not strong enough to change their behavioral intentions, but only enough to cancel out the effectiveness of a construal fit strategy. This could suggest that people's attitudes toward earthquake preparation are more negative than toward social events, or the relative strength of a construal fit manipulation is weaker compared to those in Study 4b.

On the other hand, I found that a low-level construal fit strategy tends to be more stable, compared to a high-level construal fit strategy. In Study 1, I found that although PBC (a low-level construal related factor that involves a focus on the feasibility), is a significant predictor of

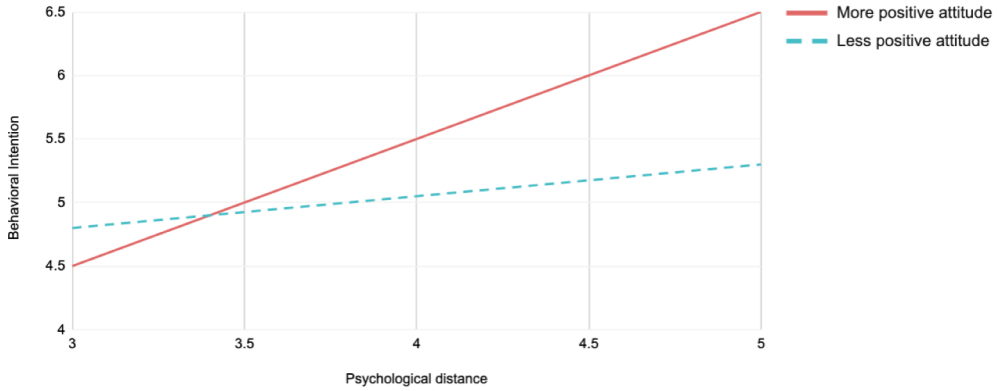


Figure 19. The Potential Interaction Effect between Attitude and Psychological Distance in How-Focused Design for those whose attitude is more positive (Study 4b)

intention in the far future, PBC may still be an important predictor of intention, especially for those who hold higher AT towards the planned behavior. Furthermore, In Study 1, I previously demonstrated that for those who hold higher AT towards the planned behavior, PBC may still be an important predictor of intention of the behavior in the far future, despite the salient construal being incongruent with temporal distance (Section 3.2.2). Similarly, when I examined the potential interaction effect between attitude and psychological distance in how-focused design for those whose attitude is more positive using the data from Study 4, I found that if one holds a more positive attitude toward earthquake preparedness behavior, a how-focused design could still be effective to increase their intention to perform the behavior, although their psychological distance to an earthquake is far (incongruent construal), compared to those with low attitude (Figure 19). To summarize, designers and practitioners should consider leveraging the relative strength of a low-level construal fit strategy, as opposed to a high-level construal fit strategy, when it is necessary.

Takeaway 4: A time-based strategy may not be as effective as expected when a target's temporal aspect changes or when managing the multiple targets' time aspects

While I demonstrated that a construal fit strategy might be applicable to address motivation at the different dimensions of time (Study 1, 2, 3 & 4), in Study 3 I also found cases where a time-based strategy may not be effective. When there are unintended situational changes (e.g. P18 put off her short-term goal to buy a car due to the unexpected loan for her emergency surgery), participants may change the way they construe the same goal (e.g. P19 had pursued a long-term goal to save for kid's college, which became a more imminent goal as her child started college). Additionally, when participants pursued multiple goals of different durations at the same time, they faced challenges in managing the tradeoff between short- and long-term goals, and a time-based strategy may not necessarily provide the appropriate support. These findings indicate the limitations of a time-base strategy, calling for the attention of researchers and practitioners when applying the findings of this work in their research and practices. Furthermore, future work should investigate how to support temporal motivation at the moment of transitioning between different levels of construal and how to design for managing multiple targets at the same time when those targets' time aspects are varied.

In this Chapter, I summarized the major takeaways that emerged across the studies in this thesis. I was able to verify the applicability of a construal strategy to address temporal motivation in the different domains and time dimensions. I also revealed what has to be considered when applying a time-based tailoring strategy in practices. Next, I will discuss the contributions of this work to theory and practices.

CHAPTER 7. DISCUSSION AND CONCLUSION

Across the studies in this thesis, I investigated how time plays a role in the dynamics of motivation and explored how to incorporate temporal motivation in technology and service design. Grounded on CLT, I examined different dimensions of time, including temporal distance, duration, and (unfixed) deadline. In doing so, I employed an integrative approach, utilizing interview, survey as well as online and field experiments from the perspective of social psychology, communication studies, HCI, and CSCW.

My work has largely followed a human-centered design process consisting of understanding design/implementation and evaluation. For each dimension of time, I first gained a formative understanding of the design space by investigating how individuals differ in their motivation by time (Study 1a, 1b; Study 3; Study 4a). I have developed the potential design solutions that drew on the design considerations I formulated from the foundational studies. Then, I empirically tested the effectiveness of these design alternatives by conducting a series of online or field experiments (Study 2a, 2b, 2c; Study 4b), generating the design guidelines and validating its generalizability to the broader context. This formative, iterative, and evaluative process allowed me to investigate time-based tailoring strategies by taking individuals' mental models into consideration of technology and service design.

My work aimed to fill the gap between theory and design by translating theoretical understanding into practical design guidelines. HCI and CSCW researchers have had a long consensus on the gap between theory and concrete designs, which must be bridged for every new technology (Hekler, Klasnja, Froehlich, & Buman, 2013). In my thesis, various social science theories (e.g., CLT: Trope & Liberman, 2010; TPB: Ajzen, 1991; goal-setting theory: Locke & Latham, 1990) helped me scope the design space, collect the data, inform the design, evaluate

the data, and examine the potential moderators that must be considered when it comes to design for temporal motivation. My thesis, in turn, contributes to bringing theory and design together by narrowing the gaps in between.

Through this body of work, I have sought to sensitize the fields of HCI and CSCW to the notion of temporality in technology or service designs by building new knowledge on the dynamics of motivation by various dimensions of time and providing concrete examples of tailoring design strategies that help increase 'timely' user engagement. In this chapter, reflecting on the series of my studies, I discuss how this work contributes to our understanding of temporal motivation regarding the body of research on time and to specific design guidelines to address temporal motivation in design.

Finally, in this section, I make sense of my findings, summarize the contributions I offer in this dissertation, discuss areas of future work, and make concluding remarks. By doing so, I demonstrate how this work confirms my two research statements: 1) Understanding how various dimensions of temporality affect one's motivation is necessary for identifying opportunities to design a time-based tailoring strategy; 2) Tailored designs in consideration of temporal motivation can lead to a higher intention to perform the desired activity.

7.1 Understanding Temporal Motivation

Across the studies on various temporal motivation, I observed crosscutting themes from different dimensions of time, duration, distance and (no) deadline. Individuals are likely to think abstractly, using high-level construal with a focus on the central aspect of targets or events, when temporal distance is further (Chapter 3), goal end-date is far off due to its long-duration (Chapter 4), and a potential event feels temporally, spatially, socially, and hypothetically far away from

themselves (Chapter 5), whereas they tend to think concretely using low-level construal when an event is proximal (Chapter 3), goal duration is shorter (Chapter 4), and their psychological distance toward a potential earthquake is closer (Chapter 5). Although the effect of temporal distance on the salient construal levels is already well-understood (Trope & Liberman, 2010), my work additionally demonstrates how the end-date of goal duration is also associated with the activation of construal level (Chapter 4) and how individuals' psychological distance could be utilized when there is unfixed deadline for the target task (Chapter 5), further influencing behavioral motivation. I observed this tendency in the multiple contexts—social events, personal finance goals, and earthquake preparedness. Collectively, my results show that what comes to people's mind and what forms their motivation differ by the temporal reference when target objects or events are perceived to happen or for how long it may last, highlighting the importance of the consideration of temporality in designing tailoring strategies for technology, information, and related services.

