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INTUITION AND EMOTION: EXAMINING TWO NON-RATIONAL APPROACHES IN COMPLEX DECISION MAKING

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ABSTRACT

This thesis was designed to examine two non-rational decision approaches in individual and team decision making. In Chapter 2 (Paper 1), a normative theory about how people should use intuition in making complex decisions is proposed. I draw from extant literature to derive why allowing intuition to interrupt analysis is beneficial to complex decision processes. In Chapter 3 (Paper 2), the theory of intuitive interruptions is applied to the entrepreneurial context. I argue that allowing intuitions to interrupt analysis helps entrepreneurs navigate the ambiguous environment in which they often find themselves. Chapter 4 (Paper 3) documents findings on the phenomenon of teams' escalation of commitment and the effect of hope. According to the results, when faced with continuous negative feedback, teams that remain hopeful persist in the face of mounting costs. In Chapter 5 (Paper 4), changes in self-efficacy and team efficacy beliefs as responses to performance feedback were examined. The results indicated that the relationship between negative feedback and a decrease in efficacy beliefs is mediated by depressive realism—the negative yet realistic expectations of future outcomes. In summary, this thesis finds that non-rational approaches facilitate decision making by filling in the gaps, colouring the tone and changing the course of thinking where exhaustive information processing (i.e., full analysis) is not possible. Employing non-rational approaches can either be a deliberate choice or a reaction of human nature. Employing non-rational approaches does not necessarily yield favourable or unfavourable results. However, the analysis confirms that non-rational approaches are largely involved in complex decision making. Findings from this thesis add to our knowledge about how complex decisions are made by individuals and teams.

Chapter 1 Overview

1.1 INTRODUCTION

This thesis investigates non-rational approaches to complex decision making. Decision making is defined as the choosing among alternative courses of action and the approaches people adopt in terms of the types of search, deliberation, and selection procedures they use in such processes (Janis & Mann, 1977). The degree of complexity of a decision relates to the amount of information from alternatives and attributes that needs to be integrated (Hogarth et al., 1992). As such, a complex decision is one that most likely involves more than two alternatives, a number of attributes to be considered and some information about each of these.

Management research, following the economics tradition, has long assumed a rational approach to management conduct and decision making. As described by classical economists, a rational decision maker is someone who knows all his alternatives, has clear preferences and is able to rank and weigh attributes of alternatives, possesses the computational skills to optimise his choice by maximising expected utility and never makes mistakes (Friedman & Rubinstein, 1998). Behavioural decision researchers, bringing together psychology and economics research, argue that in reality such a purely rational decision maker does not exist (Miller & Starr, 1967; Simon, 1956). Human agents are rational within personal and environmental constraints—that is, they are "boundedly" rational. These constraints include the limited time and cognitive capacity of human agents and the availability and quality of information in the environment (Simon, 1972), which are often limited by the uncertainty and ambiguity in dynamic environments. Uncertainty resides in the consequences that would follow each alternative; ambiguity, which is uncertainty about the probabilities of possible consequences, prevents the necessary computations from being carried out. These features characterise the information environment that most directly affects decision makers' abilities to formulate a causal understanding of choices and outcomes (Forbes, 2007). At the group or organisational level, further constraints arise from hierarchy and interpersonal dynamics. For example, conflicting goals exist in groups and organisations for which a maximising logic is difficult to implement. Powerful individuals in groups

and units in organisations might dominate the decision making based on their own preferences (Pfeffer & Salancik, 1974; Stagner, 1969).

Simon (1972) pointed out that real-life decision makers—unlike the theorised, perfectly rational decision makers who maximise and optimise—simplify their calculations and "satisfice" (i.e., settle for a satisfactory, rather than an approximate-best, decision). Similarly, Miller and Starr (1967) asserted that there is simply no way to combine all the considerations into a single, objective utility measure, even if the decision maker can provide honest ratings of subjective utility value. Simon's (1955, 1956) proposal has since inspired a rich stream of empirical research attesting to the notion of bounded rationality. Among them, the most influential work—what is now the judgment and decision-making paradigm—was that of Daniel Kahneman and Amos Tversky, who demonstrated in simple but provocative ways the mistakes people make when applying simple inferential rules to making judgments (Kahneman, Tversky, & Mar, 1979; Amos Tversky, Kahneman, & Slovic, 1974).

Despite the prosperity of research, there are reasons to believe that Simon's proposal has been interpreted in such a way that the concentration of current research deviates from his original thinking. First, despite its influence in psychology and computer science, it was not until very recently that bounded rationality's impact on mainstream economics began to materialise. It is still difficult for many, especially economists, to accept a non-rational or even irrational decision maker and find a spot for him in their theories (Friedman & Rubinstein, 1998). Despite the prevailing reality of bounded rationality, Simon's call for economists to get out of their armchairs and study how decisions are really made has not yet been answered. Second, current research on bounded rationality presents a strong focus on the negative side, such that "bounded rationality became almost synonymous with heuristics and biases" (Gigerenzer & Goldstein, 1996, p. 3). However, Kahneman and Tversky clearly explained that, heuristics (i.e., the simple decision rules) themselves are not biases. It is the misuse, over-use, or use in preference to better methods that leads to biases (Nisbett & Ross, 1980; Amos Tversky et al., 1974). Such imbalanced concentration on the negativity of bounded rationality, combined with the persistent rational tradition in management research, results in misunderstanding and passive attitudes towards non-rational decision approaches, including superstitious thinking, irrational fears, unusual beliefs, and religious beliefs (Epstein, 2011). This treatment that "bounded rationality is

inevitable such that people want to and try to be rational but fail to" misses the point originally put forth by Simon that bounded rationality is a result of adaptation to the environment. Non-rational approaches such as emotion and intuition can be functional in decision making. Emotions direct attention and help people attend to immediate needs (Keltner & Gross, 1999; Levenson, 1994). Intuition, informed by prior experience and existing knowledge, usually produces reasonably accurate inferences (Gigerenzer & Goldstein, 1996; Amos Tversky et al., 1974). Intuition and emotions are both adaptive mechanisms that help people navigate through an environment of high uncertainty and ambiguity more efficiently. Although these non-rational approaches sometimes go wrong—as demonstrated extensively by Kahneman and Tversky and others—most of the time they help people remain boundedly rational—that is, rational in an adaptive way.

1.2 RESEARCH THEME

This thesis departs from the passiveness and negativity of bounded rationality and focuses on the use of non-rational decision approaches in individual and team decision making. I aim to explore how non-rational approaches can be used by individual and teams—as "administrative men," not "economic men" (Simon, 1955, p. 9)—in complex decision making in situations of high uncertainty and ambiguity.

This approach results in two separate components of the current thesis. The first component focuses on the use of intuition in complex decisions at the individual level. The second component examines the role of team cognition and emotion in team decision making. Drawing from information-processing theories (Robey & Taggart, 1981; Simon, 1978), I define non-rationality, as opposed to rationality, as the exhaustive processing of objective information given unlimited processing capacities. Non-rationality occurs when decision makers employ non-rational approaches to aid their decision making under the circumstances of imperfect information and limited cognitive capacity. Information is perfect when both the quantity (i.e., availability) and quality (i.e., determinacy) of information are high. In any other situation—namely, where one or both are low—information is deemed to be imperfect. The inability to process all information is attributable to the limits of human intelligence combined with time limit. When applying non-rational approaches, not all information required might

be available to the decision makers and not all information available might be processed. In these situations of bounded rationality, decision makers resort to non-rational approaches. Intuition and emotions, as studied in this thesis, serve as aids to decision making that complement imperfect information and limited cognitive capacity.

In a nutshell, the theory of intuitive interruptions (Chapters 2 and 3) is a theory of complex decision making. The boundary condition is ambiguity; an environment in which intuitive interruptions are beneficial to complex decision making is one of high ambiguity. The experiment study (Chapters 4 and 5) also captures complex decision making. All decisions to be made in the simulation involve more than two alternatives, a number of attributes to be considered, and extensive information about each of these. The boundary condition here is uncertainty; the simulated information environment is one of high determinacy with a high quantity of information. Thus, together these two components of the thesis capture complex decision making in two types of complex environments: ambiguous and uncertain.

