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Origin of Value Creation: The Role of Delayed Intuition in Entrepreneurial Problem Framing

by

Chan Hyung Park

A dissertation presented to
The Graduate School
of Washington University in
partial fulfillment of the
requirements for the degree
of Doctor of Philosophy

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Chan Hyung Park

Washington University in St. Louis

August, 2022

Dedicated to my son.

ABSTRACT OF THE DISSERTATION

Origin of value creation: the role of delayed intuition in entrepreneurial problem framing

by

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Doctor of Philosophy in Organizational Behavior

Washington University in St. Louis, 2022

Professor Markus Baer, Chair

Highly successful entrepreneurial ventures often result from solving problems that have not been solved before (i.e., entrepreneurial problems). The problem-solving and entrepreneurship literatures indicate that individuals need to develop novel problem frames—uncommon interpretations of observable needs or pain points (i.e., symptoms) signaling the problems—to create solutions that other people would not typically think of and generate unique value that is key to entrepreneurial success. However, developing novel frames of entrepreneurial problems is difficult for two reasons. The symptoms of the problems are ambiguous and unstructured, and the structured information to find the right frame of problems is costly to acquire. Given the high costs associated with structured information, individuals need to rely on intuition—an associative and unconscious form of thinking—in the absence of structured, validated information to diagnose the problem frame. However, intuition is a double-edged sword that rarely results in novel problem frames and tends to exploit readily available, obvious, and well-known frames to quickly categorize and react to the problems. This dissertation draws on Cognitive-Experiential Self-Theory (CEST) to propose a delayed intuition model, in which individuals should delay intuition with rational, analytic thinking. Rational-analytic thinking can encourage individuals to think of alternative problem frames, avoid common biases in problem framing, and prevent

intuition from reaching premature conclusions. By doing so, rational-analytic thinking allows intuition to be more informed and aware of alternative frames of problems, increasing the likelihood of forming novel frames of entrepreneurial problems. Evidence from an archival study and a randomized field experiment with samples of entrepreneurs support the value of delaying intuition when generating novel frames of entrepreneurial problems.

Chapter 1: Introduction

In mid-January 2020, many health professionals in the U.S. were aware and cautious of COVID-19. Unfortunately, most health professionals associated the virus with SARS of 2003, which had only affected eight thousand people. This association was the “obvious answer” because SARS of 2003 was the closest known genetic relative of COVID-19 and preliminary stats on the cases and death rates from the viruses showed similar patterns (p. 169, Lewis, 2021). This frame or interpretation of COVID-19 as a mild virus led many health professionals to expect that COVID-19 would dissipate without a strong response.

Dr. Charity Dean, Assistant Director for the California Department of Public Health, refused this readily available frame. Her refusal was not based on structured data or proof, as she only had “super-sketchy...scattered information from unreliable sources to make decisions” (p. 195, Lewis, 2021). Nonetheless, her analysis of available information suggested that COVID-19 and SARS of 2003 were not as similar as many had thought. One such piece of information was a video she had watched on Twitter, in which Chinese government workers were welding apartment doors of residents affected by Covid-19 in Wuhan. Dr. Dean searched for other examples of contagious virus that was not only contagious like COVID-19 but also evoked radical government responses. Dr. Dean’s analysis led her to associate COVID-19 with the temporally distant but devastating pandemic of 1918, which killed fifty million people. This distant association led her to frame the problem—identify the interpretative, cognitive lens to categorize the needs or pain points (symptoms) signaling the problem (Baer, Dirks & Nickerson, 2013; Barsalou & Hale, 1993; Cornelissen & Werner, 2014)—as a “Doomsday” pandemic. The novel frame of the Doomsday pandemic led Dr. Dean to start an entrepreneurial venture that developed rapid early testing tools for COVID-19.

Stories of influential, successful entrepreneurial ventures are often about individuals who rely on their intuition or gut feeling to frame problems that have not been solved before (i.e., entrepreneurial problems; Christensen, 2013; Nickerson, Silverman & Zenger, 2007; Von Hippel, 2009). Framing entrepreneurial problems is difficult because individuals cannot readily access formal indicators or market research to determine the right frames of entrepreneurial problems (Knight, 1921; Townsend, Hunt, McMullen, & Sarasvathy, 2018). Such information may become available only after the problems are solved and the market reaches a consensus on the validated, optimal ways to interpret the symptoms of problems. During entrepreneurial problem-solving, much of the information individuals have access to remains unstructured and ambiguous (e.g., raw video footage). Individuals who engage in conscious, logical, and analytic thinking to frame these problems tend to wait for structured, validated information, which can prevent actions and cost the very opportunities to solve the problems (Alvarez & Porac, 2020; Eisenhardt, 1989; Keynes, 1937). Given the high information costs, individuals who want to frame entrepreneurial problems before other actors need to rely on their intuition—an associative and unconscious form of thinking (Dane & Pratt, 2007; Sadler-Smith, 2016). Intuition enables individuals to make decisions on the frame of entrepreneurial problems by associating the symptoms of entrepreneurial problems with those of previously framed problems (Dane & Pratt, 2007; 2009; Damasio, 2006; Simon, 1987). Through associations, individuals can decide on an appropriate frame and act to solve the problems despite the absence of structured information to make rational, logical decisions (Gavetti, Levinthal, & Rivkin, 2005; Zellweger & Zenger, 2021).

Entrepreneurship research indicates that individuals are more likely to generate new value and potentially build successful entrepreneurial ventures if their intuition develops novel rather than

common frames of problems (Casson, 1982; Felin & Zenger, 2009; 2017; Patvardhan & Ramachandran, 2020). Common frames of problems result in obvious solutions that many other firms and individuals would develop and compete with them using similar strategies (Thiel & Masters, 2014). Novel—uncommon and not widely shared—frames of entrepreneurial problems enable distinct strategies, innovative solutions, and the creation of unique value central to successful entrepreneurial ventures (Casson, 1982; Felin & Zenger, 2009; 2017; Patvardhan & Ramachandran, 2020).

The challenge in developing novel problem frames for entrepreneurial problems is that intuition is a double-edged sword that frequently results in common, obvious frames (e.g., SARS of 2003). Intuition seeks closure and tends to result in hasty, obvious associations that rely on readily available problem frames even though the associations are inaccurate or biased (Camuffo, Cordova, Gambardella, & Spina, 2020; Grimes & Vogus, 2021; Kahneman & Klein, 2009; Kahneman, 2011). For example, intuition often suffers from recency or familiarity bias (using recent experiences or familiar knowledge; Kahneman, 2011). These readily available problem frames tend to be widely studied, known, and chosen during entrepreneurial problem framing (e.g., SARS of 2003), so such frames are unlikely to generate novel strategies or value (Felin, Gambardella, & Zenger, 2020). Instead, novel problem frames tend to emerge when individuals form divergent associations that link the symptoms of entrepreneurial problems to problem frames derived from idiosyncratic experiences or distant knowledge domains (Grimes & Vogus, 2021; Nickerson, Wuebker, & Zenger, 2017; Von Hippel, 2009). Dr. Dean's association between the symptoms of COVID-19 and the (temporally) distant knowledge of the 1918 pandemic exemplifies the role of distant associations in developing novel problem frames.

However, existing research is unclear on how to form divergent, distant associations. Incubation literature suggests that intuition after taking breaks or becoming distracted from tasks is related to divergent associations and novel problem frames (Sio & Ormerod, 2009). During the breaks or when distracted, individuals incubate ideas or form novel, unconscious associations that the conscious mind would not have made. Despite the insights, incubation research is yet to propose a reliable and specified model or process to effectively generate divergent associations (Ellwood, Pallier, Snyder, & Gallate, 2009). One reason is that the existing means to form divergent associations are often unreliable (Shin & Grant, 2021). Incubation and divergent associations depend on how effectively individuals distance from the tasks to consider alternative and novel possibilities while maintaining some focus on the tasks (Rosenbaum, Gong, & Potts, 2014; Soderberg, Callahan, Kochersberger, Amit, & Ledgerwood, 2015). This detached focus or diffused attention is the central mechanism for divergent associations (Dane, 2011). While breaks and distractions are the main means to create the psychological distance, individuals may prematurely reach conclusions during or before the breaks (Bhardwaj, Crocker, Sims, & Wang, 2018), think about bizarre topics unrelated to the problems (Baer, Dane, & Madrid, 2021), or shift their focus to other tasks and do not form associations (Shin & Grant, 2021). These possibilities all reduce the likelihood of generating distant associations during incubation. Moreover, when individuals should detach from the tasks (e.g., take breaks or become distracted) also remains underspecified. Scholars have claimed that individuals should “have some exposure to the task or have made some progress on the task” before taking breaks or becoming distracted for incubation to form divergent associations (p. 792, Shin & Grant, 2021). What constitutes appropriate “exposure” and “progress” is likely to be different for each task but has not been examined for specific activities (Baer et al., 2021).

This dissertation draws on Cognitive-Experiential Self-Theory (CEST, Epstein, Pacini, Denes-Raj, & Heier, 1996) and the problem finding and solving literature (Nickerson et al., 2007) to introduce a delayed intuition model that offers insights on how to reliably form divergent associations and thereby develop novel problem frames. An important insight from CEST is that rational-analytic thinking—the conscious, logical form of thinking—can influence and guide intuition (Epstein, 2008; 2010; Haidt, 2012). When rational-analytic thinking is dominant, individuals search for various information cues, think of distant possibilities, and delay premature judgments (Carter, Kaufmann, & Wagner, 2017; Epstein et al., 1996). The information and various possibilities can feed the intuitive system with the ingredients to form more divergent associations (Haidt, 2012). According to CEST, intuition and rational-analytic thinking are orthogonal, although the dominant form of cognition drives behaviors and decisions (Epstein et al., 1996; Pacini & Epstein, 1999).