Moreover, my studies uncovered that temporal motivation is more nuanced than CLT's theoretical premises to explain temporal construal, articulating a need for the more sophisticated approach when tailoring design for temporal motivation. Regarding temporal distance, although it aligns with prior work (Liberman & Trope, 1998) in terms that people think more about attitude (relating to the why) in the far future than in the near future, I also newly found that thinking about perceived behavior control is not just limited to when the event is near. Even though an event is planned in the distal future, people may also consider it if they are sufficiently motivated (strong attitude toward the target; Chapter 3). I also discovered that people have different notions toward financial wellness goals depending their durations; however, their short- and long-term goals became tightly interrelated as the goals progressed or their situations

changed. I surfaced the limitations of CLT that do not account for the dynamics between different levels of construal, such as a change and a conflict of construal (Chapter 4).

Furthermore, I found the effectiveness of a construal fit strategy could be limited when individuals have a less positive attitude toward the target behavior and also demonstrated the importance to consider a preformed attitude toward the target behavior when helping increase one's intention to perform a behavior through congruency of construal levels (Chapter 5). To summarize, these studies consistently show that temporal motivation is explainable and driven not only by the different levels of construal but also by additional factors that CLT did not account for in its theoretical premises. This extends existing research on CLT and suggests the potential for further studies on whether or to what extent CLT is applicable. My thesis highlights a need for approaches that are more comprehensive toward temporal motivation, beyond the perspective of dichotomized mental representation as either abstract or concrete.

Although I used CLT as an underpinning theoretical lens in this thesis, I navigated the complexity of the dynamics of motivation by utilizing multiple theories beyond CLT, which in turn, contributed to additional insights on general human behaviors with regards to time. To understand what drives motivation at different time points (Chapter 3), I combined the proposition of CLT with the constructs of TPB (Ajzen, 1991) and found the potential connection between the AT component of PBC with high-level construal, used to represent distal events, and the PBC component of TPB with low-level construal, used to represent proximal events. This can address the limitations of TPB that do not account for or predict intention for future behaviors (Randall & Wolff, 1994; Sheeran, Conner, & Norman, 2001). Moreover, to understand how motivation differs by different durations of goals (Chapter 4), I draw upon goal-setting theory (Locke & Latham, 1990) to conceptualize the duration for personal finance goals.

Although studies on goal-setting theory generally viewed that short-term goals may aid the attainment of distal goals (Latham & Locke, 2007), I uncovered an additional relationship between short- and long-term goals, which enabled me to capture more complicating snapshots of temporal motivation. Despite discrete characteristics of short- and long-term financial wellness goals, these goals were often collapsed into the one dimension of their day-to-day goal-practices, and sometimes clashed with each other if resources were limited. Researchers remarked that goal theory has no position on the best way to integrate short- and long-term goals (Ordóñez, Schweitzer, Galinsky, & Bazerman, 2009). I believe my work points in one direction to delineate the relationship between short- and long-term goals by uncovering their interrelated natures. Taken together, my findings help enrich our understanding of behaviors with regards to time and demonstrate the benefits of triangulating multiple theories in doing so.

7.2 Tailoring Designs for Temporal Motivation

In addition to building new knowledge about temporal motivation, this dissertation explored how the design of technology could tailor to the dimensions of time—distance, duration and unfixed deadline—to promote user engagement. I found that people were more likely to participate in an event when the construal level of information design of the event was congruent with their temporal distance from the event on social media (Chapter 3), suggesting one mechanism of which time-based tailoring strategies increase motivation. Furthermore, I found the effects of high-level construal strategies to be more time sensitive than those of the low-level construal strategies when a specific date of target behaviors exists. For the cases of social events, it suggests that a construal fit strategy will be more useful far in advance of the event more than near in advance of the event, indicating there might also be a *better* time to utilize a temporal

distance-based strategy. Concerning personal finance goals, I uncovered that a different strategy might be effective to encourage individuals to set short- or long-term goals; however, in the meantime, they need support to manage and balance them, addressing the change of goals or situations (Chapter 4). It suggests that if designers or practitioners target to increase goal-commitments, a duration-based strategy based on a construal fit might be helpful, but the same strategy may not be effective to support everyday goal pursuits. Lastly, with regards to earthquake preparedness behaviors, people's preformed attitude on preparatory behaviors plays a critical role in making decisions for their future motivation, which moderated the effectiveness of a construal fit strategy (Chapter 5). It suggests that a preformed attitude should be first considered when devising a time-based strategy for behaviors without deadlines.

These studies also provide examples of concrete design and information elements that can promote user engagement with the consideration of time. My visual and informational design mock-ups describe the potential directions for time-based designs (e.g., far in advance of the event with a focus on the desirability of the events and with detailed explanations and pictures that depict the core aspects of events, such as an illustration: Chapter 3) that could be applied across a wide variety of platforms and applications. In particular, I demonstrated the potential of utilizing the different steps of user interactions when applying a construal fit strategy (e.g., a post shared on an individual's timeline linked to the event page on Facebook: Chapter 3). This suggests that time-based strategies could leverage the current promotion or marketing practices hyperlinked to or embedded in social media, such as on Facebook, Twitter, or Instagram. Notably, the recent interactive design features of social media that require active engagement (e.g., quiz, poll, survey) would enable us to easily assess one's psychological property (e.g., psychological distance or perceived cost) toward a target behavior (Chapter 5), ultimately

Goals for Temporal Motivation	Design Considerations
Temporal Distance *for Social Event*	
To encourage proximal behaviors or stick to plans	• Lower the perceived barrier of the behavior (e.g., providing transportation information to the event) • Highlight the ease of the behavior (e.g., feasibility-related keywords highlighted in different colors or fonts) • Use concrete images (e.g., photographs) that convey realistic ideas of the behavior
To get widespread attention	• Present the *why* (reasons) of the behaviors, focusing on expected instrumental (e.g., how important or useful the behavior could be) and affective (e.g., how pleasant or fun the behavior could be) aspect • Use abstract images (e.g., illustrations) with an emphasis on textual information that provides a holistic view of the behavior
To Improve RSVP Accuracy	• Encourage positive attitude toward the event, so that concerns with feasibility could be prioritized (e.g., highlighting benefits) • Help assess one's capability of the behavior in advance (e.g., a RSVP system that automatically shows a conflicting schedule by connecting with a calendar app)
Duration *for Financial Wellness Goals*	
To support short-term goals	• Encourage users to specify the details of goals (e.g., having decide the precise target date and amounts) • Use low-level construal related strategies (e.g., providing *how*-focused information with colored images in *loss*-frame) • Encourage frequent and active engagement with the goal progress (e.g., providing daily analytics of one's cash flow)
To support long-term goals	• Encourage users to (re-) connect to one's core values (e.g., having describe why it is important for them to achieve certain goals) • Utilize social norms that users could relate to (e.g., providing information about a certain reference group's financial activity – such as starting to save for a mortgage during one's 30s)
To balance multiple goals with different durations	• Change the focus of the strategy as the goal-duration is changed (e.g., suggesting to add more details of the goal, such as where the money would be spent, as it progresses) • Support to resume goals that were previously halted (e.g., notification to remind of one's lapsed goals) • Help better manage multiple goals or accounts (e.g., customizing features to locate multiple goals on different pages)
Unfixed Deadline *for Earthquake Preparedness*	
For those who think an earthquake is distal	• Increase positive attitude toward the behavior to boost the intervention effect (e.g., reminding of past personal experiences to increase subjective instrumental or affective values of the behavior) while emphasizing *why* to prepare for an earthquake
For those who think an earthquake is proximal	• Emphasize *how* to prepare for an earthquake • Provide actionable recommendations (e.g., providing family communication plan forms)
For those who have a negative attitude toward the behavior and who believe an earthquake is distal	• De-emphasize *why* to prepare for an earthquake to prevent a potential Boomerang effect • Help separate individuals' past earthquake experiences from the expected one in the future (e.g., informing how a potential earthquake might be different from previous ones; helping assess what worked or not)

Table 13. The Summary of Design Considerations for Temporal Motivation

increasing the effectiveness of a construal level fit strategy. This suggests that time-based design may not be necessarily limited to one type or step of interactions; rather, it could be applied to multiple stages of interactions, creating synergy effects to promote user engagement. A summary of design considerations to address temporal motivation generated through the studies in this thesis is presented in Table 13.