Chapter 2 Intuitive Interruptions in Analysis: A normative theory for complex decision making

This paper offers a normative theory about how people should make complex decisions in organisations. Drawing on extant literature, logic, and decision examples, I explain that the best way for people to combine analysis and intuition in complex decision making is to allow intuition to interrupt the analytic processes. Intuitive interruptions offer benefits that are particularly helpful in ambiguous environments. I derive implications from this argument and propose possibilities for future research.

2.1 INTRODUCTION

Decision making is probably the most important act in organisational life. Individuals in organisations make numerous decisions every day, most of which are quite complex. In this paper, I offer a theory for how to best combine analysis—a rational decision approach—and intuition—a non-rational decision approach—in individuals' complex decision making.

In organisational lives, complex decision making can be characterised by several factors. First, it is a process that requires more than a split second to complete (i.e., usually days or weeks) and often involves back-and-forth revisiting as other tasks interrupt it (Maestro & Souitaris, 2010). Second, it is often characterised by high level of personal involvement and significance (Schweiger, Anderson, & Locke, 1985). Third, it sometimes involves multiple interdependent decisions, warranting high information load and cognitive effort to connect them (Schweiger et al., 1985). Finally, it can also involve changes in the decision parameters such that additional information needs to be gathered during the decision-making process. Taking these characteristics together, the degree of complexity of a decision is defined by the amount of information that needs to be integrated (Hogarth et al., 1992). Previous research has proposed the complementarities between rational approaches and non-rational approaches, specifically analysis and intuition (Isenberg, 1984; Simon, 1987a). The concept of "whole-brain thinkers" (Taggart, Robey, & Kroeck, 1985) posits that individuals who do

not rely primarily on either one of the approaches make better decisions (Hough & Ogilvie, 2005; Mintzberg, 1976; Robey & Taggart, 1981). In line with this assertion, pioneering studies have shown that adaptive decision makers employ a mix of analysis and intuition when making complex decisions (Blattberg & Hoch, 1990; Dunwoody et al., 2000; Isenberg, 1984; Prietula & Simon, 1989). However, thus far, no research has explained how exactly to best combine analysis and intuition in complex decision making. To fill this void, I attempt to offer such a theory, thereby contributing to existing research on complex decision making by proposing intuitive interruptions as a way to combine analysis and intuition in complex decision making. I demonstrate through an example how intuitive interruptions can present themselves in decision-making processes, what triggers them, and the functions they serve in order to increase decision quality. This theory is important as it enables the field of decision making to specify the optimal, mixed use of analysis and intuition. It should matter to decision researchers, intuition researchers, as well as real-world managers striving to become adaptive decision makers. In the following sections, I review the relevant literature before presenting the example and proposing the theory.

2.2 DECISION QUALITY

Decision quality can be simply defined as the degree to which the outcomes of the decision meet a set of standards. For instance, in consumer choices, this set of standards is internally determined by the consumers; thus, how satisfied the consumers are from the choices they make defines the quality of the decision (Jacoby, 1977). In decision theories of the economics tradition, decision quality is the maximised additive value of alternatives, given that the weights of attributes are known (Barron & Barrett, 1996). This is portrayed in experimental studies in situations where an optimal "correct answer" choice is possible (e.g., Scholten, Vanknippenberg, Nijstad, & Dedreu, 2007; Schulz-Hardt, Brodbeck, Mojzisch, Kerschreiter, & Frey, 2006). Alternatively, decision quality has been defined as the mix of decision-making consistency, agreement with a composite judge, and decision consensus (Chewning, Harrell, & Carolina, 1990), which can be interpreted as procedural quality. In reality, decision quality is often defined retrospectively—that is, by its outcomes. Forbes (2007) asserted that decision quality is a latent construct that has not been measured directly in previous studies. He argued that firm performance, which is often an outcome of decision quality, is not equivalent to

decision quality. I concur with Forbes (2007) that decision quality is an individual-level latent construct leading to important outcomes that are significant to the decision maker across levels.

2.3 INTUITION

Following the latest development of intuition research in psychology and management (Sinclair, 2011a), intuition is defined as "direct knowing." Intuition is a product of the subconscious processing of information; as people are unaware of the process, they are unable to articulate it. Such processing can be holistic (i.e., processing less information in a "jigsaw puzzle" manner) or inferential (i.e., navigating through large amount of information using shortcuts of quick matching); it can rely on both deliberative and experiential systems.[1] Although the processing is subconscious, the product can surface in the consciousness and be integrated into reasoning.[2] Recent research suggests that intuition manifests itself in many forms, including expertise (i.e., automaticity in familiar tasks), creation (i.e., a new idea that does not follow existing logic), and foresight (i.e., an accurate prediction of the future). Intuition is not an affect or emotion, but is often accompanied by it, such as in a confirmatory feeling (Khatri, Ng, & Alvin, 2000; Sinclair, 2010) or a sense of unease in moral decision making. Some scholars term intuition as "affectively charged judgments" (Hodgkinson, Langan-Fox, & Sadler-Smith, 2008; Pratt & Dane, 2007). However, affect and emotion are mere correlates and not essential components of intuition (Hogarth, 2001). Hunches and gut feelings—quick judgments without reasoning (Sadler-Smith & Shefy, 2004; Slovic, 2007)—as well as heuristics—simple decision rules based on experienced-based pattern recognition

[1] The key to this new proposal is that one can deliberate without being consciously aware (Sinclair, 2011b), which significantly differs from previous theories that associates the deliberate system with consciousness and awareness or the experiential system with subconsciousness (Epstein, Pacini, Denes-Raj, & Heier, 1996).

[2] My stance differs from what Sinclair (2011b) terms "mode of reception," which suggests that how intuition surfaces in the consciousness can vary in its form as a thought or a feeling or through other senses. In the theory of intuitive interruptions, intuition is a thought, which can be accompanied by weak, strong, or no feelings.

(Gigerenzer & Todd, 1999; Amos Tversky et al., 1974)—are behavioural manifestations of intuition.

2.4 INTERACTION BETWEEN INTUITION AND ANALYSIS

Traditionally, dual process theory distinguishes between the two systems of information processing in the human mind (Chaiken & Trope, 1999). On one side is the rational, deliberate (Hogarth, 2005), and slow system of thought based on effortful, rule-based, exhaustive processing of information (McClelland, McNaughton, & O'Reilly, 2002; Sherry & Schacter, 1987)—termed System 2 by Stanovich and West (2000) and Kahneman (2003). On the other side is the non-rational, tacit, and fast system of thought involving the automatic, associative, and selective processing of information (Lieberman, 2000)—labelled System 1 (Kahneman, 2003; Stanovich & West, 2000). Such theoretical classification, along with the popularized belief of the "split brain", often gives a false sense of independence of the two systems. In the latest development of intuition research, more emphasis is placed on how they interact seamlessly (Sinclair, 2011b). Scholars have proposed that intuition does not necessarily come from System 1; indeed, it can also come from System 2 (e.g., unconscious thought, pattern matching in naturalistic decision making) (Sinclair, 2011b). In this paper, to explain how intuition can interrupt analysis, I adopt the labels analysis and intuition to represent the two types of thought. Analysis is defined as the conscious, rule-based, exhaustive processing of information whereas intuition is the output of subconscious processing—be it holistic (System 1) or inferential (System 2)—of limited information.