Insights from CEST are aptly captured in Haidt (2012)'s metaphor, in which intuition is equated to an “elephant” and rational-analytic thinking to the “trainer” riding on the “elephant.” This metaphor is rooted in the research that intuition is related to associative and more primitive parts of the brain that tend to drive actions and decisions under uncertainty and incomplete information (Dane & Pratt, 2007; Damasio, 2006; Strack & Deutsch, 2004). Because intuition seeks conclusion and compels actions, rational analysis or the “trainer” has little influence once intuition has formed associations—just as the “elephant” becomes hard to direct after starting to run (see also, confirmation biases, Epstein, 2008; Kirkpatrick & Epstein, 1992; Kunda, 1990). Nonetheless, rational-analytic thinking can influence intuition *before* intuition becomes the dominant form of thinking. The “trainer” can search for information cues more broadly, think of distant possibilities, and inform the “elephant,” all the while restraining the “elephant” from

taking premature action (Epstein, 2008; 2010). After the “trainer” feeds the “elephant” with the information and potential possible interpretations, the “elephant” is now likely to frame or respond to the problems in novel ways.

The dissertation then extends the delayed intuition model to entrepreneurial problem framing and offers insights on how individuals can develop novel problem frames. According to the problem finding and solving literature, entrepreneurial problem framing consists of two stages: 1) the consideration of alternative problem frames to explain the symptoms (stage 1) and 2) the decision among alternative problem frames (stage 2; Baer et al., 2013; Cornelissen & Werner, 2014; Mintzberg, Raisinghani, & Theoret, 1976; Rumelt, 2012). Stage 1 is likely to be when individuals should engage in rational-analytic thinking and make the relevant “progress” in the tasks by considering various alternative frames of problems. Stage 2 is likely to be when intuition is let loose and drives the decisions on the problem frames. Importantly, the problem finding and solving literature also provide important boundary conditions for the process to be effective. According to the literature, problem framing starts after observing the problem-relevant information cues or symptoms (Nickerson et al., 2007), which constitutes the relevant “exposure” to the problems. The problem finding and solving literature also indicates that individuals need relevant motivation to engage in problem finding and solving activities. For the process to be effective, individuals would need the motivation to frame and solve entrepreneurial problems (Baer et al., 2013; Park & Baer, 2022). Additionally, since the process is an extension of the delayed intuition model, the same conditions for the delayed intuition model also apply: the goal of the task is not to find the right answers but to find novel, divergent answers, and individuals have sufficient time to engage in analysis and a distant search for possibilities.

One way to meet the conditions is to examine early-stage entrepreneurs' problem framing activities when entrepreneurs are finding and solving new problems to solve. The studies in the dissertation thus focus on early-stage entrepreneurs who have identified the symptoms of entrepreneurial problems and have the motivation to solve the problems. An archival study that relies on entrepreneurs' descriptions of problem framing provides evidence that individuals who use rational-analytic thinking in stage 1 and intuition in stage 2 are more likely to develop novel frames of entrepreneurial problems. A randomized field experiment tests the delayed intuition process and finds causal evidence for the process and, by extension, the underlying model. The delayed intuition model and process also contribute to the incubation literature. Many scholars and practitioners still conclude that intuition largely results in obvious, common problem frames, and only luck or "genius" individuals' intuition results in novel frames of entrepreneurial problems (Christensen, Hall, Dillon, & Duncan, 2016; Garbuio, Dong, Lin, Tschang, & Lovallo, 2018). The delayed intuition model contributes to the problem finding and solving literature (Nickerson et al., 2007; Mintzberg et al., 1976) by offering insights on how to generate divergent associations that are key to novel problem frames and solutions (Gavetti et al., 2005; Felin et al., 2020; Vogus & Grimes, 2021). The delayed intuition model is broadly applicable to problems that 1) have no right answers and novel, divergent solutions are valued and 2) offer sufficient time to engage in analysis and consideration of alternative frames (i.e., do not require split-second decisions). The two conditions for the delayed intuition model exclude certain problems like visual identification or technical problems with clear, right answers or extremely urgent crises that do not allow even a brief analysis. Still, the delayed intuition model applies to many contexts, such as problem-solving for strategic advantages in dynamic contexts

(Gavetti et al., 2005; Kahneman et al., 2019) or creativity (Shin & Grant, 2021), in which the conditions for the delayed intuition model to be applicable are met.

The delayed intuition model also challenges the common view in the problem finding and solving literature that intuition is inferior to analysis. The literature has typically built theories on problem-solving with the assumption that the information needed to make optimal choices in problem-solving are readily available (Park & Baer, 2022; Posen, Keil, Kim, & Meissner, 2018). This assumption has led scholars to overlook contexts in which the structured information to diagnose the right frames and root causes of problems is costly to acquire—i.e., contexts often related to entrepreneurship and innovation (Alvarez & Porac, 2020). While analysis may be useful when all the relevant information can be identified, the dissertation highlights problem finding and solving contexts in which individuals need to rely on their gut feeling to create value (see also, Simon, 1987).

Finally, this dissertation contributes to the entrepreneurship literature by providing insights on generating novel frames of entrepreneurial problems. Entrepreneurship literature has examined framing from an interpersonal perspective, exploring how entrepreneurs communicate and persuade other individuals through framing their ventures or problems in distinct ways (Snihur, Thomas, Garud, & Philips, 2021). However, before distinctive frames are communicated with other actors, individuals need to first develop such frames. This dissertation explains how individuals can be more successful in doing so. The insights are particularly valuable because previous scholars had proposed conflicting views. Some scholars have proposed that intuition is essential and analysis is ineffective in entrepreneurial problem framing and solving, while other scholars claim that a rational, scientific approach is superior to intuition (Alvarez & Porac, 2020; Camuffo et al., 2020). This dissertation relies on decades of research in CEST (Epstein, 1994;

2010) to propose a more nuanced model in which rational-analytic thinking and intuition supplement each other. Although analysis alone can result in costly delays and missed opportunities (Alvarez & Porac, 2020) and intuition alone can result in the heuristic, obvious associations (Camuffo et al., 2020), the delayed intuition model proposes that individuals can develop superior, novel frames of entrepreneurial problems if they use analysis and intuition in tandem.

Chapter 2: Theory

2.1 Entrepreneurial Problems

Highly successful, influential entrepreneurial ventures often start from solving needs or pain points that have not been solved before (i.e., entrepreneurial problems). These problems do not refer to incremental problems wherein the goal is to solve well-known needs or pain points better with improved products. Instead, entrepreneurial problem-solving aims to solve highly novel problems incumbents have not solved (Binns, O'Reilly, & Tushman, 2022; Tamaseb, 2021). As a result, entrepreneurial problems are not observed within existing markets or firms like strategic and managerial problems (Christensen, Ojomo, & Dillon, 2019; Nickerson et al., 2007). For instance, individuals may become aware of entrepreneurial problems from external, transformative events like COVID-19, experiences of pain points that existing products and services do not solve, or observations of needs or pain points of individuals who are outside the known market segments (Alvarez & Porac, 2020; Christensen et al., 2019; Von Hippel, 2009). Framing and solving entrepreneurial problems are difficult because significant portions of entrepreneurial problems' symptoms are ambiguous and unstructured, and structured information to find the right frames of problems is costly to acquire. In other words, the problems are likely observed not from repeatedly used performance indicators or expectations but rather perceived or experienced through ambiguous and unstructured information cues (Christensen et al., 2016; Nickerson et al., 2007; Von Hippel, 2009). For example, symptoms of entrepreneurial problems may include raw video footage, first-hand observations, hunches, and other unprocessed, unstructured information that can be interpreted in multiple ways (Townsend et al., 2018). Indeed, structured and validated measures to frame the problems would emerge after the problems are solved and widely understood (Berglund, Bousfiha, & Mansoori, 2020; Taleb,

2007). However, waiting for the measures and other structured information likely costs the opportunities to solve and understand these problems before other actors. So entrepreneurial problem-solving and value creation often entails framing and solving problems without structured information (Keynes, 1937; Knight, 1921; Schumpeter, 1934).

Solving problems that have not been solved before does not guarantee successful ventures, because success in entrepreneurial ventures can also depend on success in funding, marketing, operation, and other activities. Nonetheless, entrepreneurial problems represent distinct problems that increase the likelihood of value creation and building successful entrepreneurial ventures (Alvarez & Barney, 2005; Rindova & Courtney, 2020). Decision-makers in established firms typically seek predictability and are risk-averse, so they prefer to solve problems with known outcomes and proven approaches (Knight, 1921; Mueller, Melwani, Loewenstein, & Deal, 2018). Consequently, the decision-makers often focus more on problems in existing markets and available customers, in which the potential profit and outcomes are predictable (Binns et al., 2022). Individuals who undertake the uncertainty in outcomes and take actions to solve entrepreneurial problems are thus uniquely positioned to build highly successful entrepreneurial ventures (Knight, 1921). Individuals solving entrepreneurial problems can build unique capacities, customer relations, and knowledge that can serve as competitive advantages when other firms finally recognize the opportunities and decide to also solve the same problems (Christensen, 2013; Kupor, 2019; McKelvey, 2020).

Indeed, a review of entrepreneurial ventures found that two of the most significant factors related to entrepreneurial firms' success (reaching one billion dollars in valuation) in the U.S. since 2005 are finding new needs or pain points (i.e., entrepreneurial problems) and building new knowledge and capacities to solve these problems (Tamaseb, 2021). These two factors

essentially are facets of the entrepreneurial problem-solving process. The importance of solving entrepreneurial problems explains why some Silicon Valley venture capitalists advise entrepreneurs to create new “pain killers” rather than new “vitamin pills” that improve the status quo. In his review, Tamaseb (2021) recorded that more than two-thirds of entrepreneurial firms that reached a billion-dollar mark (also called “unicorns”) solved entrepreneurial problems and developed new “pain killers.” Nearly two-thirds of the comparison group of firms that shared similar characteristics (e.g., amounts of funding, founding team compositions) but did not reach similar successes sold “vitamin pills.” Although “vitamin pills” can result in valuable ventures and the unicorn status is not the only way to measure success in entrepreneurship and innovation, entrepreneurial problems seem to be particularly valuable in building successful ventures or products that provide unique value.