7.3 Future Work

Several areas of future work that build on the research I presented in this dissertation are possible. A clear next step might be to examine time-based tailored strategies on a larger scale and in broader contexts to further study their ecological validity and generalizability in practice. Although my visual and information design mock-ups in the thesis aimed to represent the current technology design that participants might be familiar with, by the nature of my participant pool, AMT, they might consider the target activities (e.g., events on social media) still hypothetical. A number of technologies exist that may benefit from time-based strategies, such as distance (e.g., booking flights, travel, or accommodation), duration (e.g., committing to physical health, career, or academic performance goals), and no duration (e.g., marketing for car insurances), for which practitioners and designers could leverage a construal fit strategy. It will be worthwhile to test what user interface design features or information elements could be tailored to address temporal motivation, how tailored design might be effective to encourage system-specific user engagement, as well as to what extent we could expect the time-based tailoring strategy to work (e.g., long-term engagement, repeated exposure).

Along the same line, additional opportunities exist to translate other construal fit strategies that other researchers have examined in the stylized lab studies into the technology

design. Several studies examined different ways of activating different levels of construal. For example, goal-priming tasks (e.g., participants list why or how statements for three different activities: Alter, Oppenheimer, & Zemla, 2010), past-event priming tasks (e.g., participants think of a past life event and describe why [more abstract] or how [more concrete] it occurred), and the Behavior Identification Form[8] (Vallacher & Wegner, 1989) are all known to be effective for identifying or activating a more abstract (or concrete) mindset as intended.

Future researchers and designers should further explore how these tasks could be translated into visual or informational design elements that could be more applicable to a time-based tailoring strategy in the context of technology. In my thesis, I focused on a few strategies for a construal fit (e.g., why- or how-focused design in Studies 2a and 4; image types in Study 2c); however, there is definitely a room to expand the design tool kits for time-based tailoring strategies and build on the body of literature on a construal fit.

Furthermore, future research can expand the breadth of time-based strategies by examining the potential of other dimensions of time beyond temporal distance, duration, and (no) deadline as part of tailoring strategies. For example, how do people perceive *cyclical* events (e.g., routine medical appointments, holiday donations) and how can designers and practitioners reflect users' cyclical-temporal motivation in promoting the target actions? To what extent is the strategy similar or different from those for temporal distance or an uncertain temporal boundary? Moreover, if temporal buffers, unspecified amounts of time that are built into schedules to allow for the uncertainty in the estimated duration to accomplish a task, are known as a necessity in

[8] The form identifies 25 actions (e.g., making a list) along with two ways that the behavior might be identified (e.g., the more abstract description for making a list is getting organized, whereas the more concrete description is writing things down). Participants select the identification they personally believe best describes the behavior. An abstraction score is calculated by counting the number of higher-level actions identified by participants (Fujita et al., 2006).

organization management with temporal elasticity (Lee & Liebenau, 2000), then how could they be conceptually tied with lapse, known as an important factor in behavior change (Bouton, 2000; Epstein, Kang, Pina, Fogarty, & Munson, 2016)? What do temporal buffers mean in technology design and how could they be used for tailoring designs to support behavior change or to increase user engagement?

Finally, a time-based strategy could be colored by the cultural difference in which people interact with time. Even though the main stream of research around temporality, including this thesis, primarily relies on Western culture metaphors for accounts of time, as noted in prior work (Lindley, 2015), other research should not be ignored that demonstrate how culture affects the ways in which people organize themselves around time (Reinecke et al., 2013) and in which they represent temporal rhythm and stability. The fields of HCI and CSCW will greatly benefit from considering various dimensions of time, shaped by the different cultural practices, when designing technology to better engage potential users and better support individuals' physical and psychological well-being.

7.4 Conclusion

Time is critical in human behaviors and the ways people interact with time affect how they think and what they value in their decision-making and planning of future behaviors. Although time has great potential for a tailoring strategy, the fields of HCI and CSCW are still lacking in the research and design of time-based tailoring strategies that help increase user engagement. In this thesis, I aimed to deepen our understanding of temporal motivation and examine time-based design guidelines through a series of studies.

Here, I explored the design space of time-based tailoring strategy in a technology. I showed how people's motivations interact with the different dimensions of time (distance and duration) and how their psychological distance could be leveraged as a motivator when there is unfixed deadline for tasks from the perspective of CLT. I also developed time-based designs to promote user engagement and examined their effectiveness in various contexts, including social events, financial wellness goals, and earthquake preparedness behaviors, and outlined that time-based technology could be further applicable in a broader context.

My findings show that researchers, designers, and practitioners can and should utilize various time perceptions in technology and service design to increase user engagement. I presented concrete mechanisms by which they can do so and what additional aspects they need to consider when applying a construal fit strategy. Technology is only going to become more embedded and essential to everyday behaviors, asserting the potential and importance of a time-based tailoring strategy to engage users while supporting their physical and psychological health alongside technology. Hence, the results of this thesis can contribute to HCI and CSCW communities and beyond by providing insights for broader system and service designs to improve user engagement with consideration of temporal motivation.

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CHAPTER 9. APPENDIX

Here I present the stimulus I used for my studies.

9.1. Study 2a Stimuli

9.1.1 Posts on Timeline

9.1.1.1 Message on Why-focused design

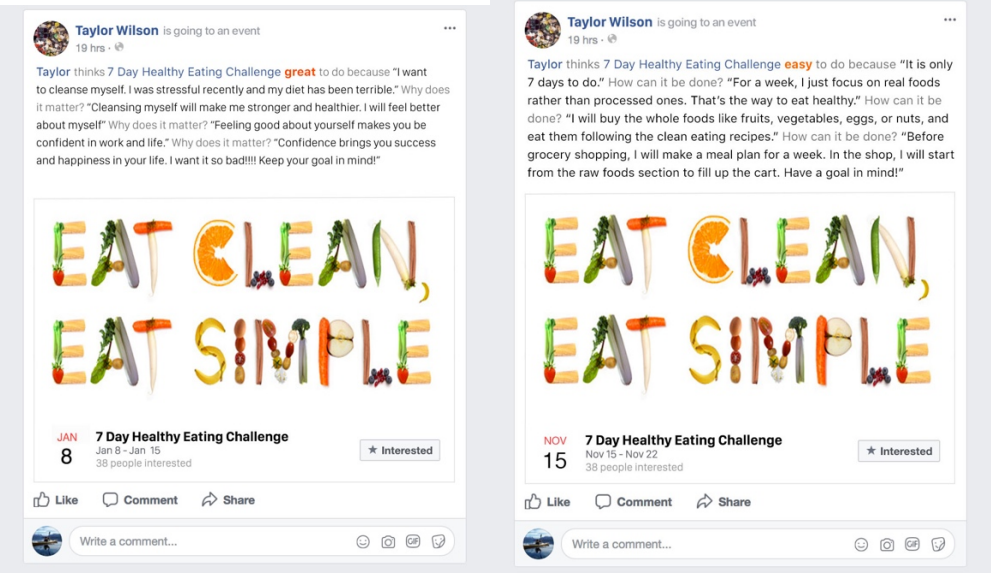
Taylor thinks 7 Day Healthy Eating Challenge **great** to do because *"I want to cleanse myself. I was stressful recently and my diet has been terrible."* Why does it matter? *"Cleansing myself will make me stronger and healthier. I will feel better about myself".* Why does it matter? *"Feeling good about yourself makes you to be confident in work and life"* Why does it matter? *"Confidence brings you success and happiness in your life. I want it so bad!! Keep your goal in mind!"*