Previous research on managerial decision making is rooted in the rational tradition of neo-classical economics. It often assumes and prescribes managers to be rational agents who perform a full comparison of alternatives and weigh all consequences through an exhaustive process and integration of the information (Werder, 1999). Based on this view, non-rational approaches have been studied in a predominantly negative light (e.g., heuristics as sources of biases; Tversky & Kahneman, 1974). However, according to Simon (1972, 1982), people try to be rational, but fall short due to computational limitations and environmental and task constraints. Therefore, they adapt to the complex reality by using non-rational approaches to aid rather than substituting rational approaches. This explanation implies that rational and non-rational approaches,

such as analysis and intuition, should work together, not compete with each other in complex decision making.

Indeed, pioneering studies demonstrate that adaptive decision makers employ a mix of analysis and intuition in their decision making (Blattberg & Hoch, 1990; Dunwoody et al., 2000; Isenberg, 1984). Blattberg and Hoch (1990a) found that a combination of database model and managerial intuition always outperforms either of these decision inputs alone. Through in-depth interviews, Isenberg (1984) found that senior executives rely heavily on a mix of intuition and analysis. These findings are in line with the notion of "whole-brain thinkers" (Taggart et al., 1985)—namely, individuals who do not rely primarily on either one of the systems appear to be better decision makers (Hough & Ogilvie, 2005; Mintzberg, 1976; Patton, 2003; Robey & Taggart, 1981). However, in these studies, the actual process of combining analysis and intuition remains a black box.

2.5 THREE SCENARIOS OF INTUITIVE INTERRUPTIONS IN ANALYTIC PROCESSES

To illustrate the interaction between analysis and intuition in complex decision making, I present here three logically plausible modes and how they can be applied to a complex decision via an example of a recruitment decision. However, I first specify the key assumptions as well as the level of analysis. First, it is assumed that the human mind has only one consciousness, which is a well-supported claim in psychology. The logical process of which individuals are consciously aware is linear. Some output of the previous process is carried forward and integrated into the next process whereas others are disregarded. Second, decisions are comprised of alternatives (i.e., different courses of action to take), attributes (i.e., criteria on which alternatives can be evaluated), and information about them (J. Baron, 2008; Hastie & Dawes, 2009). The level of analysis is

the individual, which also includes cases when the decision maker utilises intuitive or analytic inputs from others but ultimately makes the decision alone.[3]

2.5.1 ONE INJECTION OF INTUITION AT THE END

Imagine a human resource (HR) executive trying to select among six job candidates (i.e., known alternatives) for a position that is key to the future of the company. She first conducts a thorough analysis of the candidates, carefully weighing all attributes, calculating consequences, and comparing them to her goal (i.e., selecting the best candidate at a reasonable cost who can add value to the company). As a result of the analysis, she shortlists two candidates. However, based on the analyses, no clear winner emerges: Neither is better than the other on the key attributes. Unable to make a choice based on her analyses, she turns to her intuition and picks one of them without further reasoning. She cannot articulate the reasoning behind this choice. In this mode, analysis is first performed on all alternatives along all attributes, which requires exhaustive information processing. However, the ultimate choice of an alternative is intuitive—commonly portrayed in managerial intuition research as relying on intuition to reach a complex decision (Agor, 1989). This scenario is illustrated in Figure 2–1.

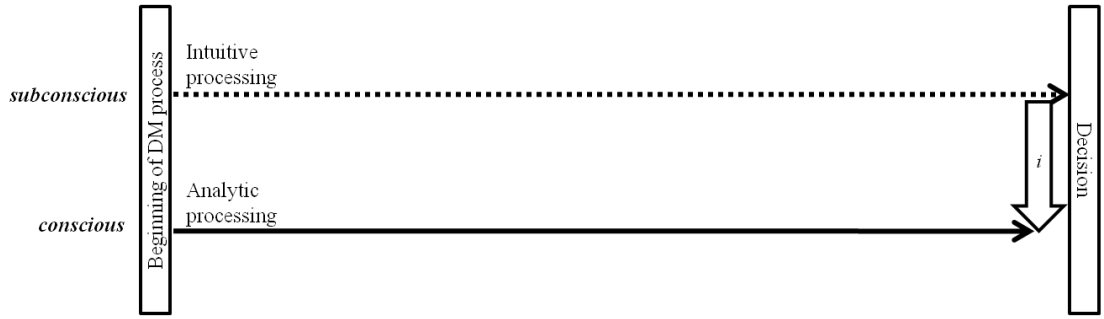

Figure 2-1 One injection of intuition at the end

2.5.2 ONE INJECTION OF INTUITION AT THE BEGINNING

Adopting a different approach, the HR executive first intuitively picks two of the six candidates, already having a favourite in mind. She does not have clear reasoning

[3] In the current discussion, I do not address the possibility of unconscious thought or telepathic transmissions of information (i.e., knowing through others without communication) (Dijksterhuis, 2004; Strick, Dijksterhuis, & Van Baaren, 2010).

behind this choice, but this approach undoubtedly helps her reduce the cognitive load of evaluating all candidates. Furthermore, she intuitively decides to only look at work experience and expected salary—a decision likely based on her previous experience in recruiting, which had signified that these two criteria tend to be the most important. The subsequent analysis is quite simple and fast. She picks her favourite candidate after confirming that he has more previous experience than the other candidate but expects a similar salary.

In this mode, decision makers first shortlist one or a few alternatives intuitively and then perform limited information processing to analyse this partial set before a final decision can be reached (see Figure 2–2). Sometimes a course of action has already been chosen intuitively and the analysis is used to confirm or disconfirm such a choice. For instance, in his description of chess masters, Simon (1987) provided a clear example of such interaction between analysis and intuition in chess playing:

> Even under tournament conditions, good moves usually come to a player's mind after only a few seconds' consideration of the board. The remainder of the analysis time is generally spent verifying that a move appearing plausible does not have a hidden weakness. (p. 59)

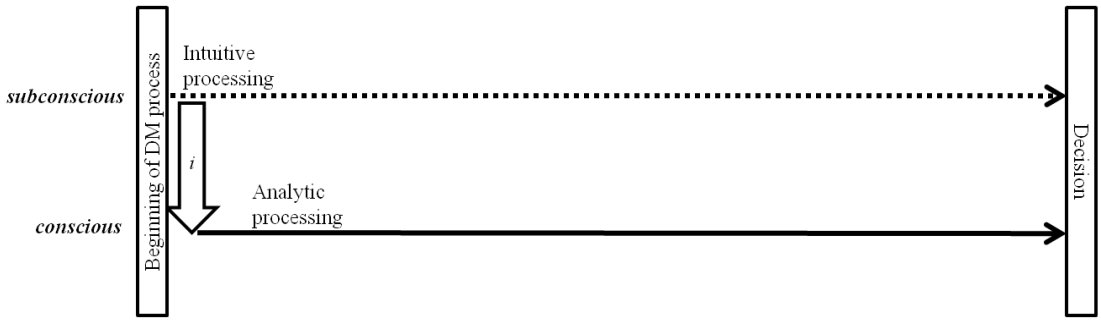

Figure 2-2 One injection of intuition at the beginning

This mode corresponds to what is described in previous research as using the analytic system to monitor the intuitive system (Kahneman, 2003). Klein (2004) proposed a recognition-primed decision model in which:

> Pattern recognition provides the initial understanding and recognition of how to react to a particular event, and the mental simulation (i.e., imagining how the reaction will play out) provides the deliberate

> thinking (i.e., the analysis) to see if that course of action really would work. (G. Klein, 2004, p. 65; notation added)

Similarly, Shapiro and Spence (1997) suggested that managers initially use a gut-level, intuitive response, followed by analytical reasoning.