2.2 Entrepreneurial Problem-solving

The problem finding and solving literature states that nonroutine problem-solving generally starts from problem finding or observing initial, concrete symptoms of problems (Baer et al., 2013; Nickerson et al., 2007). The initial symptoms, such as observations or experiences of pain points and deviations from expectations, focus problem-solvers’ attention. Symptoms provide foundational information and clues about the problems, but what the problems mean and what to do may not be immediately obvious. After problem finding, individuals thus benefit from problem framing that helps categorize the symptoms. Problem framing helps individuals interpret the symptoms as information cues and know which knowledge domains are relevant (Baer et al., 2013; Barsalou & Hale, 1993). The knowledge domains help formulate the problems or diagnose the underlying causes, guiding solution search processes (Nickerson & Argyres,

2018; Mintzberg et al., 1976). In other words, problem frames enable individuals to understand what is going on and what to do (Walsh, 1995).

2.3 Novelty as the Criterion of Success in Entrepreneurial Problem Framing

Previous scholars suggest that novel problem frames are central to successful entrepreneurial problem-solving (Casson, 1982; Felin & Zenger, 2009; Felin et al., 2020). Common problem frames lead individuals to take actions that most other people would take and conceptualize problems in mundane ways. Many people would share such frames, so their strategies and approaches to solutions will be similar and are unlikely to generate unique value (Felin & Zenger, 2017). Instead, entrepreneurial success is often related to uncommon problem frames that few people come up with because these frames enable entrepreneurs to develop unique strategies and create value that other firms or competitors do not (McKelvey, 2020; Thiel & Masters, 2014; Patvardhan & Ramachandran, 2020). Although novelty in problem frames does not ensure success in entrepreneurship, novel problem frames are critical in generating unique strategies, products, or services fundamental to entrepreneurial success (Felin & Zenger, 2009; 2017; Shin & Grant, 2021).

This emphasis on novelty is consistent with the broader framing literature that considers novel frames valuable in innovation and adaptive strategies in dynamic environments (Cornelissen & Werner, 2014). In these environments, individuals operate with limited information and benefit from novel ideas. Scholars have claimed that existing, familiar frames in these contexts result in cognitive inflexibility and lower performance (Benner & Tripsas, 2012; Tversky & Kahneman, 1989). For instance, Nokia and Blackberry's inability to understand the problems that Apple attempted to solve with iPhones illustrates this point. The firms continued to frame their

problems in terms of cost or physical keyboards and failed to develop new frames to categorize the problems that iPhones were solving.

Beyond the framing literature, several streams of research suggest that novel problem frames are key to innovation and value creation. In the innovation literature, Christensen (2013) suggested that the most important reason incumbent firms failed to identify disruptive innovations before they were disrupted was that they had exploited familiar problem frames (see also Christensen et al., 2016). For instance, incumbents often use existing indicators optimized for known problems when they need to interpret and categorize new, unvalidated symptoms to understand disruptive innovations that serve new market segments and address novel pain points (Christensen et al., 2019). The research on ambidextrous leadership is centered on the observation that existing organizational knowledge and systems are poor at solving new needs and pain points that entrepreneurial problems represent (O'Reilly & Tushman, 2021). The literature recommends incumbents launch subsidiaries that remain independent and distant from the host organization to create new knowledge and capabilities for entrepreneurial problems (Binns et al., 2022; Tushman & O'Reilly, 1996).

Jim McKelvey, a co-founder of Square, illustrates the importance of novel frames for entrepreneurial problems. He observed a symptom of an entrepreneurial problem when he experienced difficulty accepting credit card payments while working as a small-scale glassblower in the U.S. (McKelvey, 2020). These payments had to go through existing financial transaction platforms that demanded high fees and security requirements that small merchants could not easily accommodate. The pain point was widespread among small-scale merchants who frequently lost sales and revenue because of existing financial platforms. However, McKelvey's frame of the problem as a lack of digital financial services optimized for small-scale

merchants was new as most other merchants thought the pain point was part of operating small-scale businesses (McKelvey, 2020). McKelvey associated the pain points with the problems in technology domains while most other merchants did not, which led him to collaborate with Jack Dorsey and explore technological solutions.

2.4 Antecedents for Novel Frames

Research on entrepreneurship suggests that intuition—the unconscious and associative form of thinking (Dane & Pratt, 2007)—is essential in entrepreneurial problem framing (Alvarez & Porac, 2007; Foss & Klein, 2005; Rindova & Courtney, 2020). Given high information costs related to entrepreneurial problems, individuals benefit from using their experiences, values, and personal beliefs embedded in intuition to categorize these problems (Foss & Klein, 2005; Rindova & Courtney, 2020). In contrast, rational-analytic thinking (the conscious, logical, and rational form of thinking) relies on validated information such as proven, repeatedly used indicators or measures to make logical decisions and judgments that other rational individuals can accept (Damasio, 2006; Epstein, 2008; Lieberman, 2007). So, rational-analytic thinking can prevent decisions until such information becomes available (March, 2006; McKelvey, 2020). However, individuals are unlikely to find validated logic or proof to rationally defend novel frames for entrepreneurial problems as the problems have not been successfully solved, so rational-analytic thinking can cost the opportunities to solve the problems (Keynes, 1937). Instead of waiting, individuals intending to create value often need to take explorative actions before structured information to ascertain the right frames of problems becomes available. For example, Dr. Dean had to decide on a potential frame and act before COVID-19 became systematically analyzed and the structured information about its features was known. Intuition enables such explorative actions because individuals relying on intuition can use their personal

beliefs, experiences, and values to fill in the gaps in available information (Dane & Pratt, 2007; Sadler-Smith, 2016; Zellweger & Zenger, 2021). In particular, intuition can enable individuals to associate the symptoms of entrepreneurial problems with those of previous problems in diverse domains. Then, intuition encourages individuals to take the leap of faith and make bold choices on untested, novel problem frames (Alvarez & Porac, 2020). Neuroscience research reports that individuals whose intuitive capacities are compromised fail to make judgments and decisions when they have insufficient information to find optimal, correct answers (Damasio, 2006). Without intuition, even trivial choices like deciding which restaurants to go to with a new friend become difficult unless individuals have comprehensive information to make optimal choices (e.g., knowledge of the friend's preferences and understanding of all possible restaurants and menus). Furthermore, unique, contrarian beliefs that underlie novel problem frames are sometimes precisely what most people consider irrational or unscientific because the frames are different from most other individuals' frames of the problems (Thiel & Masters, 2014; Patvardhan & Ramachandran, 2020). What is rational may be to follow and accept the common frames that other people have generated and accepted rather than deviate from them (March, 2006).

2.5 Intuition as a Double-edged Sword

While intuition enables decisions among alternatives despite incomplete information, intuition is a double-edged sword that frequently generates obvious associations and frames (Camuffo et al., 2020; Christensen et al., 2016; Kahneman, 2011). Intuition compels individuals to reach conclusions and closure (Epstein et al., 1996), so intuition can lead individuals to impose readily available problem frames onto the problems to quickly understand what is going on and what to do (Grimes & Vogus, 2021; Hodgkinson et al., 2009; Simon, 1972). The quick associations and

reactions to problems are adaptive if problems are familiar and individuals have relevant knowledge sets (Dane & Pratt, 2007; 2009; Kahneman, 2003) but expose individuals to stereotypes, prejudices, and biases when the phenomena are highly novel (Kahneman & Klein, 2009). For instance, recency bias can lead individuals to associate new problems with problems that had occurred in the recent rather than distant past, even when the problems from the distant past are more appropriate in explaining the symptoms (SARS of 2003 rather than the pandemic of 1918). Familiarity biases lead individuals to impose problem frames that individuals have used before and understand well because doing so can save effort in finding other potential problem frames, even though the familiar frames do not explain the symptoms well (Tetlock & Gardner, 2016).

More systematic evidence of the divergent capacities of intuition is present in the incubation literature. The literature has found that taking breaks or becoming distracted from tasks can help individuals form more divergent associations (Sio & Ormerod, 2009). Breaks and distractions enable individuals to distance themselves from the tasks and integrate diverse sources of information to form novel or distant associations that the conscious, logical mind might not form or expect (Dane & Pratt, 2009; Norris & Epstein, 2011; Stanczyk, Foerstl, Busse, & Blome, 2015). Breaks and distractions can prevent individuals from forming decisions prematurely and grabbing the “low hanging fruit” or jumping to the most obvious associations (Rosenbaum et al., 2014) and allow individuals to make unexpected connections (Dane, 2011).

Despite its valuable insights, the incubation literature lacks a systematic model that can reliably encourage divergent associations. Incubation depends on individuals’ cognitive distance from the tasks, allowing diffused attention and a broad search for distant information and possibilities (Dane, 2011; Sio & Ormerod, 2009). Breaks and distractions are widely used to create cognitive

distance but are considered insufficient and unreliable (Ellwood et al., 2009; Shin & Grant, 2021). During the breaks or when distracted, individuals can still jump to obvious associations, disengage with or forget about the tasks, daydream about bizarre, unrelated topics, and thus generate no novel ideas (Baer et al., 2021; Bhardwaj et al., 2018; Haidt, 2012). As importantly, researchers indicate that certain “exposure” or “progress” in the tasks is crucial for incubation to form divergent associations but what the “exposure” or “progress” entails remains unclear (Shin & Grant, 2021). The lack of reliable guidance and precision in the incubation literature has led scholars and practitioners to maintain that intuition is unreliable and results in obvious, biased associations (Christensen et al., 2016; Garbuio et al., 2018).