9.1.1.2 Message on How-focused design

Taylor thinks 7 Day Healthy Eating Challenge **easy** to do because *"It is only 7 days to do by myself."* How can it be done? *"For a week, I just focus on real foods rather than processed ones. That's the way to eat healthy."* How can it be done? *"I will buy the whole foods like fruits, vegetables, eggs, or nuts, and eat them following the clean eating recipes."* How can it be done? *"Before grocery shopping, I will make a meal plan for a week. In the shop, I will start from the raw foods section to fill up the cart. Have a goal in mind!"*

9.1.1.3 The Examples of Posts

Far, Why-focused design (left: High-level matching) vs. Near, How-focused design (right: Low-level matching)



9.1.2 Event Pages

9.1.2.1 The Example of Far, Why-focused event page

The 7-day Healthy Eating Challenge will make you feel **great** about yourself.

Enjoy REAL food and feel more energetic.

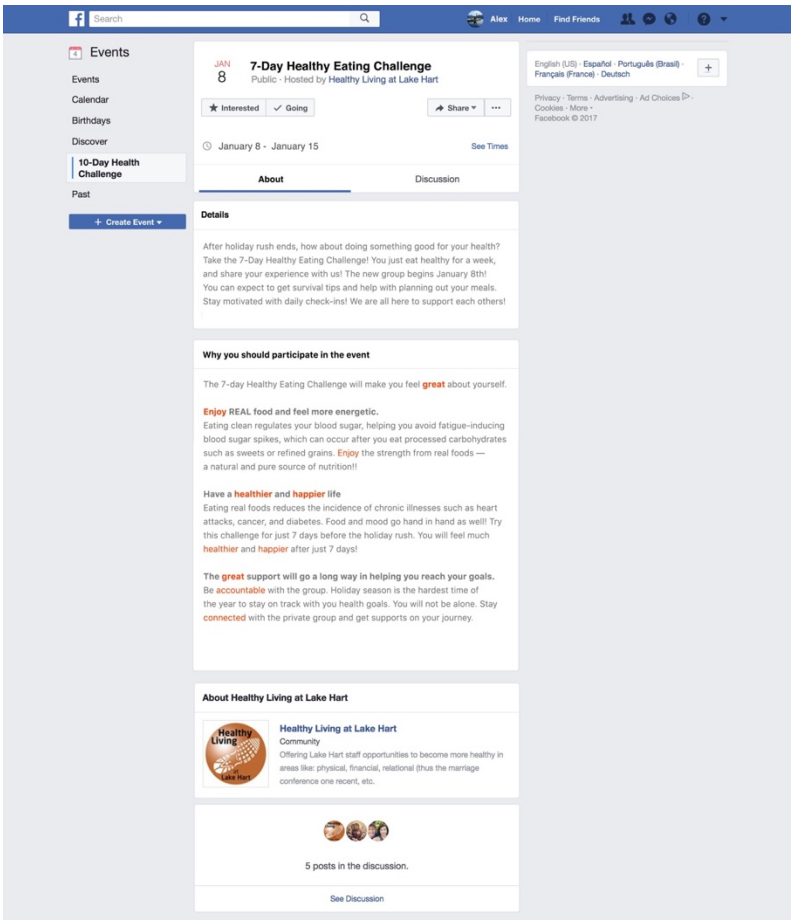
Eating clean regulates your blood sugar, helping you avoid fatigue-inducing blood sugar spikes, which can occur after you eat processed carbohydrates such as sweets or refined grains. **Enjoy** the strength from real foods —a natural and pure source of nutrition!!

Have a **healthier** and **happier** life

Eating real foods reduces the incidence of chronic illnesses such as heart attacks, cancer, and diabetes. Food and mood go hand in hand as well! Try this challenge for just 7 days before the holiday rush. You will feel much **healthier** and **happier** after just 7 days!

The **great** support will go a long way in helping you reach your goals.

Be **accountable** with the group. Holiday season is the hardest time of the year to stay on track with you health goals. You will not be alone. Stay **connected** with the private group and get supports on your journey.



9.1.2.2 The Example of Near, How-focused event page

The 7-day Healthy Eating Challenge is **simple** to do. There are only 5 steps!

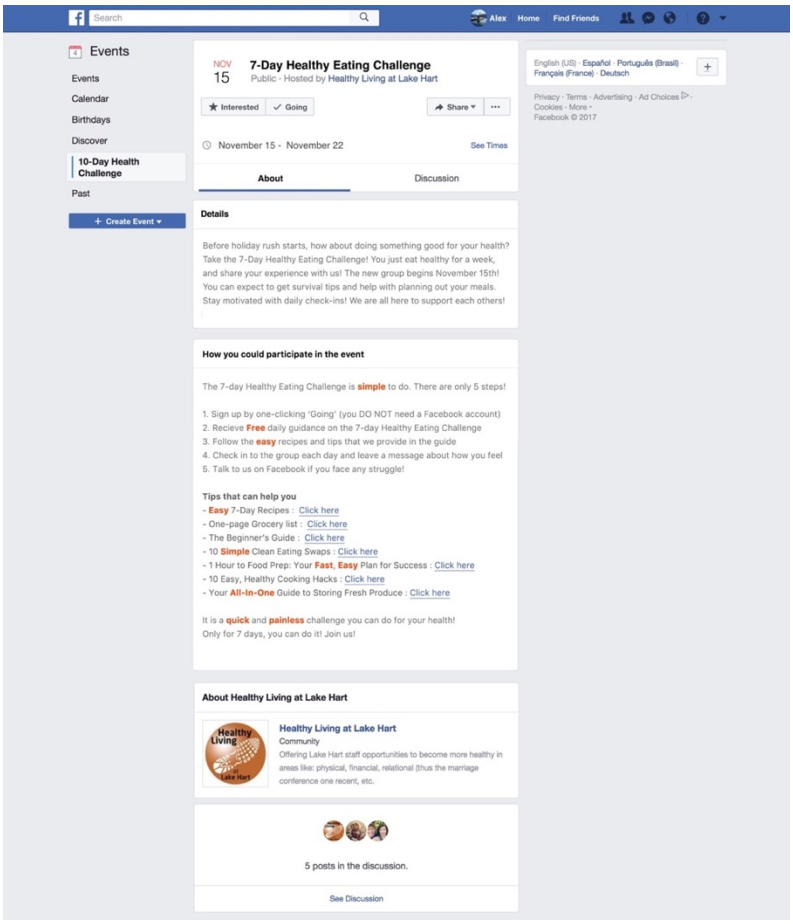
1. Sign up by one-clicking 'Going' (you DO NOT need a Facebook account)
2. Receive **Free** daily guidance on the 7-day Healthy Eating Challenge
3. Follow the **easy** recipes and tips that we provide in the guide
4. Check in to the group each day and leave a message about how you feel
5. Talk to us on Facebook if you face any struggle!

Tips that can help you

- **Easy** 7-Day Recipes : Click here
- One-page Grocery list : Click here
- The Beginner's Guide : Click here
- 10 **Simple** Clean Eating Swaps : Click here
- 1 Hour to Food Prep: Your **Fast**, **Easy** Plan for Success : Click here
- 10 Easy, Healthy Cooking Hacks : Click here
- Your **All-In-One** Guide to Storing Fresh Produce : Click here

It is a **quick** and **painless** challenge you can do for your health!