2.5.3 MULTIPLE INJECTIONS OF INTUITION

Adopting yet a different approach, the HR executive starts with an analytic process to identify her goals and produce a list of attributes for evaluating the candidates. She then intuitively ranks the importance of the attributes: work experience and expected salary first, qualifications second, then other skills. References are considered with the least weight unless they signify something exceptionally negative. This intuitive input helps the HR executive focus the subsequent rounds of analytic processes via which she evaluates the six candidates. She applies an intuitive cut-off point of five years of experience, which reduces the set of candidates to three. She then continues the analysis on the remaining attributes on her list, dropping one more candidate based on inferior qualifications. At this point, she is left with two candidates, one of whom becomes favoured based on his total scores on the attributes. She decides to interview the two finalists once more. During the interviews, she has a gut feeling that her favourite candidate is highly qualified, but has passed the "prime" of his career and is looking for a place to relax. She thus intuitively decides to add a new attribute: career aspiration. This motivates another round of analysis as the information is not readily available. She realises that she actually needs reliable references from her personal network in the industry. She also decides to reintroduce a third candidate from the rejected pile back into the set, whom the HR executive remembered as being extremely motivated. Ultimately, her hunch that her original favourite candidate "has peaked" is confirmed. Based on the new evidence, she selects the candidate whom she had dropped earlier, who has "enough" experience but is "still hungry" for more achievement.

The last mode represents multiple injections of intuition at different points of the decision process (see Figure 2–3). Specifically, periodic injections of intuitive thoughts enter consciousness and interrupt the on-going analytical process.

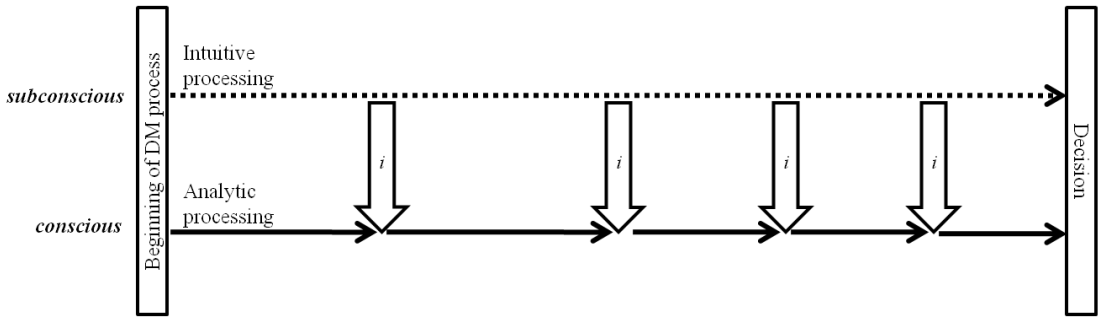

Figure 2-3 Multiple injections of intuition

To date the interaction between intuition and analysis has not been extensively discussed in the literature. However, traces of this mode of multiple interruptions of intuition in analytic processes can be found. Multiple occurrences of intuition are implicitly present in research on rational decision making, termed as heuristics (i.e., inferential intuitions) (Gigerenzer & Goldstein, 1996; Luce, 1956; Simon, 1987b, 1990). Similarly, an implicit assumption of analysis underlies research on managerial intuition. Intuition is often portrayed, but not explicitly stated, as appearing during analysis. Intuitive decision makers, after getting an intuitive spark, continue working on issues "until they find a match between their gut and their head" (Isenberg, 1984, p. 86). These hints support the plausibility of multiple injections of intuition in analytic processes.

2.6 THE CONCEPT OF SWITCH

To capture the process of intuitive interruptions in analysis, I propose the term *switch* based on the one consciousness argument. Whenever an intuition surfaces in the consciousness and the decision maker allows it to interrupt the ongoing analysis, he or she must switch from analysis to the intuitive thought and then switch from the intuitive thought back to analysis. The decision maker is not always consciously aware of this process. Intuition often appears as an instantaneous "aha" moment such that very little attention is paid to its origin before it is blended into the current thought process. Two factors should be noted about the switch. First, switching from analysis to intuition does not imply that decision makers deviate from the logical flow in which they are currently engaged. As intuition is instantaneous, unless the process concludes at the final intuition (i.e., in the case of one injection at the end), individuals must switch back to analysis to continue with decision making. However, interrupting intuition can change the direction

in which the analysis is going. This point will be further articulated in Section 3.7. At this point in discussion, it is clear that one injection in the beginning or at the end of analysis implies one switch whereas multiple injections imply multiple switches. As switching back and forth requires different mechanisms, particularly from the perspective of mood and cognition theories, the concept of the switch is necessary in facilitating discussions on the antecedents of intuitive interruptions in the following.

2.6.1 EXTERNALLY DRIVEN VERSUS INTERNALLY DRIVEN

Switching is sometimes externally driven. Decision makers, being constrained or required by their decision environment, can employ the switch spontaneously and passively. A passive switch from analysis to intuition occurs when a lack of information forces decision makers—after analysing the available information as much as they can—to switch to intuition or enter an incubation period before they can resume the process again with new insight or new information (Helie & Sun, 2010). A switch from intuition to analysis is required when, for example, individuals are required to present formal analysis to support their proposed solution, which in fact is an intuitive one. Switches can also be internally driven. Individuals can predetermine switch as a cognitive strategy and constantly remind themselves to be creative or "think outside of the box" when careful analysis is insufficient for generating a satisfactory solution. Similarly, for those who are prone to intuiting, a self-driven switch from intuition to analysis (G. Klein, 2004; Shapiro & Spence, 1997; Sun, Slusarz, & Terry, 2005) is a different kind of cue for one to "think twice" before diving into the decision. Intuition researchers assert that such skills can be developed through training (Vaughan, 1989).

2.6.2 RATIONAL CHOICE VERSUS AFFECT DRIVEN

Switching between analysis and intuition can also be triggered by feelings. A stream of research on the interaction between affect and cognition provides the basis for this argument (Forgas & George, 2001; Lerner & Keltner, 2000; Schwarz, 2000). Researchers have proposed that the analytic mode is consistent with negative affective states while the intuitive mode is consistent with positive affective states (Bower, 1981, 1991). Previous research shows that, when in a positive affective state, people are more inclined to (a) perceive the overall situation as favourable, which requires little further contemplation; (b) recall previous success experiences and have higher confidence in making a decision; and (c) avoid an effortful thinking process in order to remain in the current positive affective state (M. S. Clark & Isen, 1982; Isen, 1984). As such, in a

positive affective state, an "intuitive" mode is seen as being more suitable (Sinclair, Ashkanasy, Chattopadhyay, & Boyle, 2002). Meanwhile, when in a negative affective state, people tend to (a) perceive the overall situation as unfavourable and enter a scrutinising, "find fault" mode; (b) associate the situation with negative outcomes, which bring about doubts and worries; and (c) engage in detailed and careful analysis to avoid mistakes in an attempt to improve the current affective state (Elsbach & Barr, 1999; R. Erber & M. W. Erber, 1994; Parrott & Sabini, 1990). In this case, an analytic mode is seen to be the most fitting.

Following this logic, switches between analysis and intuition can be triggered by a change of affective state. A switch from intuition to analysis can follow a sudden bad mood, whereas a switch from analysis to intuition might be caused by an inflow of positive emotions. As described in previous research, these moods and emotions can come from either inside ("integral affect") or outside ("incidental affect") the decision situation (Pham, 2007). Examples of these, respectively, are negative feedback for the current task and a generally positive mood from the pleasant weather.

> The implications of the relationship between affective states and switching between the two types of thoughts are two-fold. First, active switching is possible through the manipulation of mood. It seems highly probable to use emotions as initiators of intuition or analysis, such as deliberately putting oneself in a good mood to initiate intuition, considering that it can hardly be achieved directly through a conscious choice. Second, the implication of the affect-switch link lies in the "regulation" mechanism (Gross, 1999): How to be able to intuit even when in an extreme state of anger or sadness or analyse carefully even when in absolute excitement is an awareness and skill that can be learned. Such skills prevent individuals from becoming overwhelmed by emotions and enable them to function properly in both modes.