2.6 Insights from CEST

The dissertation provides the missing insights in the incubation literature by building the delayed intuition model from Cognitive-Experiential Self-Theory (CEST). CEST shares an important similarity with other theories of human cognition in that CEST divides cognition into two distinct modes: rational-analytic thinking and intuitive, unconscious, and associative thinking. For example, William James (1997) divided cognitions into associative thinking and true reasoning. In his view, associative thinking uses previous experiences, while true reasoning relies on more analytic thinking capacities. Evans (2008) differentiated between heuristic and analytic processes, in which heuristic thinking filters the relevant information using schemas, and the analytic process then makes judgments using the filtered information. Petty and Cacioppo (1986) theorized that individuals might engage in careful analysis and elaboration of a phenomenon to generate arguments or take shortcuts to make quick judgments. Several other models exist, such as Strack and Deutsch’s (2004) reflective and impulsive systems, Lieberman’s (2007) reflexive and reflective systems, and Sloman’s (1996) rule-based, conscious thinking and

associative, experiential thinking. Perhaps the most famous dualistic model is system one and system two thinking. System one is automatic, instinctive, and fast thinking. System two is conscious, analytic, and slow (Stanovich & West, 2000; Kahneman, 2003). The theories largely accept that dispositional and situational factors influence individuals' cognition at a given time (Dane, Baer, Pratt & Oldham, 2011; Hodgkinson & Sadler-Smith, 2018).

Consistent with other dualistic models of human cognition, CEST proposes that one dominant form of thinking drives behaviors at a given moment (Epstein et al., 1996; Pacini & Epstein, 1999). However, unlike other dualistic models of human cognition, CEST views that the two forms of cognitions are orthogonal and that activating one form of cognition does not turn off the other. Instead, according to CEST, optimal performance may depend on intuition and rational-analytic thinking in conjunction or a particular sequence (Dane et al., 2011; Epstein, 2008, 2010). For example, although intuition is unconscious and consciously monitoring or influencing this process is difficult, CEST suggests that individuals can use rational-analytic thinking to set the path for intuition before intuition becomes dominant (Epstein, 2008; 2010; Haidt, 2012). As in Haidt's metaphor (2012), the "trainer" (rational-analytic thinking) can search and analyze relevant information and possibilities and inform the "elephant." With the information and analyzed possibilities, intuition can form novel sets of decisions or choices that intuition could not have made.

According to CEST, rational-analytic thinking can be useful in paying greater attention to the available information cues like symptoms and entertaining alternative, distant problem frames, which can prepare intuition to form more divergent associations. Rational-analytic thinking is related to rejecting readily available but inadequate explanations and putting a greater cognitive effort into developing alternative interpretations of events (Amit & Sagiv, 2013; De Dreu, 2003;

Kruglanski, 1989; Livi, Kruglanski, Pierro, Mannetti & Kenny, 2015). For instance, a negotiation study found that individuals who engaged in rational-analytic thinking did not use obvious, heuristic associations and instead reflected on available information to form more informed decisions (Ten Velden, Beersma, & De Dreu, 2010). The evidence thus suggests that rational-analytic thinking is related to considering alternative interpretations or frames of problems rather than accepting readily available problem frames. This process is important because, if intuitive thinking is dominant, individuals can jump to reaching conclusions from any one of the possible problem frames. The unconscious mind is constantly looking for associations, even during analysis. When individuals are searching for new information, the unconscious mind activates memories (implicit or explicit) to see if the memories of various experiences or knowledge sets can explain what individuals see (Dane & Pratt, 2007; Epstein, 2008). Although some activation in intuitive thinking is unavoidable, ensuring that rational-analytic thinking is the generally dominant form of thinking increases the likelihood that individuals do not loosen their restraints on intuition and let intuition reach conclusions. Related to this argument, lab experiments found that rational-analytic thinking is related to developing independent interpretations and opinions rather than accepting traditional explanations (Amit & Sagiv, 2013; De Grada, Kruglanski, Mannetti & Pierro, 1999). Although analysis is unlikely to help individuals decide on new, bold, and untested frames (Damasio, 2006; March, 2006), rational-analytic thinking is crucial in considering distant information and possibilities and making the relevant “progress” to allow more distant, uncommon associations.

The delayed intuition model is consistent with adaptive heuristics and CEST-based psychotherapy research. The literature on adaptive heuristics (e.g., Gigerenzer, 2008) provides similar insights on how intuition can be adaptive. This literature emphasizes that individuals first

analyze the situations to know which heuristics to activate with greater accuracy. While this stream of research is not as widely studied as the mainstream heuristic research (e.g., systems 1 and 2), the research has accumulated a robust set of insights on how individuals can be intentional in using heuristics and optimizing performance for different tasks (Luan, Reb, & Gigerenzer, 2019). Even among athletes and other individuals who have to act quickly to their surroundings, a short analysis of the situation and delay in judgments are related to greater performance in this literature. Psychotherapy reliant on CEST (Epstein, 2008; 2010) also directs individuals to analyze intuitive responses with rational-analytic thinking before making judgments. The analysis can produce multiple potential interpretations of events (e.g., emotionally challenging experiences are interpreted as opportunities for growth), and intuitive responses can change based on the analysis (individuals embrace rather than avoid the experiences)

2.7 Delayed Intuition Process

This dissertation proposes a delayed intuition process for entrepreneurial problem framing by integrating CEST and the problem finding and solving literature. The process is an application of the model toward entrepreneurial problem framing activity. So, the process assumes that individuals have found the symptoms signaling entrepreneurial problems and individuals have the motivation to find and solve entrepreneurial problems before other actors to create value. Like the delayed intuition model, the applicability and value of the process depend on the assumptions that individuals' goal in the tasks is not to find the right answers but to find novel and divergent answers and that individuals have the time to analyze and engage in a distant search. The process is thus not applicable for problem framing for visual identification problems, urgent crises, or technical problems with optimal, right answers.

The process is useful in understanding what “exposure” and “progress” may help intuition form divergent associations. The “exposure” is likely to be the ambiguous symptoms of entrepreneurial problems found during entrepreneurial problem finding (Nickerson et al., 2007). The “progress” is likely the consideration of alternative problem frames using rational-analytic thinking, which provides individuals with the repertoire of associations they can make. The problem finding and solving literature divides problem framing into two stages (Cornelissen & Werner, 2014; Baer et al., 2013; Vaccaro, Brusoni, & Veloso, 2011). Stage 1 is considering diverse symptoms and potential possible problem frames to explain them. Stage 2 involves deciding on entrepreneurial problem frames. The two stages are not objective timestamps but are valuable in understanding when individuals need to use rational-analytic thinking or intuition. In stage 1, the “trainer” observes the information and thinks of potential associations while restraining the “elephant” from taking action. The “elephant” is awake and listens to the “trainer.” When individuals need to decide on the problem frame, they can take off the restraints on the “elephant” in stage 2, which is now aware of distant but relevant associations. Assuming that routine problems that can be solved with common frames would likely have been solved already, this process would encourage individuals to choose uncommon and distant problems. In the delayed intuition process for entrepreneurial problem framing, rational-analytic thinking is dominant in stage 1, and intuition is dominant in stage 2.

The delayed intuition model and process emphasize that the sequence from analysis to intuition is optimal in generating novel frames of entrepreneurial problems. Rational-analytic thinking alone will result in a continuous search for more structured information to decide the logically correct or optimal frames of problems (Damasio, 2006; Epstein, 2008). Intuition alone would result in obvious associations and common problem frames. Perhaps more importantly, intuition

followed by analysis is unlikely to result in novel problem frames for the following reasons. First, research on confirmation biases indicates that individuals are unwilling to change their intuitive judgments (Kirkpatrick & Epstein, 1992; Kunda, 1990). Once intuition becomes dominant, and forms conclusions, the sense of certainty and closure intuition creates leads individuals to feel that their conclusions are already reached (Epstein, 2008; 2010). Since intuition is unconscious, the underlying rationales are hard to objectively evaluate and reject, even if individuals have the intention to revise them. Second, since intuition compels actions, individuals whose intuition has become dominant will likely have started developing solutions or reacting to the problems (Bhardwaj et al., 2018). Changing or rejecting problem frames can also nullify individuals' efforts to develop solutions, so individuals are likely to persist in their initial intuitions and ignore information suggesting that familiar problem frames are inappropriate (Benner & Tripsas, 2012; Mueller et al., 2018). CEST and related literatures such as adaptive heuristics thus focus on guiding and informing intuition rather than correcting intuition after the associations are formed. Drawing on the problem-solving literature and CEST, this dissertation proposes that:

Hypothesis: Framing entrepreneurial problems using rational-analytic thinking prior to intuition (i.e., during stage 1) results in greater novelty of entrepreneurial problem frames (in stage 2) compared to cases in which intuition is not preceded by or precedes rational-analytic thinking.

Chapter 3: Study 1

Study 1 uses an archival dataset to test the hypothesis. The archival data consists of Chinese agriculture entrepreneurs' descriptions of their problem framing process. The entrepreneurs participated in an entrepreneurship training program at a Chinese university (Mean age = 36.72, Female = 26 %). The training program was a collaboration among a government institution, a private firm, and a university. The program's overarching goal was to train leading, ambitious, growth-oriented Chinese agriculture entrepreneurs to advance the industry and conduct research on Chinese agriculture entrepreneurs. As part of the program, the program director asked participating entrepreneurs to describe their problem-solving process that resulted in the creation of their firms. These problems epitomize entrepreneurial problems, as venture creation and growth-oriented entrepreneurship are linked to solving problems existing products and services in the marketplace do not solve.

I computed a power analysis to determine the minimum number of participants required for the study. I assumed a medium effect size (Cohen's value = 0.15 for general regressions), power of 0.80, and nine variables (two thinking styles at Times 1 and 2 and five controls) for the analysis. The analysis reports that I need at least 98 participants. I collected data from 171 entrepreneurs.

3.1 Entrepreneurial Problem Framing

The descriptions of entrepreneurial problem framing depended mainly on the responses to two questions that participants answered as part of their assignments in the training program. The first question asked them to describe their initial encounters with problems that motivated them to start their ventures. The second question asked them to report how they interpreted and framed the problems. The two questions capture entrepreneurs' problem framing processes from the

observations or experiences of symptoms and consideration of any alternative problem frames (stage 1) to the eventual development of novel problem frames (stage 2).