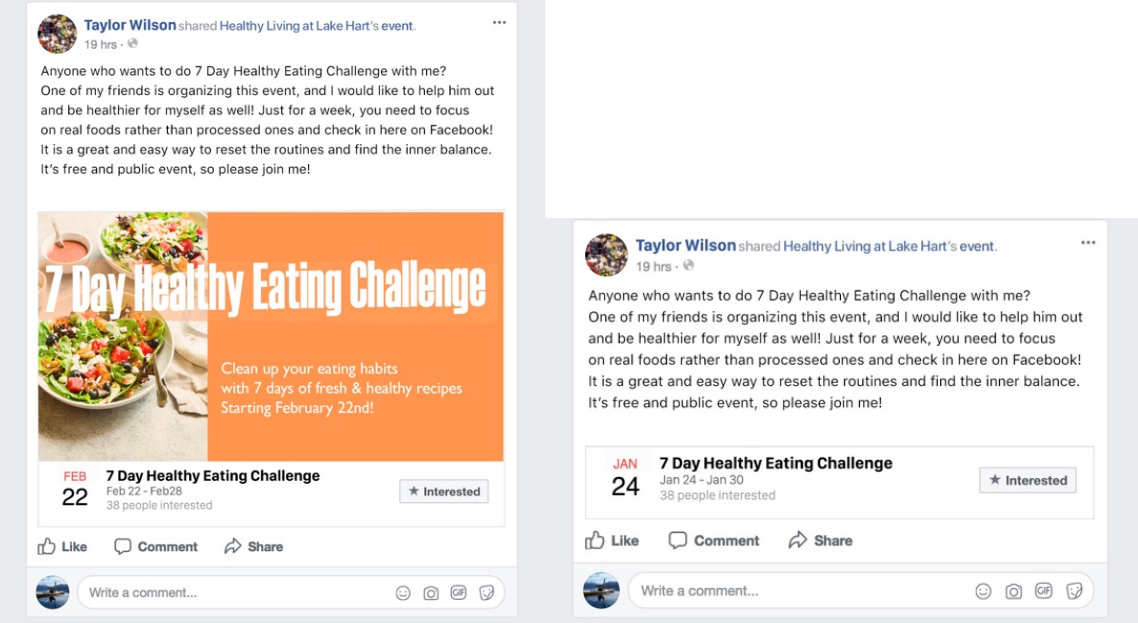
Only for 7 days, you can do it! Join us!


Search
Alex
Home
Find Friends
Events
Events
Calendar
Birthdays
Discover
10-Day Health Challenge
Past
+ Create Event
NOV
15
7-Day Healthy Eating Challenge
Public · Hosted by Healthy Living at Lake Hart
Interested
Going
Share
November 15 - November 22
See Times
About
Discussion
Details
Before holiday rush starts, how about doing something good for your health? Take the 7-Day Healthy Eating Challenge! You just eat healthy for a week, and share your experience with us! The new group begins November 15th! You can expect to get survival tips and help with planning out your meals. Stay motivated with daily check-ins! We are all here to support each others!
How you could participate in the event
The 7-day Healthy Eating Challenge is simple to do. There are only 5 steps!
1. Sign up by one-clicking 'Going' (you DO NOT need a Facebook account)
2. Recieve Free daily guidance on the 7-day Healthy Eating Challenge
3. Follow the easy recipes and tips that we provide in the guide
4. Check in to the group each day and leave a message about how you feel
5. Talk to us on Facebook if you face any struggle!
Tips that can help you
- Easy 7-Day Recipes : Click here
- One-page Grocery list : Click here
- The Beginner's Guide : Click here
- 10 Simple Clean Eating Swaps : Click here
- 1 Hour to Food Prep: Your Fast, Easy Plan for Success : Click here
- 10 Easy, Healthy Cooking Hacks : Click here
- Your All-In-One Guide to Storing Fresh Produce : Click here
It is a quick and painless challenge you can do for your health!
Only for 7 days, you can do it! Join us!
About Healthy Living at Lake Hart
Healthy Living at Lake Hart
Community
Offering Lake Hart staff opportunities to become more healthy in areas like: physical, financial, relational (thus the marriage conference one recent, etc.
5 posts in the discussion.
See Discussion
English (US) · Español · Português (Brasil) · Français (France) · Deutsch
Privacy · Terms · Advertising · Ad Choices · Cookies · More · Facebook © 2017