2.7 BENEFITS OF INTERRUPTING INTUITIONS IN ANALYSIS

To discuss the benefits of interrupting intuitions in analysis, one approach is to look into what extensive analysis alone cannot do. A research construct relevant to the degree of analysis is decision comprehensiveness—namely, the extensiveness with which an organisation's top executives systematically gather and process information from the

external environment in making strategic decisions. Integrating the work of Ellsberg (1961) and Huber and Daft (1987), Forbes (2007) theorises that comprehensiveness is only beneficial in situations of high quantity and high determinacy of information—what he terms uncertainty—but not in other situations in the "quantity x determinacy" matrix—what he terms ambiguity. Quantity implies the availability of information in the environment whereas determinacy is the degree to which the meaning of information is clear, which implies its usefulness or quality. Forbes's (2007) proposal—namely, only under uncertainty does comprehensiveness have a positive effect on decision quality—reconciles previous research about the effect of comprehensiveness on decision quality. However, in situations of ambiguity in which comprehensiveness has no effect, it remains unclear what can be suggested to decision makers as a suitable approach to complex decision making. Drawing from recent research on intuition, I propose that allowing intuition to interrupt the analytic processes of complex decision making helps decision makers deal with ambiguity (Table 2-1). The mechanism I propose echoes Mintzberg's (1976) assertion that intuition must be translated into logical order if it is to be put to use. I elaborate on this proposition in the following discussion.

Table 2-1 *Quantity x Determinacy Matrix: Uncertainty vs. ambiguity*

		Determinacy = Quality	
Quantity		L	H
	H	*Ambiguity* Holistic intuition is helpful	*Uncertainty* Comprehensiveness has a **positive** effect on decision quality (Forbes, 2007)
	L	*Ambiguity* Nothing helps…	*Ambiguity* Inferential intuition is helpful Expert's intuition operates on a small quantity of high-quality information

2.7.1 INTERRUPTING INTUITION REDIRECTS ANALYSIS

Intuition research often implicitly projects intuition as a provider of new perspectives, which motivates subsequent analysis (Agor, 1989; Behling & Eckel, 1991; Claxton, 1998; Isaack, 1978; Sadler-Smith & Burke, 2009). Studying senior managers' thinking processes, Isenberg (1984) found that intuition appears in the forms of hunches and gut feelings in analytic processes, alarming decision makers—like warning bells (Rowan, 1989)—that something is not quite right even when backed by full analysis. For instance, "The data on the group were inconsistent and unfocused. I had the sense that they were talking about a future that just was not going to happen, and I turned out to be right." (Quote from a CFO of a leading technical products company in Isenberg, 1984, p. 85).

This description of the function of intuition corresponds well to a particular type of intuition: holistic intuition. Recent research reveals that intuition can be the outcome of different types of processing. Holistic intuitions are products of information processing in a "jigsaw puzzle" manner that enables decision makers to see a complex situation as a synthesised whole instead of odd bits and pieces. For instance, extensive research has been conducted on the holistic processing in face recognition—namely, the integration of facial features and their spatial relations into a whole representation (Tanaka & Farah, 1993). Seeing "the whole picture" of a decision sometimes generates innovative insights that do not follow the logic of the current analysis. Such intuitive insight motivates subsequent analysis and changes the course of thinking. J. Baron (2008) illustrated this process with the following example: "Initially the executive saw only a single possibility—to go along—but some evidence against that possibility presented itself, specifically, an intuition or uneasy feeling. Such intuitions are usually a sign that more evidence will be found" (p. 9). The executive's intuition uncovered a whole new aspect of the situation—namely, the morality of the plan—and directed a further round of information search and analysis (J. Baron, 2008). Interrupting intuition reveals a new aspect of the decision to be further analysed.

Proposition 1: Interruption of holistic intuition is positively related to the redirection of analytic processes.

2.7.2 INTERRUPTING INTUITION FOCUSES ANALYSIS

In classic decision theories (Edwards, 1961; Einhorn & Hogarth, 1981; Payne & Bettman, 1992; Slovic, Fischhoff, & Lichtenstein, 1977), intuition sometimes appears in the form of heuristics (i.e., simple decision rules), which help reduce information

processing load and accelerate analytic processes (Kahneman & Klein, 2009). For instance, the ranking of attributes in terms of importance and the sequence of consideration is often determined intuitively. When an attribute is not quantifiable, "as good as", "worse than", and "good enough" judgments are often called for without much conscious reasoning. For example, in the satisficing heuristic, decision makers typically set an "acceptable" level for all "important" attributes and then find the first alternative that is "good enough" in terms of these attributes (Luce, 1956; Simon, 1987b, 1990). These arbitrary elements represent possible intuitive input. Another example is the lexicographic heuristic, such as the "take the best" heuristic (Gigerenzer & Goldstein, 1996), which involves identifying the "most important" attribute and then choosing the best alternative based on that attribute. In this decision-making strategy, the ranking of attributes in terms of importance, which could be determined intuitively, has a significant impact on the final choice.

Such "intuition as heuristics" (Akinci & Sadler-Smith, 2012) correspond to one type of intuition: inferential intuition (i.e., automated responses frozen into habit). In their recent call to synthesise naturalistic decision-making research and the heuristics and biases paradigm, Kahneman and Klein (2009) concurred that heuristics and experts' intuition, or intuitive expertise, are closely related constructs that share the same basis—namely, inferential intuitions. Although heuristics and biases research focuses on the "inaccuracy" while expertise research focuses on the "accuracy of intuition", they both subscribe to the mechanism of inferential intuition (i.e., navigating through large amount of information using shortcuts to make quick matches). Interruptions of inferential intuitions in the analysis—that is, introducing cut-off points, ranking the importance of attributes, and sequencing their consideration—reduce the information-processing load and narrow the focus of any subsequent analysis.

Proposition 2: Interruption of inferential intuition is positively related to the focusing of analytic processes.

2.7.3 SWITCHING IN ACTION

Simon (1987a) specified the necessary conditions of logical analysis: "In logical decision making, goals and alternatives are made explicit, the consequences of pursuing, different alternatives are calculated, and these consequences are evaluated in terms of how close they are to the goals" (p. 57). In other words, a full logical analysis cannot be performed or "gets stuck" when (a) goals are unclear and not all alternatives are known, and (b)

their consequences cannot be accurately calculated and evaluated, which happens when attributes are not well specified, ranked, or sequenced. Consequently, alternatives cannot be valued on each attribute.

As proposed by Forbes (2007), comprehensiveness (i.e., pure analysis) is not beneficial in ambiguous decision environments: When there is little information, there is not much to analyse. When there is information but a low level of determinacy, more analysis leads to "paralysis" (Langley, 1995) as more conflicting results will prevent decision makers from reaching the decision. In these ambiguous situations, intuitive interruptions benefit the decision process in a number of ways. When there is little information but the available information is of high determinacy, inferential intuitions help decision makers achieve higher decision quality through the activation of experts' scripts (i.e., memory structure based on extensive experiences which can operate on a limited amount of information yet remain accurate). The key mechanism, as previously discussed, is quick pattern matching. The necessary condition for this mechanism to work is that the quality (i.e., determinacy) of information is high. Inferences made on low-quality information will inevitably be false. Injections of inferential intuition, once allowed entry into the decision process, focus subsequent analysis by reducing the set of alternatives and by ranking and sequencing attributes.

In another type of ambiguous situation where information is of high quantity but of low determinacy, holistic processing helps decision makers synthesise the implicit connections and recognise the situation as a whole. Decision makers are therefore able to filter out "noise" (i.e., irrelevant information) and uncover good-quality information amongst the bad. This is based on the assumption that low determinacy of information is caused by a mix of high-quality (accurate) and low-quality (inaccurate and false) information.[4] In other words, among the conflicting results produced by the information in the environment, one or several of them would be true. Holistic intuitions, once allowed entry into the decision process, redirect subsequent analysis by revealing

[4] In the case of "zero" determinacy (i.e., the information is completely false and of no value), this mechanism will not work.

new perspectives and adding new alternatives and attributes. Drawing from the above arguments, I make the following propositions.

Propositions 3: In ambiguous environments, allowing intuition to interrupt analysis leads to a higher decision quality than not allowing intuition to interrupt analysis (i.e., pure analysis) in complex decision making.