3.2 Measures of Rational-Analytic Thinking and Intuition

I used the Chinese version of LIWC (Linguistic Inquiry and Word Count) to capture entrepreneurs' thinking at stages 1 and 2 of entrepreneurial problem framing. LIWC uses dictionaries of words associated with different cognitive and emotional dimensions (e.g., positive affect, causal diagnosis) and identifies the usage of these terms in texts to provide overall evaluations of individuals' cognition reflected in their writing. Scholars have developed and improved LIWC over the past three decades, and LIWC is one of the most widely used and validated tools for natural language processing (Pennebaker, 1993; Pennebaker, Francis, & Booth, 2001; Pennebaker, Boyd, Jordan, & Blackburn, 2015). For instance, scholars have used LIWC to empirically capture rational and intuitive thinking in various data (Rand & Epstein, 2014; Tausczik & Pennebaker, 2010), including President Trump's tweets (Jordan & Pennebaker, 2017). LIWC is available in many languages, including Chinese.

I have used the Analytic dimension of LIWC to capture the degree to which the entrepreneurs engaged in rational-analytic or intuitive thinking. LIWC scholars claim that greater values in Analytic represent more rational-analytic thinking while smaller values represent more intuitive thinking (Pennebaker et al., 2015). The scholars have also validated and used Analytic as a proxy for rational-analytic thinking in several studies, including one with over 50,000 college admission essays (Jordan & Pennebaker, 2017; Jordan, Sterling, Pennebaker, & Boyd, 2019; Pennebaker, Chung, Frazee, Lavergne, & Beaver, 2014). The Chinese version of Analytic relied on the following formula: $30 + \text{preposition} - \text{personal pronoun} - \text{impersonal pronoun} - \text{auxiliary verb} - \text{conjunction} - \text{adverb} - \text{negation}$. Prepositions indicate that individuals are trying to tie

together different factors to form more complex sentences, indicative of rational-analytic thinking (Davies, 2011; Epstein et al., 1996; Pennebaker et al., 2014). The personal pronoun, impersonal pronoun, auxiliary verb, conjunction, adverb, and negation are related to intuitive thinking (Jordan et al., 2019). For example, using personal pronouns indicates a more personal, informal writing style associated with intuition. Adverbs and impersonal pronouns (e.g., it, that) are typically avoided in formal writing as they can be unnecessary or unclear.

For example, an answer for Question 1 that scored high in Analytic included the following sentences, which contained many prepositions and complex sentences:

Apple farmers were often hopeless in legal and logistic processes. Buyers could put the deposit for the apples without writing down the contracts. Farmers had to wait for the buyer every day without having a way to complete the sales. So farmers typically reduced risk by accepting numerous sales requests from buyers as they expected many buyers would not go through with the sales.

The same entrepreneur answered question 2 with the following sentence, which was rated low in Analytic: “I saw a contract problem. I thought farmers should become more used to writing and using legal contracts.” Personal pronoun, “I,” and auxiliary verb, “should,” reduced the Analytic dimension. Incidentally, the frame in the answer for question 2 was rated as high in novelty by the raters because this approach contrasted with other farmers’ frame of the problem as risk diversification, while capturing apple farmers’ needs and pain points.

For the ease of interpreting results, I reversed rational-analytic thinking in stage 2 to capture intuitive thinking (i.e., Intuitive) since the delayed intuition model prioritizes intuition in stage 2. I subtracted each participant’s Analytic value from the maximum value in the sample (52.22) so that a greater value in Analytic in stage 2 resulted in lower Intuitive in stage 2. Although this linear transformation of the variable does not influence the analysis results, the results can more easily highlight the effects of intuitive thinking in stage 2. As an alternative measure of cognition in stages 1 and 2, I also created a variable, Delayed Intuition, which is categorical and has the

value of 1 if Analytic in Stage 1 is larger than Analytic in Stage 2. The variable captures whether individuals relied on intuition more during the later stage of entrepreneurial problem framing, consistent with the delayed intuition model. The variable is useful as a within-subject measure, complementing the between-subject measures of rational-analytic and intuitive thinking. The between-subject measures provide insights into whether greater reliance on rational-analytic thinking and intuition generally results in novel problem frames. Delayed Intuition offers insights on whether individuals who increased their reliance on intuition from stages 1 to 2 developed more novel problem frames over time. The two alternative measurement approaches can increase confidence in inferring conclusions from the results. Below, I have analyzed the data with Analytic and Intuitive, and Delayed Intuition.

3.3 Pretest

I have conducted a pretest (a between-subject, randomized experiment) to validate LIWC in the context of entrepreneurial problem framing. The goal of the pretest was to check if the manipulations to encourage rational-analytic or intuitive thinking indeed influenced the language that individuals used and the Analytic dimension in particular. The sample for the pretest was from Prolific Academics. Through this platform, I selected a sample of individuals who were entrepreneurs or had the intention to become one (N = 220; 0.34 % male, average age = 27.97). The pretest asked all participants to frame the problem using the following instruction. The pretest did not divide problem framing into stages 1 and 2 because novelty of problem frames or changes in cognition were not the focus of the pretest.

Often, important opportunities come from finding and solving needs or pain points that existing products and services do not solve. **Please think about needs or pain points (indicators of underlying problems) that existing products and services do not solve.** What were the pain points or needs, who were experiencing them, and when? **Then, please frame the needs and pain points you have identified—what is the problem you are trying to solve?** Develop a

unique frame that distinguishes this problem from other similar problems that existing products or services solve.

For example, in the late 1970s, Jobs and Wozniak felt the need for computers that were easier to move and smaller in size while working at a computer firm, Atari. Steve Wozniak and Steve Jobs framed the pain points as a problem of ‘creating *personal* computers’ when existing firms were focused on creating large mainframe computers.

Consistent with previous research, the manipulations used formal, direct instructions to influence

individuals’ cognition (Dane et al., 2011). Specifically, half of the participants received the

following text to adopt rational-analytic thinking: “Please use logic to frame the needs or pain points. Provide logical arguments and/or concrete evidence to support your answers. Please do

not make judgments relying on your intuition.” The other half of the participants were in the

intuition condition and read the following text instead: “please rely on your gut feeling to frame

the needs or pain points. Use your intuition and write down what *you* personally think is the right

answer. Please do not search for logical, rational explanations for your answer.” The expectation

was that the manipulations would influence the use of languages related to rational-analytic

thinking and intuition, and LIWC and the Analytic dimension would capture the influence.

I included widely used scales for rational-analytic and intuitive thinking as manipulation checks

(Novak & Hoffman, 2009). The scale draws on the rational-experiential inventory (Pacini &

Epstein, 1999) and the need for cognition scale (Cacioppo, Petty, & Kao, 1984), which have

been used and validated in studies with Chinese and U.S. research participants (Su et al., 2021;

Zhang, Gursoy, & Xu, 2017). In contrast to the two other measures that are about general

tendencies to engage in rational-analytic and intuitive thinking, the scales by Novak and

Hoffman (2009) are developed to capture thinking styles for specific activities.

The scales by Novak and Hoffman (2009) started with the following sentence: “Please answer

the following questions. When finding the pain points and framing them...” The measures of

rational-analytic thinking depended on the answers to the following: “I reasoned things out

carefully,” “I approached the task analytically,” and “I arrived at my answer by carefully assessing the information” (Cronbach’s alpha = 0.77). The measures of intuitive thinking relied on the answers to the following: “I relied on my sense of intuition,” “I used my gut feelings,” and “I trusted my hunches” (Cronbach’s alpha = 0.93). The scales ranged from 1 = *Strongly Disagree* to 5 = *Strongly Agree* for all measures. I averaged the responses to the questions to form the final measures of cognition.

The manipulations were successful in influencing cognition according to the manipulation check questions. Participants in the rational-analytic thinking condition reported a greater use of rational-analytic thinking ($Mean = 4.42, SD = 0.50$) than those in the intuitive thinking condition ($Mean = 4.05, SD = 0.78, M_{\text{difference}} = 0.37, 95\% CI = [0.20, 0.54], t(189.71) = 4.21, p < 0.0001, d = 0.56$). Participants in the rational-analytic thinking condition reported that they relied less on intuitive thinking ($Mean = 3.16, SD = 1.36$) than the participants in the intuitive thinking condition ($Mean = 4.36, SD = 0.74, M_{\text{difference}} = 1.21, 95\% CI = [-1.50, 0.91], t(168.32) = 8.18, p < 0.001, d = 1.10$).

More importantly, individuals in the rational-analytic thinking condition scored higher in Analytic ($Mean = 75.48, SD = 25.88$) than those in the intuitive thinking condition ($Mean = 66.98, SD = 29.76, M_{\text{difference}} = 8.50, 95\% CI = [1.13, 15.88], t(216.83) = 2.27, p = 0.02, d = 0.30$). The results provide a further validation that LIWC is a useful tool in capturing individuals’ rational-analytic and intuitive thinking.

3.4 Control Variables for Study 1

Control variables for Study 1 included sex, age, breadth and depth of knowledge, revenue from the past year, and political orientation. Previous simulation studies found that individuals’ breadth and depth of knowledge can influence how individuals interpret and categorize problem-

related information (Gavetti et al., 2005). Depth of knowledge was measured as the number of years the entrepreneurs held the current position. Breadth of knowledge was measured as the number of different positions entrepreneurs had taken in their careers. Revenue is related to the size and success of the firm, which may influence how entrepreneurs report the frames of problems. For example, if the firms are successful, entrepreneurs may be more confident and do not feel the need to write in detail as they believe their performance speaks for itself. Log of revenue from the past year was thus included as another control variable. Political orientation (1 for communist, 0 for nonaffiliated) may influence entrepreneurs' tendency to consider the government's interests in framing their problems. Communist farmers may be likely to frame problems in ways coherent with the Communist party's goals, such as helping the poor residents of rural China (Marquis & Qiao, 2020).