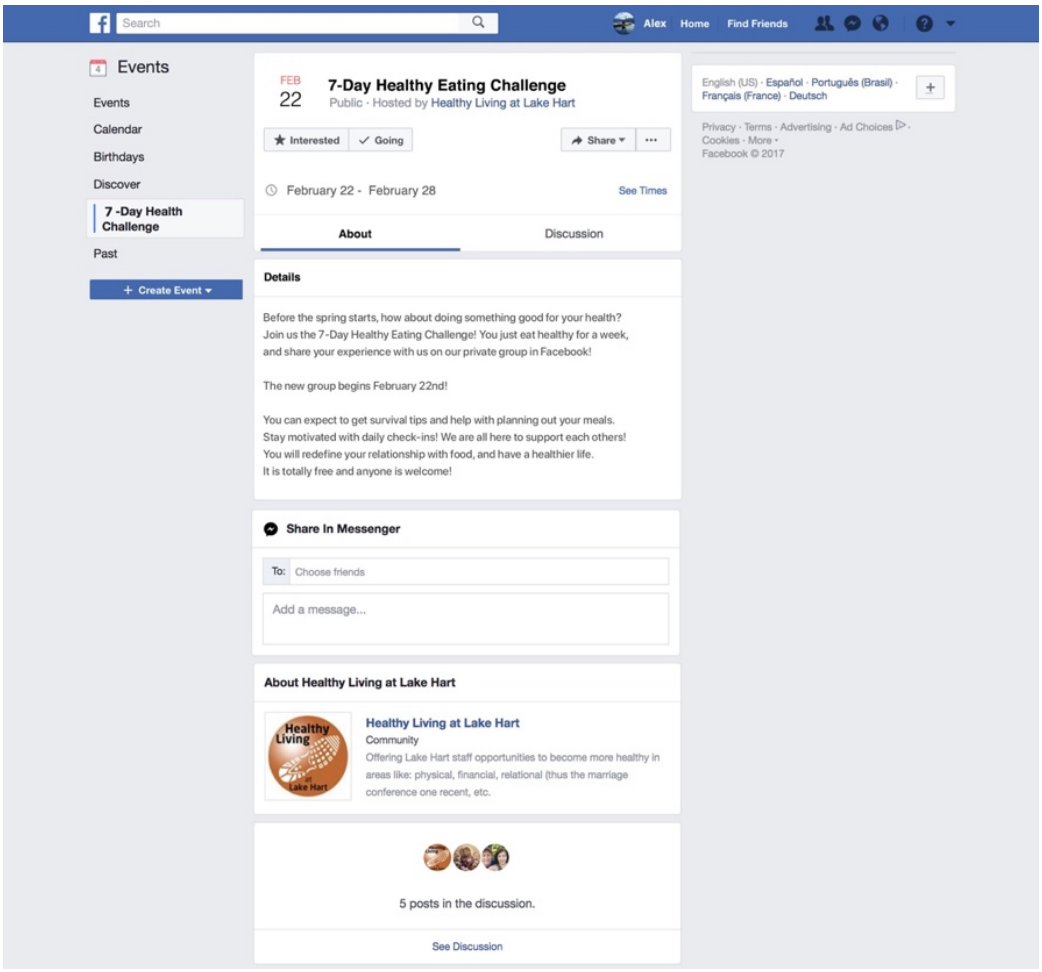
9.2 Study 2b Stimuli

9.2.1 The Examples of Posts on Timeline

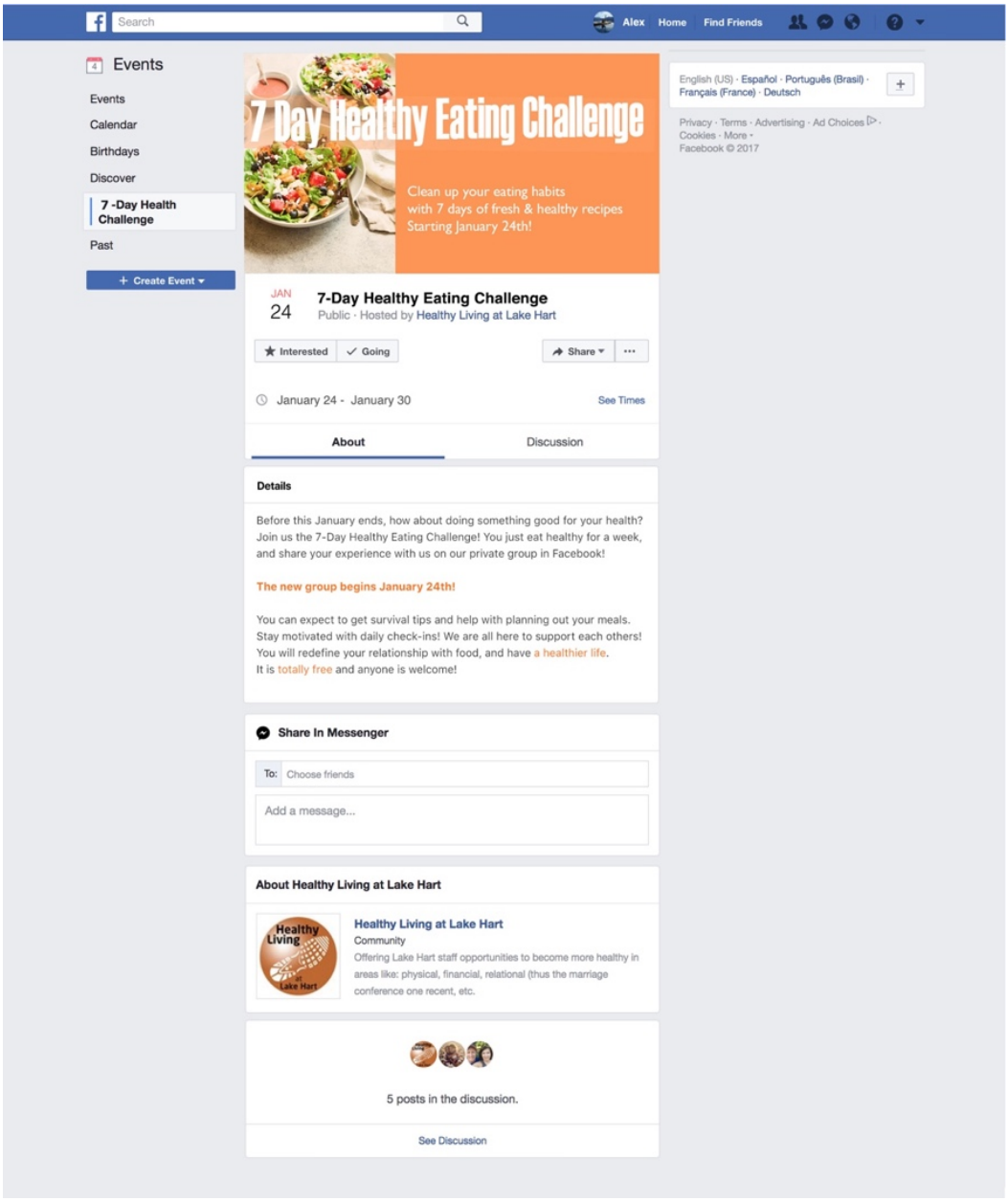
Far, text only condition (Left: High-level matching) vs. Near, text plus image condition (Right; Low-level matching)