Proposition 4a: The redirecting benefit of holistic intuition mediates the relationship between holistic intuitive interruptions and decision quality.

Proposition 4b: The focusing benefit of inferential intuition mediates the relationship between inferential intuitive interruptions and decision quality.

The conceptual model is graphically illustrated in Figure 2-4.

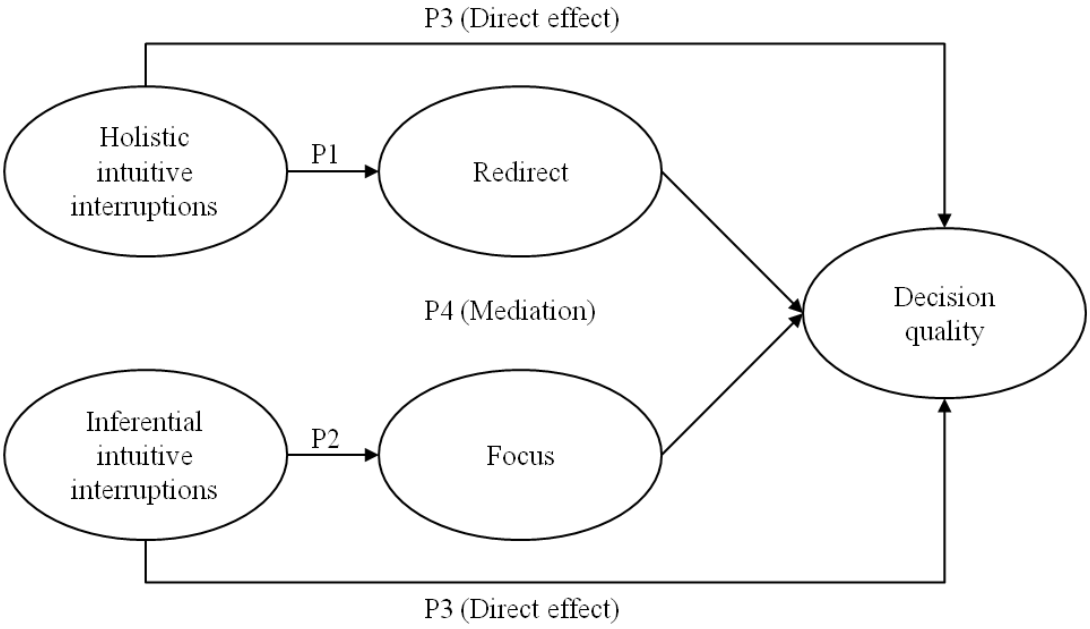

Figure 2-4 Conceptual model

2.8 DISCUSSION

The current theory contributes to research on decision making by specifying how interrupting intuitions can benefit analyses and propose the mechanism of "switch" to describe how they manifest in the decision process. I am speaking directly to scholars who advocate combining analysis and intuition, but do not specify how (Harper, 1988;

Isenberg, 1984; Mintzberg, 1976; Prietula & Simon, 1989; Robey & Taggart, 1981). The theory of intuitive interruptions reconciles decision research, which favours rational approaches rooted in neo-classical economic theories (Allison, 1971; Ansoff, 1965), with intuition research, which advocates the power of non-rational approaches (Agor, 1989; Hogarth, 2001; G. Klein, 2004; Pratt & Dane, 2007). By pointing out that intuition is beneficial when it interacts with analysis, I hope to help the two camps meet halfway.

2.8.1 THE CAVEATS

The current theory is normative; therefore, the proposal thus far has a positive framing: Interrupting intuitions are beneficial to analysis and complex decision making. However, a number of caveats should be noted. First, too much interruption can become distraction. A punctuated analytic process can become aimless and never see an end. The limited attention span and working memory of humans mean that analysis cannot be picked up where it was left after an intuitive interruption. Second, internally driven switching, as proposed in the proceeding discussion, is cognitively demanding. Previous research shows that cognitive style is a relatively stable disposition that dictates individuals' preferences in using analysis or intuition to approach all sorts of decision tasks in their daily lives (Allinson & Hayes, 1996; Hodgkinson & Sadler-Smith, 2003). The stress imposed on decision makers from constantly reminding themselves to switch to the other mode can be significant, particularly for those with strong cognitive style. Research has also indicated that the nature of decision tasks—more specifically, task complexity—dictates the choice of information processing mode (Payne, 1976; Timmermans, 1993). In other words, it could be challenging for people to think more in highly automated behaviours or rely on their intuition in completely unfamiliar tasks. Finally, people have varying levels of abilities in analysing and intuiting, which are well documented by research on general intelligence (Thurstone & Thurstone, 1941) and intuitive expertise (Kahneman & Klein, 2009). Abilities directly relate to the quality of analysis and intuition they can produce, which impact decision quality. An interesting point put forth is that experts are naturally superior in using inferential intuitions whereas novices can possibly produce holistic intuitions just like experts because holistic intuitions do not rely on previous experience or existing cognitive structures, but rather on the ability to make holistic associations (Pratt & Dane, 2007). In other words, based on the current theory, it is possible that experts function well in an ambiguous environment with high determinacy and a low quantity of information

whereas novices can function just as well as experts in an ambiguous environment with low determinacy and a high quantity of information. In summary, although the assumption of the current theory is that it is always possible to use either type of thought across tasks of different levels of complexity, it is reasonable to say that individual differences in the frequency, preferences, and mastery of intuitive interruptions as well as the switching between modes can impact decision quality.

2.8.2 IMPLICATIONS FOR RESEARCH

The intuitive interruptions theory generates insights and new directions for research on decision making. First, intuitive interruptions can help explain the empirical paradox of "combined" speed and comprehensiveness in strategic decision making. Eisenhardt (1989) found that, in high-velocity environments, fast decision makers use more information, develop more alternatives, and have superior performance. From the information-processing perspective, the positive link between fast speed and the large amount of information processed is puzzling. According to the current theory, multiple injections of intuition can help focus analysis by bringing decision makers' attention to important information and reducing the overall processing load while simultaneously considering more alternatives and attributes. Intuitive interruptions redirect and motivate subsequent analysis when information is lacking and focus and accelerate subsequent analysis when information overloads. Intuitive interruptions explain the combination of fast speed and comprehensive analysis of important information, which characterises fast and effective strategic decision makers.

Second, intuitive interruptions can help explain recent empirical findings of the positive effect of polychronicity on strategic decision making and firm performance (Maestro & Souitaris, 2010). Polychronicity is the extent to which people prefer and tend to engage in multiple tasks simultaneously or intermittently instead of one at a time (Bluedorn, 2002; Maestro & Souitaris, 2010). Polychronic managers prefer to work on multiple complex decisions intermittently, mixing tasks from multiple decisions. Previous research has found that an "incubation" period of intuition often occurs, such that intuition takes time to "cook" in the background (i.e., subconsciously) and comes to mind when least expected (Goldberg, 1983). Instead of continuing to analyse Decision A when stuck, polychronic decision makers go on to work on Decision B and let incubation for Decision A continue. When something for Decision A comes to mind intuitively, they switch back to Decision A. Repeating this process and expanding it to even more

decisions leads to more intuitive input into the decision process. Polychronic decision makers, compared to monochromic ones, might find it easier to allow interrupting intuitions into their analysis for each of their decisions and enjoy higher decision quality. I offer these thoughts to be examined empirically in future research.

2.8.3 MANAGERIAL IMPLICATIONS

Traditionally, practitioner literature and academic research have advised managers to use intuition at one point in time to make a major decision (Agor, 1989). Practitioner books often overstate the benefits of intuition whereas academic research informs managers that experts' intuition is useful for making instant major decisions. Conversely, I argue that having the full expertise to make a complex decision in an instant is not common in business. Complex decision making is more often a thought journey, and the level of experience often varies between the elements that constitute a complex decision. The theory of intuitive interruptions informs managers how to use intuition "at discretion" during complex decision making. Intuition does not have to be used only once to serve as the sole basis of decision. Decision makers can use intuition before and after analysis as well as at multiple times during the decision process. Allowing interrupting intuitions to guide their analytic process is beneficial to complex decision making.