3.5 Dependent Variable

Two experts in the Chinese agriculture industry evaluated the novelty of problem frames on a Likert scale (from 1 = *not at all novel* to 7 = *highly novel*). This approach is consistent with how novelty of ideas is evaluated in the creativity literature (Amabile, 1983; Hennessey & Amabile, 2010). The experts remained blind to the hypothesis and reached high convergence in their evaluation of novelty ($\alpha = .92$). An example of novel frames may identify a market for locally grown and brewed coffee in China—before this market existed. Before independent coffee brands and shops emerged in China, many Chinese people equated coffee to Starbucks and ignored the need for local coffee.

3.6 Results and Discussion

After initial analysis, the results indicated that the effects of the main independent variables need to be scaled. Given that the dependent variable ranges from one to seven and the Analytic

dimension ranges up to fifty-two, the interaction term's effect was observable only from the third decimal digit (0.001). For the analysis, I scaled Analytic in Stage 1 and Intuitive in Stage 2 by dividing the variables by a hundred.

Table 1 contains descriptive statistics and correlations among the variables. The value of Delayed Intuition is 0.22, meaning 22 % of the participants reduced their reliance on analytic thinking and increased the use of intuition in Stage 2 compared to Stage 1. One correlation that is worthy of attention was the correlation between rational-analytic thinking in Stage 1 and Delayed Intuition, which indicates that individuals who relied highly on rational-analytic thinking were more likely to increase their reliance on intuitive thinking in Stage 2.

Table 1 Descriptive statistics and correlations, Study 1

| Variable | Mean | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|--------------------------|-------|------|-------|-------|-------|-------|-------|------|------|-------|------|
| 1. Analytic Stage 1 | 0.13 | 0.14 | | | | | | | | | |
| 2. Intuitive Stage 2 | 0.29 | 0.08 | -0.24 | | | | | | | | |
| 3. Delayed Intuition | 0.22 | 0.41 | 0.53 | 0.29 | | | | | | | |
| 4. Novelty of frames | 3.20 | 1.11 | 0.27 | -0.01 | 0.29 | | | | | | |
| 5. Gender | 0.26 | 0.44 | 0.08 | -0.05 | -0.02 | 0.00 | | | | | |
| 6. Age | 36.72 | 7.65 | -0.15 | -0.01 | 0.05 | 0.13 | 0.09 | | | | |
| 7. Political orientation | 0.31 | 0.46 | -0.03 | 0.11 | -0.01 | 0.09 | -0.16 | 0.08 | | | |
| 8. Breadth of knowledge | 2.73 | 2.73 | 0.05 | -0.12 | 0.07 | 0.02 | -0.01 | 0.20 | 0.10 | | |
| 9. Depth of knowledge | 4.40 | 3.01 | 0.14 | -0.10 | 0.02 | -0.03 | 0.06 | 0.17 | 0.12 | -0.11 | |
| 10. Revenue (log) | 6.53 | 1.35 | -0.07 | 0.00 | -0.10 | 0.07 | 0.05 | 0.07 | 0.18 | -0.02 | 0.07 |

Models in Table 2 support this dissertation's hypothesis. Model 2 indicates that neither rational-analytic thinking in Stage 1 likely has a main effect on novelty of problem frames ($b = 2.79$, $SD = 0.64$, $p < 0.01$) but not intuitive thinking in Stage 2 ($b = 0.59$, $SD = 1.02$, $p = 0.57$). Model 3 with the interaction reports that the interaction is significant ($b = 14.80$, $SD = 6.20$, $p = 0.02$). The main effects with the inclusion of the interaction are negative (Analytic: $b = -1.08$, $SD = 1.74$, $p < 0.54$; Intuitive: $b = -1.52$, $SD = 1.34$, $p = 0.26$). Figure 1 illustrates the interaction effect in Model 3. Model 4 finds that Delayed Intuition is related to greater novelty ($b = 0.80$, $SD =$

0.20, $p < 0.01$). Entrepreneurs who relied more on intuitive thinking and less on rational-analytic thinking in stage 2 compared to stage 1 framed entrepreneurial problems with greater novelty.

Table 2 Regression results for novelty of entrepreneurial problem frames, Study 1

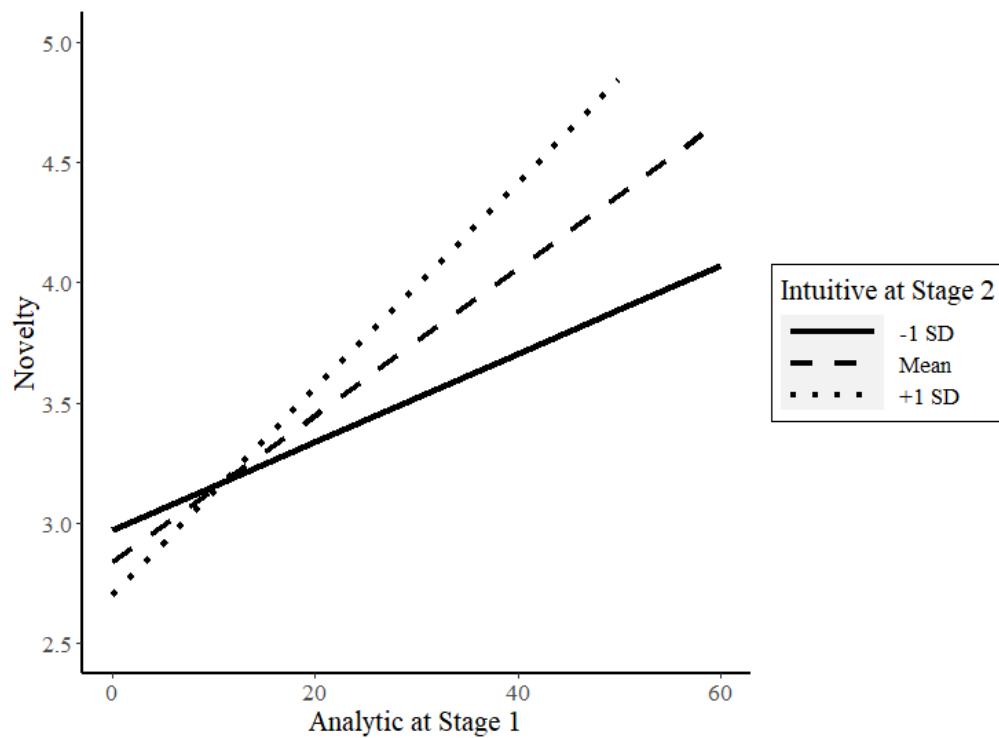
| Variable | Model 1 b (SE) | p | Model 2 b (SE) | p | Model 3 b (SE) | p | Model 4 b (SE) | p |
|---|-------------------|------|-------------------|------|-------------------|------|-------------------|------|
| <i>Control variables</i> | | | | | | | | |
| Gender | 0.00 (0.20) | 1.00 | -0.07 (0.19) | 0.70 | -0.08 (0.19) | 0.66 | 0.02 (0.19) | 0.94 |
| Age | 0.02 (0.01) | 0.09 | 0.03 (0.01) | 0.01 | 0.03 (0.01) | 0.02 | 0.02 (0.01) | 0.11 |
| Breadth of knowledge | -0.02 (0.06) | 0.77 | -0.04 (0.06) | 0.49 | -0.05 (0.06) | 0.40 | -0.04 (0.06) | 0.57 |
| Depth of knowledge | -0.03 (0.03) | 0.39 | -0.05 (0.03) | 0.10 | -0.04 (0.03) | 0.12 | -0.03 (0.03) | 0.30 |
| Revenue (log) | 0.04 (0.07) | 0.52 | 0.06 (0.06) | 0.31 | 0.08 (0.06) | 0.20 | 0.07 (0.06) | 0.28 |
| Political Orientation | 0.19 (0.19) | 0.32 | 0.20 (0.29) | 0.29 | 0.17 (0.18) | 0.36 | 0.20 (0.19) | 0.27 |
| <i>Main variables</i> | | | | | | | | |
| Analytic in Stage 1 | | | 2.79 (0.64) | 0.00 | -1.08 (1.74) | 0.54 | | |
| Intuitive in Stage 2 | | | 0.59 (1.02) | 0.57 | -1.52 (1.34) | 0.26 | | |
| Delayed Intuition | | | | | | | 0.80 (0.20) | 0.00 |
| <i>Interactions</i> | | | | | | | | |
| Analytic in Stage 1 × Intuitive in Stage 2 | | | | | 14.80 (6.20) | 0.02 | | |
| Constant | 2.29 (0.59) | 0.00 | 1.44 (0.68) | 0.03 | 2.11 (0.72) | 0.00 | 2.08 (0.56) | 0.00 |
| Observations | 171 | | 171 | | 171 | | 171 | |
| R ² | 0.03 | | 0.13 | | 0.16 | | 0.12 | |
| Log-likelihood | -257.83 | | -248.29 | | -245.31 | | -249.82 | |

According to the log-likelihood tests across Models in Table 2, the model fit for Model 2 is a significant improvement from that of Model 1 ($\chi^2(2) = 19.10, p < 0.01$). The model fit for Model 3 was a significant improvement from the fits for Model 1 ($\chi^2(3) = 25.04, p < 0.01$) and Model 2 ($\chi^2(1) = 5.95, p = 0.01$). Model 4 with Delayed Intuition was a significantly better fit from Model 1 ($\chi^2(1) = 16.04, p < 0.01$) but lesser fit than Model 2 ($\chi^2(1) = 3.06, p = 0.08$) and Model 3 ($\chi^2(2) = 9.00, p = 0.01$). The results were not directly comparable, though, since Model 4 used a different measurement approach for cognition compared to the other two models. Model 4 is at the individual level compared to Model 2 or 3, which relied on cross-level measures of cognition, offering distinct yet convergent insights on the rule of delayed intuition. The result further suggests that the sequence of using rational-analytic thinking and intuition resulted in problem frames with greater novelty. The final analysis for the dataset was the simple slope test. The interaction between Analytic in Stage 1 and Intuitive in Stage 2 is statistically significant when Intuitive in Stage 2 was low (-1 SD: conditional effect = 1.96, SD = 0.72, $p = 0.01$), at the mean level (Mean: conditional effect = 3.20, SD = 0.65, $p < 0.01$), and high (+1 SD: conditional

effect = 4.43, $SD = 0.93$, $p < 0.01$). The results suggest an overall positive interaction relationship between Analytic in Stage 1 and Intuitive in Stage 2.