9.2.2 The Examples of Event Pages
Far, text only condition



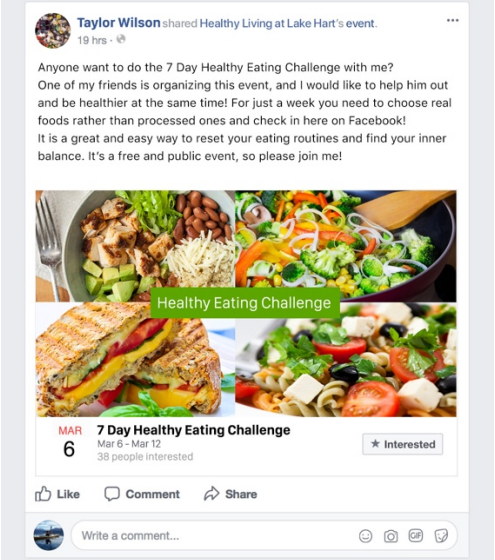
Near, text plus image condition

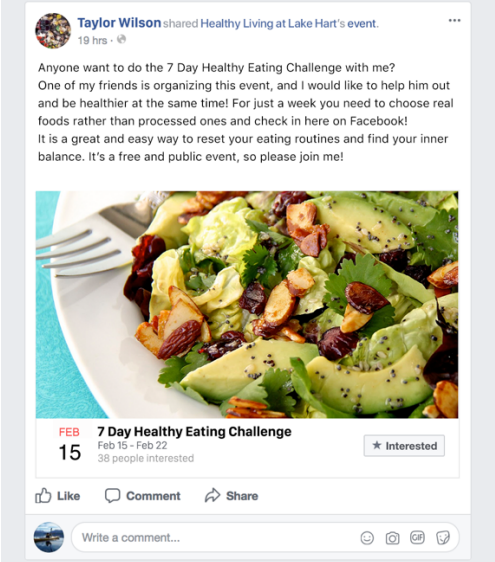


9.3. Study 2c Stimuli

9.3.1 The Examples of Posts on Timeline

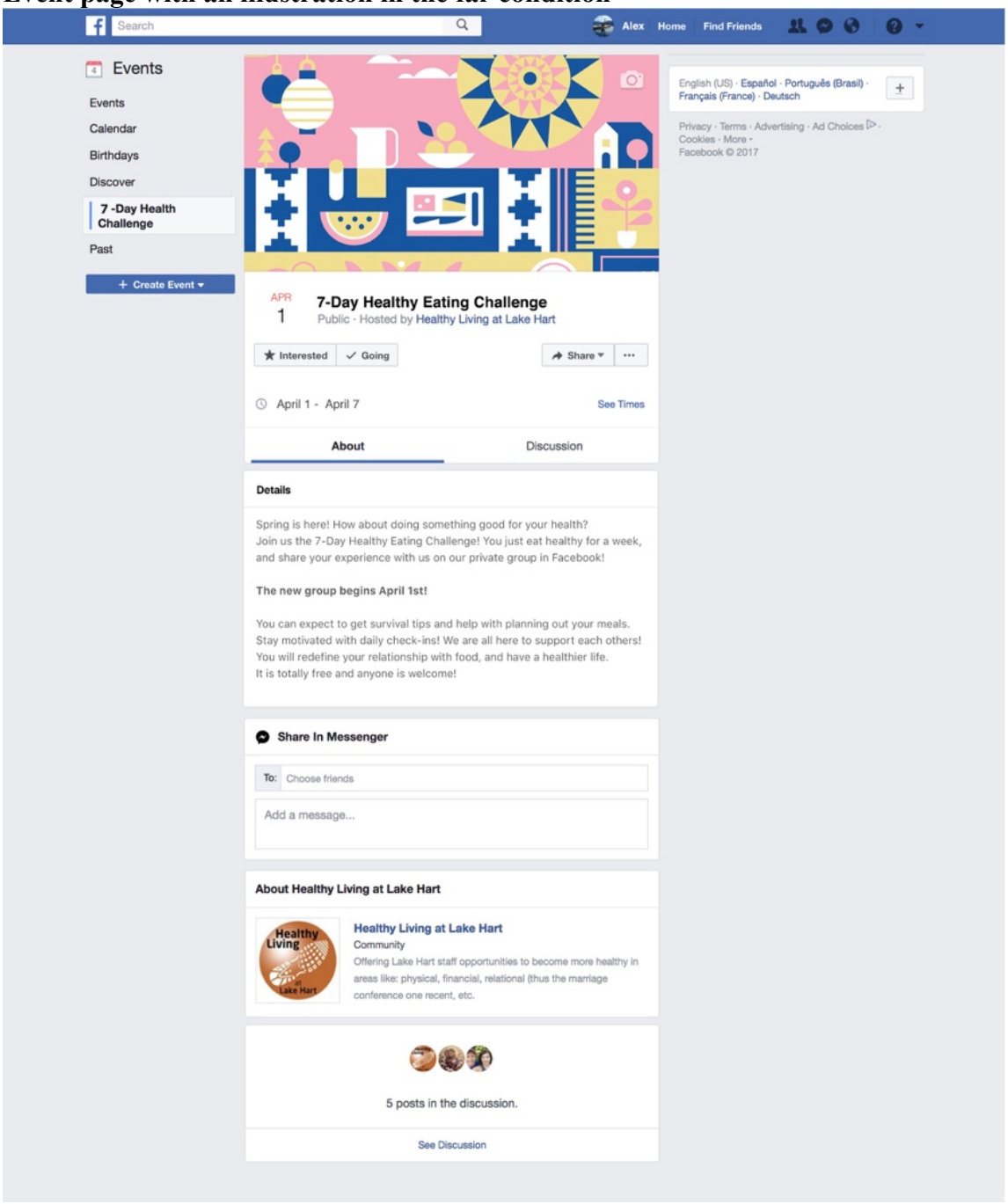
A Post of illustration in the far condition (Left); A Post of picture in the near condition (Right)