2.9 CONCLUSION

This paper offers a normative theory of how people should combine analysis and intuition in complex decision making—that is, allowing intuition to interrupt analysis, which manifests as back-and-forth switches between the analytic and intuitive thinking modes. Multiple injections of intuition improve analysis as they serve the functions of redirecting and motivating, as well as focusing and accelerating, subsequent analysis. The theory of intuitive interruptions offers insights and future directions for strategic decision-making research. As a normative theory, intuitive interruptions are useful in informing practitioners in their complex decision making.

Chapter 3 Intuitive Interruptions in Entrepreneurs' Complex Decision Making

This research note applies the theory of intuitive interruptions to entrepreneurship and argues that entrepreneurs can benefit from allowing intuitions to interrupt analysis in their complex decision-making process in the entrepreneurial environment—an environment that is often highly ambiguous. In this chapter, I illustrate how intuitive interruptions can aid different cognitive activities involved in the entrepreneurial process—namely, opportunity discovery and improvisation. I offer possibilities for future research on entrepreneurial cognition.

3.1 INTRODUCTION

How do entrepreneurs think? Research on entrepreneurial cognition has answered this question by examining the cognitive strategies entrepreneurs employ when making venture-related decisions. By focusing on entrepreneurs as the agent of new venture creation (R. A. Baron, 2007), this stream of research revives interests in the micro side of entrepreneurship and puts the "enabler" back into the focus (Gartner, Shaver, Gatewood, & Katz, 1994). Studying entrepreneurial cognition—defined as "the knowledge structures that entrepreneurs use to make assessments, judgments or decisions involving opportunity evaluation and venture creation and growth" (R. K. Mitchell et al., 2002, p. 97)—has provided unique explanations as to how entrepreneurs differ from non-entrepreneurs (R. A. Baron, 2004). Pioneering studies have shown that entrepreneurs exhibit unique thinking patterns compared to non-entrepreneurs. Cognitive schemas help entrepreneurs remain highly aware of changes in the surroundings and notice opportunities without searching for them ("entrepreneurial alertness"; Gaglio & Katz, 2001). Pattern recognition enables them to "connect the dots" and recognise opportunities not visible to others (R. A. Baron, 2006). Other cognitive strategies help entrepreneurs feel in control of their own fate when the future is unpredictable ("effectuation"; Sarasvathy, 2001), strategize to meet their goals with the limited resources at hand ("bricolage"; Baker, Miner, & Eesley, 2003), and identify and

develop opportunities by rehearsing possibilities in their minds ("counterfactual thinking and mental simulation"; Gaglio, 2004). In its spirit, this stream of research goes beyond personality traits and finds specific mental processes that characterise such entrepreneurial thinking. (For reviews, see R. K. Mitchell et al., 2007; 2002; 2004.)

Although greatly insightful, little research to date has conceptualised in detail how information is processed and organised in entrepreneurs' mind, which might be what is fundamentally driving them to think and perceive the world differently from non-entrepreneurs. Recently, entrepreneurship scholars have advocated for the need to consider the role of intuition in entrepreneurial cognition (Blume & Covin, 2011; J. R. Mitchell, Friga, & Mitchell, 2005). Researchers have clearly demonstrated that entrepreneurs often use intuition to explain their actions (J. R. Mitchell et al., 2005), and enough reasons exist to believe that entrepreneurs, being in their decision environment, do use intuition in their decision making. In the past, intuition as a construct has been rejected due to the methodological challenges to measuring it; such challenges have not yet been resolved by psychology research (Dane & Pratt, 2009; J. R. Mitchell et al., 2005). However, Blume and Covin (2011) argue that, as entrepreneurs so frequently attribute their action to intuition, understanding entrepreneurial intuition is critical, regardless of its actual use. Grounded in information-processing theories (Simon, 1979) and the classic notion of bounded rationality (Simon, 1957), this paper tries to join this stream of research by proposing a specific cognitive process from which entrepreneurs can benefit, thereby allowing intuitive interruptions into their analyses. This process, as proposed in the intuitive interruptions theory (Chapter 2), often manifests as a switch from analysis to intuition, then from intuition back to analysis.[5] The current proposal draws from current research on intuition (Sinclair, 2011a) and complements the framework of entrepreneurial intuition proposed by Mitchell et al. (2005). Equipped with knowledge about the role of intuition in entrepreneurial thinking, efforts to determine how entrepreneurs think differently can proceed to the next level, where we are able to explain why they can perform certain cognitive activities (e.g., identify opportunities and improvise more efficiently than non-entrepreneurs).

[5] Exceptions are the cases of one injection of intuition at the beginning or the end of the decision process.

The chapter is structured as follows. First, I summarise in brief the theory of intuitive interruptions. I then discuss roles of intuitive interruptions in opportunity discovery and improvisation, two of the important entrepreneurial actions found in previous research. I conclude with implications for entrepreneurship theory and practice.

3.2 THE THEORY OF INTUITIVE INTERRUPTIONS IN ENTREPRENEURSHIP

In Chapter 2, the theory of intuitive interruptions was proposed. Drawing on Forbes's (2007) proposal that comprehensiveness (i.e., pure analysis) is only beneficial to decision quality in an information environment with high determinacy and quantity (i.e., under uncertainty), I propose that in two types of ambiguous environment, interruptive intuitions in analysis can help decision makers achieve higher decision quality. In an environment with high quantity but low determinacy of information, holistic intuitions (i.e., synthesised output of jigsaw puzzle-like processing) interrupt analysis and redirect subsequent analysis by revealing a new perspective and adding new alternatives and attributes. In an environment with high determinacy but low quantity of information, inferential intuitions (i.e., frozen-into-habit automated responses from extensive prior experience) interrupt the analysis and focus subsequent analysis by reducing the set of alternatives and ranking and sequencing attributes. In other words, through the focusing on and redirection of benefits of inferential and holistic intuitions, respectively, intuitive interruptions contribute to higher decision quality.

I will now proceed to the entrepreneurial context to elaborate upon intuitive interruptions in entrepreneurship. Entrepreneurs, being in their ambiguous decision environment (Alvarez & Busenitz, 2001; Begley & Boyd, 1987; McMullen & Shepherd, 2006), benefit from interrupting intuitions in complex decision-making processes in different cognitive activities in the entrepreneurial process. This discussion includes an attempt to apply the new theory of intuitive interruptions in entrepreneurship and offer rudimentary ideas of how the two types of interrupting intuitions can help entrepreneurs navigate the entrepreneurial environment.

3.2.1 INTUITIVE INTERRUPTIONS AND OPPORTUNITY RECOGNITION

The entrepreneurial process begins with entrepreneurs identifying and evaluating opportunities before deciding to pursue them. Previous research shows that the

elements of an opportunity are often seemingly unrelated ideas that exist in distant geographical or knowledge spaces (Gregoire, Barr, & Shepherd, 2006). Entrepreneurs, who are attuned to subtle changes in the environment, can rely on holistic intuitions to "connect the dots" (R. A. Baron, 2006) and notice opportunities while others cannot (Gaglio & Katz, 2001). On one hand, noticing without searching for hints lacks intention, which implies subconscious information processing. As proposed in the theory of intuitive interruptions, holistic intuitions help people see the whole picture and are most useful in generating new possibilities in the ongoing analysis. Such alertness to opportunities (Busenitz, 1996; Minniti, 2004) is an effortless act that cannot be forced and is often times different from common logic. On the other hand, the ability to discover opportunities is an entrepreneurial expertise—something only entrepreneurs can do and something serial entrepreneurs are expected to do better than novices (R. Mitchell & Chesteen, 1995; Sarasvathy, 2008). Theoretically, the existing knowledge structure built on experience from previous ventures should facilitate the discovery of opportunities (J. R. Mitchell et al., 2005). However, thus far, entrepreneurship research has not empirically examined experts' intuition of serial entrepreneurs in terms of its effectiveness in continuously discovering opportunities.