Study 1 uses a sample of entrepreneurs in the agriculture industry and supports the dissertation's hypothesis. The finding indicates that intuition does not generate novel frames of entrepreneurial problems unless rational-analytic thinking is used in stage 1. The results are consistent with the view that intuition tends to rely on narrow, heuristic associations, but analysis can guide intuition to rely on divergent associations and generate novel problem frames.

Figure 1 effects of the interaction between Analytic (stage 1) and Intuitive (stage 2) on novelty



The use of an archival study is valuable since the empirical approach provides a lens to examine entrepreneurs' thinking processes without interventions. However, Study 1 also has limitations. First, the subjects in this study were from one industry, limiting its generalizability. Secondly, rational-analytic thinking and intuition were measured on a linear scale rather than using two independent measures. This linear scale is limited in capturing the nuances of rational-analytic

thinking and intuition since the two forms of thinking are orthogonal according to CEST (Pacini & Epstein, 1999). Still, existing research in CEST suggests that individuals' intuition and rational-analytic thinking are not likely to be activated at high levels simultaneously. So, a high value in Analytic likely means that rational-analytic thinking is dominant. In turn, the relative decrease in Analytic across time indicates that rational-analytic thinking is less likely to be dominant (Jordan et al., 2019; Jordan & Pennebaker, 2017).

Nonetheless, an experiment that formally renders one form of cognition dominant during stages 1 and 2 of entrepreneurial problem framing can increase the precision of the dissertation's empirical approach. Finally, Study 1 does not provide causal evidence. Without causal evidence, Study 1 can mean that entrepreneurs who have found novel problem frames may justify their problem frames retroactively by exaggerating the amount of effortful, analytic thinking involved in the problem framing process (i.e., reverse causality). Study 2 aims to address the shortcomings with a randomized field experiment.

Chapter 4: Study 2

I collaborated with an entrepreneurship training center in Hangzhou, China, to test the dissertation's hypothesis in a randomized field experiment. The participants in this study were entrepreneurs in the consumer sector, most of whom sold products and services on online platforms like Taobao. The setting is particularly relevant to the dissertation because the conference's main aim was to help entrepreneurs discover new product and service ideas and value creation opportunities. The conference offered lectures and networking sessions to learn about recent trends in the consumer industry and broaden entrepreneurs' connections. I conducted Study 2 over two days at an entrepreneurship conference so that the participants could potentially have the time to think of distant associations and incubate ideas. I sent out the Qualtrics link to the experiment materials on the first day of the conference when the attendees were registering for and settling down for the conference. Participants who filled out the surveys on Day 1 also received the link to fill out surveys on Day 2.

Study 2 used a 2 x 2 between-subject experiment design, in which I manipulated cognition (either rational-analytic or intuitive) in stage 1 (Day 1) and stage 2 (Day 2) of entrepreneurial problem framing. The manipulations generated four conditions: analytic-analytic, analytic-intuitive (delayed intuition), intuitive-analytic, and intuitive-intuitive. Other variables such as age and gender were not significantly different across the conditions.

Power analysis for an experiment with four conditions given a medium effect size (Cohen's $f = 0.25$), power of 0.80, and a significance level at 0.05 reported that I need around 39 subjects per condition, with 156 in total. Among 285 conference attendees, I collected data from 167 participants (Mean age = 38, Female = 28 %, participation rate = 59 %), with over 40

participants per condition. The study was preregistered (<https://archive.org/details/osf-registrations-cp4w3-v1>).

4.1 Entrepreneurial Problem Framing

The study asked the participants to explicitly write down their entrepreneurial problem framing processes as they engaged in them. Previous research indicates that this “think aloud” approach using verbal or written language accurately and reliably captures rational-analytic and intuitive thought processes (Ericsson & Simon, 1993; 1998; Laureiro-Martínez & Brusoni, 2018). The instructions for entrepreneurial problem framing are the same across the conditions. The initial instruction (stage 1) aimed to launch entrepreneurial problem framing by asking the participants to identify the symptoms and explain what they were about, potentially allowing them to consider possible alternative interpretations of the symptoms. Stage 2 instruction asked entrepreneurs to frame the problems. The instructions were:

Stage 1: Often, important opportunities come from finding and solving needs or pain points that other people neglect and do not solve. Please think about needs or pain points (indicators of underlying problems) that you have come across in recent years but existing products and services do not solve. These needs or pain points can be within or outside your industry, and you may not know the solutions. What were the pain points or needs about, who were experiencing them, and when?

Stage 2: Yesterday, you wrote down needs or pain points that you have observed, but existing products and services were yet to resolve. *Today, please frame the needs and pain points—what new categories of problems do they represent?*

4.2 Manipulations

Consistent with previous research, the manipulations relied on formal instructions (Dane et al., 2011). Specifically, the manipulations in stage 1 were the following:

Rational-analytic thinking: Please think analytically and rationally when answering the questions. Provide logical arguments and/or concrete evidence to support your answers. Please do not make judgments relying on your intuition.

Intuitive thinking: Please rely on your gut feelings to answer the questions. Use your intuition and write down what *you* personally think is the right answer. Please do not search for logical, rational explanations for your answer.

The manipulations in stage 2 were the following:

Rational-analytic thinking: please use logic to frame the needs or pain points. Provide logical arguments and/or concrete evidence to support your answers. Please do not make judgments relying on your intuition.

Intuitive thinking: please rely on your gut feeling to frame the needs or pain points. Use your intuition and write down what *you* personally feel is the right answer. Please do not search for logical, rational explanations for your answer.

4.3 Manipulation Check Questions

Since Study 2 had two manipulations in stages 1 and 2, I have two manipulation checks. The manipulation check questions were the same scales for rational-analytic and intuitive thinking used in the pretest for Study 1 (Novak & Hoffman, 2009). Cronbach's alpha for rational-analytic thinking in stages 1 and 2 are 0.76 and 0.81. Cronbach's alpha for intuitive thinking in stages 1 and 2 are 0.86 and 0.71. The response scales ranged from 1 = *Strongly Disagree* to 5 = *Strongly Agree* for all measures. I averaged the responses to the questions to form the final measures of cognition.

4.4 Dependent Variable

The dependent variable is novelty of problem frames. Consistent with Study 1, two experts in the consumer sector rated the frames entrepreneurs generated in terms of novelty (from 1 = *not at all novel* to 7 = *highly novel*). Given high convergence in the answers between the coders ($\alpha = .85$), I averaged novelty across the two evaluators in subsequent analysis.

4.5 Manipulation Check

The manipulation check questions indicate that the manipulations in stages 1 and 2 were successful. In stage 1, participants in the rational-analytic thinking condition reported a greater use of rational-analytic thinking ($Mean = 3.49, SD = 0.69$) than those at the intuitive thinking condition ($Mean = 3.14, SD = 0.91$), ($M_{\text{difference}} = 0.37, 95\% CI = [0.11, 0.61], t(154.29) = 2.87, p < 0.01, d = 0.44$). Participants in the rational-analytic thinking condition relied less on intuitive

thinking ($Mean = 3.07, SD = 0.83$) than those in the intuitive thinking condition ($Mean = 3.73, SD = 0.81$), ($M_{\text{difference}} = 0.66, 95\% CI = [-0.90, 0.42], t(161.94) = -5.41, p < 0.001, d = 0.84$). Similarly, in stage 2, participants in the rational-analytic thinking condition reported a greater use of rational-analytic thinking ($Mean = 3.70, SD = 0.60$) than the participants in the intuitive thinking condition ($Mean = 3.24, SD = 0.83$), ($M_{\text{difference}} = 0.46, 95\% CI = [0.24, 0.68], t(149.98) = 4.11, p < 0.001, d = 0.64$). Participants in this condition also reported that they relied less on intuitive thinking ($Mean = 3.70, SD = 0.81$) than those in the intuitive thinking condition ($Mean = 3.96, SD = 0.64$), ($M_{\text{difference}} = 0.26, 95\% CI = [-0.48, -0.04], t(157.95) = -2.33, p = 0.02, d = 0.36$).

4.6 Results and Discussion

A two-way ANOVA without the interaction between intuition and rational-analytic thinking in stages 1 and 2 revealed significant main effects of rational-analytic thinking in stage 1 ($F(1, 164) = 17.00, p < 0.001, \text{partial } \eta^2 = 0.09$), and rational-analytic thinking in stage 2 ($F(1, 164) = 5.64, p = 0.02, \text{partial } \eta^2 = 0.03$). A two-way ANOVA with the interaction term finds significant effects of the rational-analytic thinking condition in stage 1 ($F(1, 163) = 17.38, p < 0.001, \text{partial } \eta^2 = 0.10$), and the rational-analytic thinking condition in stage 2 ($F(1, 163) = 5.77, p = 0.02, \text{partial } \eta^2 = 0.03$). The interaction term is also significant ($F(1, 163) = 4.67, p = 0.03, \text{partial } \eta^2 = 0.03$). Planned contrast test reveals that entrepreneurs in the analytic-intuitive condition generated problem frames of greater novelty, ($t(165) = 5.03, 95\% CL = [0.54, 1.65], p < 0.01$). T-test comparisons of the means across the four possible conditions also find support for this dissertation's hypothesis. Entrepreneurs in the analytic-intuitive thinking condition (delayed intuition) developed frames with greater novelty ($N = 41, Mean = 3.45, SD = 1.66$) compared to the analytic-analytic thinking condition ($N = 42, Mean = 2.60, SD = 1.20$), ($t(72.74) = 2.68, 95\%$

$CL = [0.22, 1.49]$, $p = 0.01$), the intuitive-analytic thinking condition ($N = 42$, $Mean = 2.21$, $SD = 0.86$), ($t(59.536) = 4.25$, 95 % $CL = [0.65, 1.82]$, $p < 0.001$), and the intuitive-intuitive thinking condition ($N = 42$, $Mean = 2.26$, $SD = 0.97$), ($t(64.145) = 3.97$, 95 % $CL = [0.59, 1.79]$, $p < 0.001$). The evaluations of novelty across the analytic-analytic thinking, intuitive-analytic, and intuitive-intuitive thinking conditions were not significantly different from each other, $p > 0.10$. The results from the two studies consistently support this dissertation's hypothesis and the delayed intuition model. Study 2 addresses the shortcomings in Study 1. Study 2 is also valuable as this study formally tests the delayed intuition process. Despite the differences in methodologies and industries, Studies 1 and 2 supported the importance of delayed intuition when generating novel frames of entrepreneurial problems.