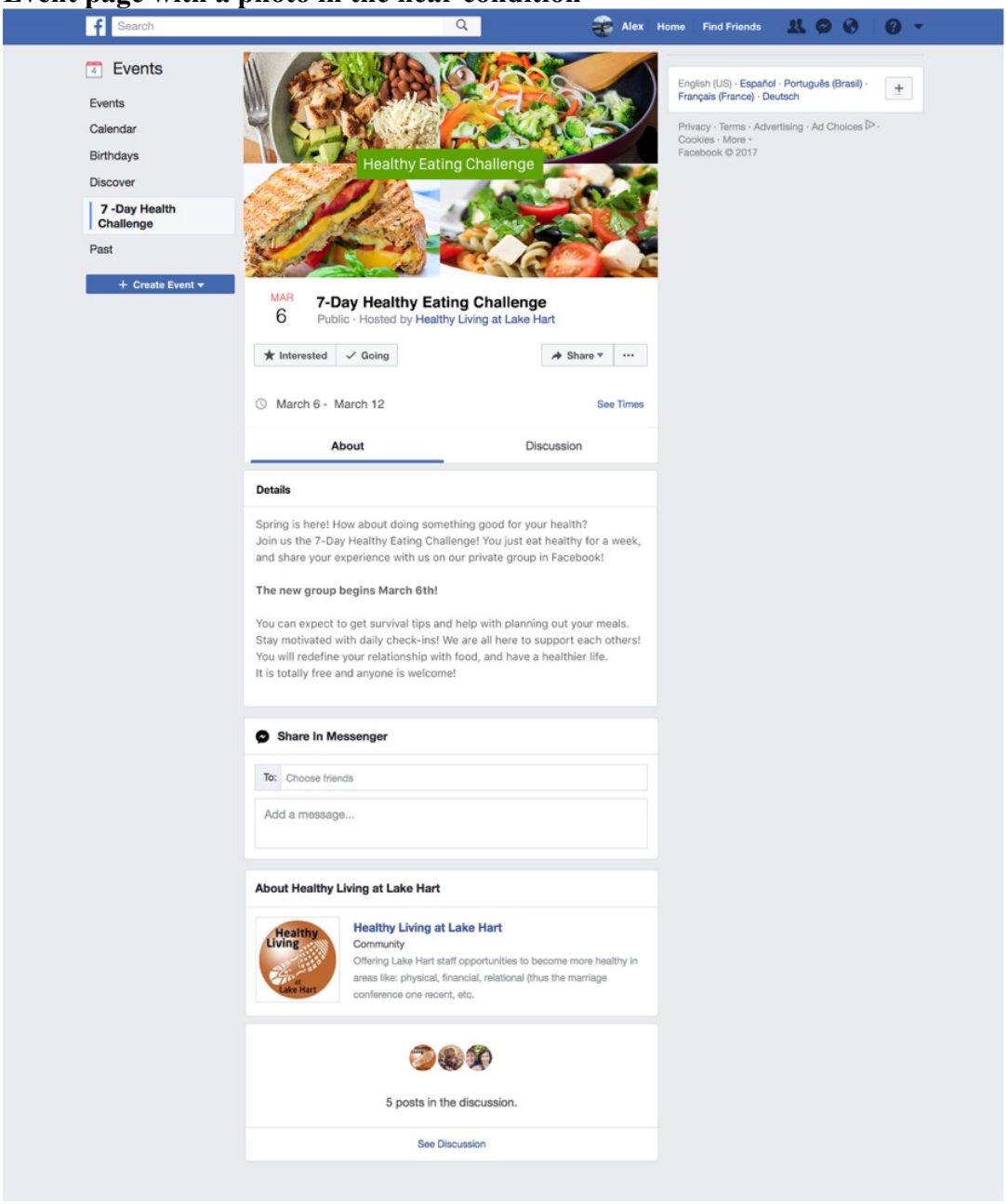


9.3.2 The Examples of Posts on Event Pages

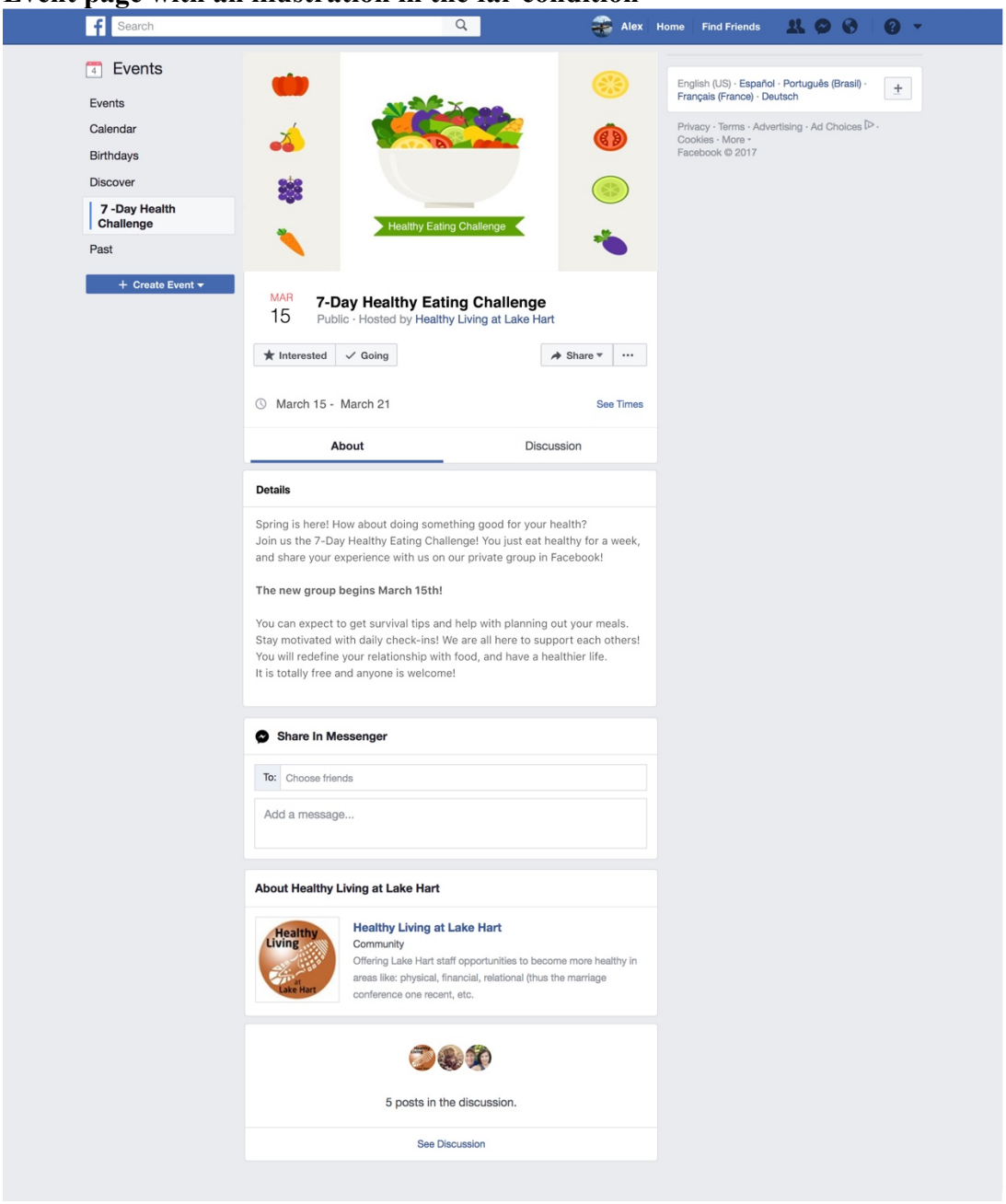
Event page with an illustration in the far condition



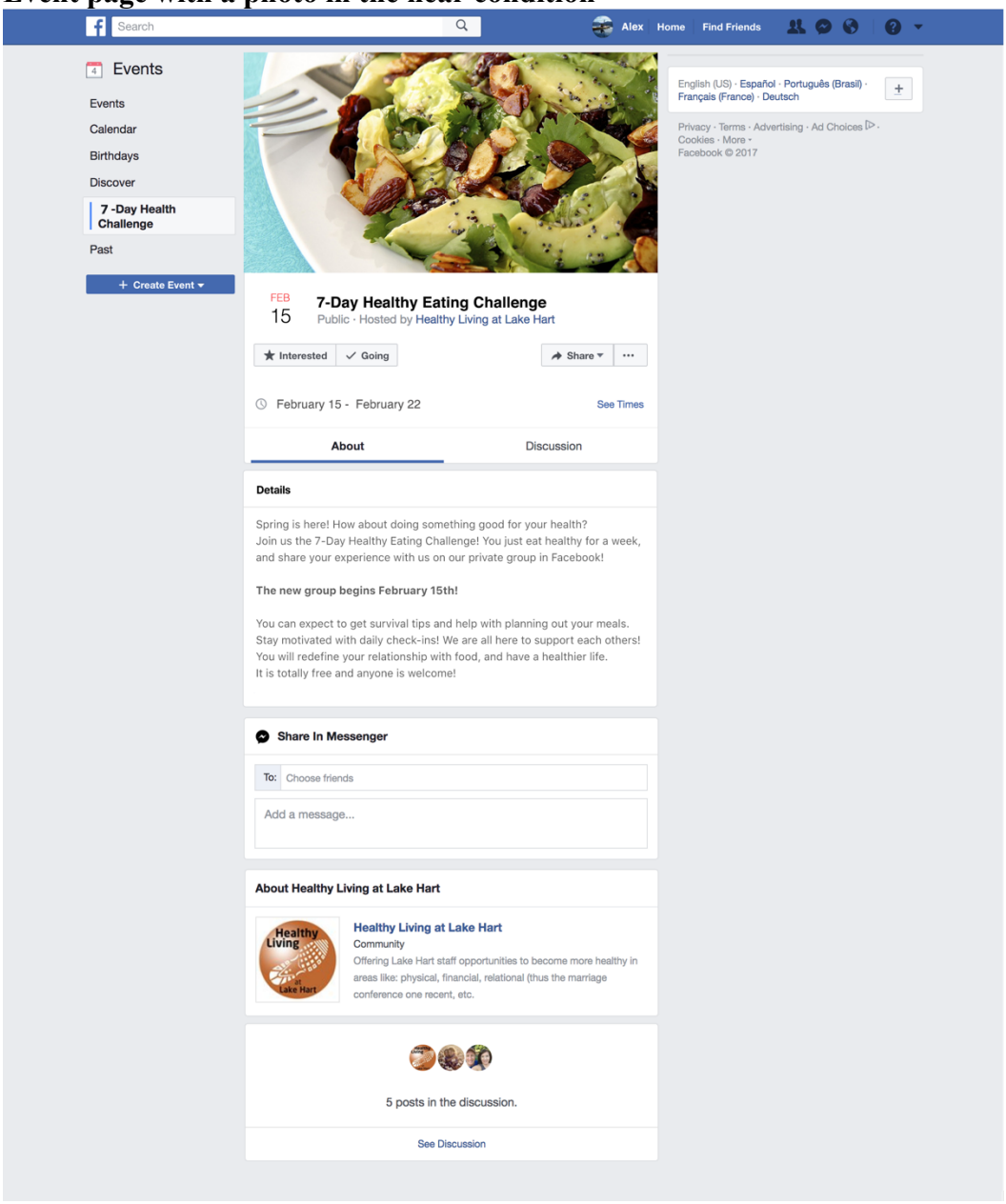
Event page with a photo in the near condition



Event page with an illustration in the far condition



Event page with a photo in the near condition



9.4. Study 4 Stimuli

Why We Should Prepare for Earthquakes
Communities, families, and individuals should be prepared for earthquakes.

Why should we prepare for earthquakes?
An earthquake is a sudden, rapid shaking of the earth, striking without warning, at any time of year, day or night. Forty-five U.S. states and territories are at moderate to very high risk of earthquakes. Once an

earthquake happens, you will have no time to prepare. This means you could be in danger with little or no warning.

Why is being prepared important?
Your precautionary efforts can significantly lessen the impact of earthquakes. Taking steps to prepare for earthquakes can reduce the fear, anxiety, and losses that accompany earthquakes. It can protect you and your family, home, and assets, and also help you to recover faster if it happens.

Why does being prepared matter?
Your and your family's safety and happiness are important! You should protect yourself and your family by knowing what to do before, during and after an event. Local responders may not be able to reach you immediately, or they may need to focus their efforts elsewhere. Earthquake preparedness is everyone's responsibility.

How We Could Prepare for Earthquakes
Communities, families, and individuals could be prepared for earthquakes.

How could we prepare for earthquakes?
You can easily learn about what to do and where to go during or/and after earthquakes and make your own plans for you and your family. You can also quickly identify the likelihood of an earthquake occurring in your region, and its potential impact, which can help you focus your preparation plans for such an event.

How can we plan for earthquakes?
Plan for an earthquake and talk about it with your family so that everyone knows what to do in case of an earthquake. Decide how you will communicate in an emergency—Make sure everyone has a list of emergency contact numbers. Build an emergency kit and practice DROP, COVER and HOLD ON in each safe place.

How can we act upon these plans?
Organize disaster supplies and important documents in convenient locations. Free guidelines are also available that you can easily follow to make effective plans. Download the free emergency apps on mobile and sign up to receive emergency notifications about incidents in your neighborhood.