Chapter 5: General Discussion

5.1 Implications

This dissertation examines the beneficial effects of delaying intuition when generating divergent associations and proposes the delayed intuition process for entrepreneurial problem framing. The dissertation establishes the challenge and importance of developing novel problem frames for entrepreneurial problems. Then, characterizing entrepreneurial problems in terms of their high information cost and unstructured symptoms, the dissertation establishes intuition's importance in entrepreneurial problem framing. This dissertation draws on CEST to explain how rational-analytic thinking before intuition can delay formalized use of intuition (as the dominant form of thinking) and guide intuition to rely on more divergent associations so that the resulting frames are more novel. The delayed intuition process then applies the delayed intuition model to the two stages of entrepreneurial problem framing.

This dissertation contributes to the problem finding and solving literature. Existing problem finding and solving literature has focused on managerial and strategic problem-solving, assuming that structured information to find the right frames is readily available (Posen et al., 2018).

However, this assumption is inadequate in entrepreneurship and innovation contexts (Alvarez & Porac, 2020). This dissertation thus builds a model and process of problem-solving with the assumption that the structured information is not readily available, advancing the research on problem-solving for innovation or entrepreneurial success. Furthermore, the delayed intuition model highlights the value of intuition in the context of high information costs or incomplete information. This insight is valuable because intuition is often viewed as inferior to analysis in the problem finding and solving literature, even though some scholars had claimed that intuition was sometimes useful and essential in problem-solving (e.g., Simon, 1987). This dissertation

indicates that the context of entrepreneurship and the constraint of information costs serve as conditions that render intuition central in problem-solving.

Relatedly, the delayed intuition model and process also contribute to the incubation literature by offering insights on how individuals can more effectively incubate ideas and form divergent associations. This dissertation explains that rational-analytic thinking can help individuals have sufficient “exposure” and make the relevant “progress” towards the tasks by ensuring that rational-analytic thinking remains during the first stage of entrepreneurial problem framing. The claim does not negate the value of distractions or breaks but extends the existing literature by suggesting that breaks and distractions are tools to create cognitive distances from the tasks and essentially facilitate the process that individuals who maintain rational-analytic thinking would undergo. The delayed intuition model and CEST suggest that individuals who use rational-analytic thinking toward entrepreneurial problems search more distantly over time and do not jump to conclusions (De Grada et al., 1999; Livi et al., 2015). Breaks and distractions are means to help this distancing process. Indeed, while Studies 1 and 2 focus on rational-analytic thinking and intuition, they implicitly allow for breaks or distractions. Study 1 documents entrepreneurial problem framing over several weeks to months, and Study 2 allows individuals to sleep on the decisions on problem frames. What is unique about this dissertation is that the delayed intuition model brings forth the role of rational-analytic thinking in guiding intuition, rather than viewing that rational-analytic thinking and intuition are separate and do not influence each other.

The dissertation also contributes to the literature on entrepreneurship by clarifying the roles of analysis and intuition. Previous research had viewed the two forms of cognition as competing with each other. CEST provides a third view in which each form of cognition complements each other, and the combination potentially results in superior performance. Moreover,

entrepreneurship literature has largely focused on the latter stages of entrepreneurial problem-solving such as framing opportunities and solutions for other people to gather support or developing solutions (Snihur et al., 2021). This dissertation provides the missing insights on how individuals generate novel frames of entrepreneurial problems.

This dissertation is also important for practice. For individuals who tend to rely on rational-analytic thinking, the delayed intuition model implies that they could benefit from intentionally embracing intuition at a later stage of problem framing if they intend to solve entrepreneurial problems and create unique value. In contrast, entrepreneurs tend to rely on quick and fast associations (Camuffo et al., 2020), and they can potentially benefit from delaying intuition with rational-analytic thinking. Entrepreneurship training centers or incubators can formally create processes that encourage the participants to engage in rational-analytic thinking, delay actions for a certain period, and then follow their gut feeling or intuition. Haidt's metaphor can also be informative for many practitioners who may not have thought that their rational-analytic thinking can inform and guide their intuition, or they could only use intuition or analysis to frame their problems. Finally, the insights from the dissertation are also relevant to the practice of design thinking. The design thinking process is frequently used in innovation and entrepreneurship training programs. The process involves divergence and convergence in developing ideas (Brown, 2008), but the process does not specify which cognition drives divergence and convergence. This dissertation offers the missing insights.

5.2 Limitations and Future Directions

This dissertation assumes that individuals have unique experiences, beliefs, or values that can be a source of divergent associations. However, the degree to which individuals have diverse experiences or knowledge of problems varies (Amabile, 1983). Future research can thus examine

the factors that can influence the repertoire of problems individuals already know before problem framing. Although listing all the problem frames individuals know can be difficult, scholars can instead use proxies. For instance, past experiences in foreign nations or unique hobbies could be sources of idiosyncratic knowledge structures and problem frames that other people do not share (Maddux, Lu, Affinito, & Galinsky, 2021) and increase the likelihood of individuals generating novel problem frames.

Second, the delayed intuition model can potentially be further specified. The dissertation assumes that individuals search for information and possibilities more distantly over time while engaged in rational-analytic thinking. Still, the model may be further specified and structured if scholars also include various means to encourage more distant search. For example, scholars could consider construal level theory (Trope & Liberman, 2010), which claims that individuals think more concretely at a low construal level while they think more flexibly and abstractly at a high construal level. A low construal level is useful in focusing on the concrete details and symptoms of problems. A high construal level or abstract thinking style is useful in helping individuals think more flexibly of more distant possibilities at a greater cognitive distance. So, a more nuanced process for divergent associations and entrepreneurial problem framing may instruct individuals to use high construal levels during stage 1 to think about broader possibilities (see also Park & Baer, 2022).

Another limitation is that the two studies in the dissertation both relied on entrepreneurs, limiting the applicability of the studies to the general population. Future research should explore whether delaying intuition results in novel associations or ideas across different samples to test the broader applicability of the delayed intuition model. For example, entrepreneurs may be particularly motivated to find and solve problems that have not been solved before. Still, the

general population may not look for or intend to solve entrepreneurial problems. Without proper motivation, individuals may not maintain rational-analytic thinking toward their problems because this form of thinking demands a greater cognitive effort to sustain (see also Shin & Grant, 2021; Park & Baer, 2022).

Moreover, this dissertation does not specify objective points at which individuals should move from stage 1 to stage 2 in entrepreneurial problem framing. Although the delayed intuition process divides stages 1 and 2 based on the activities individuals engage in, objective timestamps (e.g., 90 % of the time in stage 1 and 10 % in stage 2) can be useful for practitioners. The prediction is difficult because each entrepreneurial problem is unique and objective predictions on how much delay and analysis are needed are difficult. Nonetheless, future scholars could further specify the delayed intuition model by examining the role of “saturation points” drawn from the inductive research process literature. The inductive research process involves developing models to categorize novel phenomena when existing knowledge is inadequate, insufficient, or incommensurable with the reality (Locke & Golden-Biddle, 1997). Like entrepreneurial problem-solving, this theory-building process entails gathering qualitative, scattered information to understand and interpret the phenomena. In the literature, saturation points refer to temporal points in which new information does not provide novel insights into the phenomena (Saunders et al., 2018). Saturation points inform qualitative researchers when they should stop collecting more data and start developing theories. When translated to entrepreneurial problem-solving, individuals can potentially check if they have reached saturation points and determine whether they should now decide on the problem frames. The dissertation does not examine the social-exchange aspect of developing cognitive, novel frames of entrepreneurial problems. While the contributions toward the cognitive origins of

entrepreneurial problem frames are novel and valuable, future research can examine how individuals' social interactions influence them (Snihur et al., 2021). Social interactions can broaden individuals' information search process (Dane, 2010), which is relevant especially when individuals engage in rational-analytic thinking. When using rational-analytic thinking, individuals are likely to examine past experiences that are partly accumulated through their social interactions or talk to other individuals to better understand the problems. Social interactions and factors such as the diversity of social networks can serve as moderators that influence the effectiveness of rational-analytic thinking in the delayed intuition model. Finally, future researchers can examine the roles of specific emotions in the distant association process and the delayed intuition model. Although intuitive thinking is affective (Dane & Pratt, 2007), each emotion leads individuals to act in different ways. The model in this dissertation, though, does provide some guidance on which emotions to explore when forming distant associations. Given that high activation of intuitive thinking results in jumping to conclusions, scholars can examine the role of high activation emotions (e.g., anger) and test whether the emotions prevent individuals from engaging in analysis compared to low activation emotions (e.g., calm). Emotional research in broad-and-build (Fredrickson, 2004) further indicates that positive affect may facilitate gathering data and generating alternative possibilities. The broad-and-build theory claims that positive affect like interest or happiness can lead individuals to explore phenomena more broadly. In summary, calm, relaxed, and serene emotional states, which are positive and low activation, can be useful in the initial stage of entrepreneurial problem framing, while high activation and negative emotions such as fear and nervousness can prevent the rational-analytic thinking process. Since rational-analytic and intuitive thinking is orthogonal, these emotions can be potentially important even when people are dominantly using

rational-analytic thinking because the unconscious mind can influence the degree to which individuals can concentrate on analysis.

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