Mitchell et al. (2005) proposed that intuition is only relevant to entrepreneurship research within the boundaries of opportunity recognition. In these authors' formulation, entrepreneurial intuition is most likely to be observed at the level of the cognitive process, or executive control system, that is closest to consciousness.[6] They argued that entrepreneurial awareness is an expert script stored in the executive control system that "enables the process whereby an individual comes to consciousness of an opportunity" (p. 661). This seems to point to entrepreneurial intuition as a type of

[6] This claim is somewhat confusing for several reasons. (1) Consciousness is defined as "phenomenal awareness." (2) The authors argued that entrepreneurial intuition about an opportunity "surfaces onto consciousness" and "comes to awareness." (3) The authors simultaneously claimed that, Level 4, the executive control system where the expert script of entrepreneurial alertness and entrepreneurial intuition reside, is a "higher level of consciousness" (p. 661). Consequently, it is unclear if the executive control system itself, and other levels described, are conscious.

expert intuition. The theory of intuitive interruptions concurs that intuition is a product of nonconscious processes that can surface onto consciousness—that is, interrupt analysis. However, it does not make the assumption that entrepreneurial intuition can only be inferential. Holistic intuition, which can come from memory structures "further away" from the consciousness, is also crucial in opportunity discovery as it helps entrepreneurs connect seemingly unrelated ideas.

3.2.2 INTUITIVE INTERRUPTIONS AND IMPROVISATION

Entrepreneurs improvise in the founding of new ventures as well as in emergent firm strategies and competencies—that is, during and after start-up (Baker et al., 2003). Drivers of improvisation include having a historical record within good references, not having a formal plan available, facing time pressures (Leybourne, Sadlersmith, & Sadler-Smith, 2006), and the decision maker having no previous experience in the task. Improvisation as a concept originated from performance art and refers to "creat[ing] and perform[ing] spontaneously or without preparation" (*Oxford Dictionary*, 2000). In organisation studies, improvisation is defined as "the spontaneous and creative process of attempting to achieve an objective in a new way" (Vera & Crossan, 2004, p. 733) and "the convergence of planning and execution" (Moorman & Miner, 1998). These two definitions combined imply a novelty element and a "plan as you go" strategy that is often required in dynamic and turbulent environments into which new information constantly flows (Baker et al., 2003; Moorman & Miner, 1998) and improvisational actions are initiated based on the conditions of time pressure, ambiguity, and uncertainty (Vera & Crossan, 2004). In organisational studies, improvisation has been studied as an organisational-level construct. However, entrepreneurship scholars have studied the improvisation of entrepreneurial individuals, such as the work on bricolage (Baker et al., 2003; Baker & Nelson, 2005).

Bricolage is an entrepreneurial action of "making do with what is at hand" and "creating something from nothing" in terms of resources (Baker & Nelson, 2005) and networks (Baker et al., 2003). The entrepreneurs in these studies often demonstrate a lack of prior intention, yet quickly react to an emergent opportunity (e.g., start running a new business without any prior planning). Scholars find bricolage to be a construct that

shares similarity with improvisation.[7] Recent research shows that entrepreneurs' ability to improvise is positively related to venture performance and is positively moderated by their self-efficacy (Hmieleski & Corbett, 2008).

Indeed, scholars recognise the important role of intuition in improvisation such that improvisation has been defined as "intuition guiding action in a spontaneous way" (Crossan & Sorrenti, 1997). Creativity and spontaneity are defined as the fundamental dimensions of improvisation encompassing other frequently mentioned aspects, such as intuition, flexibility, and the use of materials at hand (Vera & Crossan, 2004). The kind of intuition involved in improvisation, as described by improvisation researchers, seems to be inferential. For example, Crossan (1998, p. 593), following Weick (1998), defined intuition involved in improvisation as "the rapid processing of experienced information." In her study, the ability of theatre actors to improvise comes from years of theatrical training and performing experience. In other words, good improvisation is built upon traditional skills in a particular domain (Crossan, 1998). More specifically, the author argues:

> given that there is little or no time between conceiving of and executing an action in improvisation, whether improvisation produces coherent action depends fundamentally on the existence of a large number and variety of procedural routines that can be recombined to fit in a given context. (p. 709)

These descriptions of improvisation clearly point to the role of inferential intuitions, which are manifestations of experience and practice. However, the following description hints that a role for holistic intuition also exists: "learning from the environment often requires that individuals break out of their traditional frames of reference to see the environment in its full richness and complexity. Doing so requires the application of intuition"(Crossan, 1998, p. 595).

[7] However, Baker *et al*. (2003) clarify that improvisation implies bricolage, but bricolage does not imply improvisation as bricolage can be involved in planned actions too.

Moorman and Miner's (1998b) description of jazz composition demonstrates that improvisation seems to depend on a mix of holistic intuition and inferential intuition. For example, on one extreme, the first level of improvisation involves "modest adjustments to a pre-existing piece or process. […] musicians often begin with 'the head' of a piece, playing the song and its standard chords, but making slight modifications in style and emphasis." On the other extreme, "the improviser discards clear links to the original referent and composes new patterns. The improviser may begin with a standard head but moves on to melodic improvisations that have internal patterns unrelated to the original harmonic, rhythmic, or melodic structures" (p. 703). In the former, more inferential intuitions might be involved than holistic intuitions. In the latter, more holistic intuitions might be involved than inferential intuitions. Moreover, the composition of a whole song most likely involves multiple interruptions of intuition—some holistic, some inferential.

Moorman and Miner (1998b) argued that improvisation is influenced by two types of memory: procedural and declarative. Procedural memory stores action sequences, scripts, and routines while declarative memory consists of ideas and facts (Miner & Mezias, 1996). Procedural memory seems to be closely related to inferential intuition as "a key characteristic of procedural memory is that it becomes automatic or accessible unconsciously" (Moorman & Miner, 1998b, p. 708)—that is, a frozen-into-habit automated response stored in action scripts that are speedy and effortless. Meanwhile, declarative memory consists of the general knowledge or principles of things that can be applied to different situations, for example in jazz composition, the musical theory about chord progression or rhythmic pattern (Moorman & Miner, 1998b). This seems to correspond to holistic intuition as "the importance of declarative knowledge in making sense out of new situations, deriving meaning from unstructured situations, or using principles to predict outcomes" (p. 710).

Organisational improvisation theory (Moorman et al., 1998) states that procedural memory is positively related to coherence and speed, but negatively related to novelty of improvisation. Declarative memory, on the other hand, is positively related to coherence and novelty, but negatively related to speed. These relationships can be compared with the theory of intuitive interruptions. First, coherence of action is enhanced by existing cognitive structure, either of routines or facts. Second, it is known that inferential intuition is fast; however, no research-based explanation exists as to

why holistic intuition should be slower. Third, it is true we do not expect inferential intuition to generate something new as its function is to focus analysis (i.e., scope it down, not expand it). Thus, there seem to be some consistencies as well as inconsistencies between improvisation theory and the theory of intuitive interruptions. These ideas are offered for future research.

There are two more insights from this cross-comparison. First, it is clear in intuition literature that the basis of inferential intuition is expertise (i.e., existing knowledge structure built on prior experience and extensive practice). However, it has not been clearly specified from which kind of knowledge structure holistic processing can draw. Drawing from improvisation theory, it seems that general knowledge not specific to the current task might help people organise information. Another possibility is that the activation of inferential or holistic intuition and the memory that one draws from are determined by the degree of similarity between the situation at hand and experienced situations stored in the memory. Second, improvisation theory views the two types of memory as complementary competencies that offset one another's weaknesses (Moorman & Miner, 1998b). Improvisation scholars have suggested a number of ways to combine declarative memory and procedural memory to achieve higher coherence, speed, and novelty altogether, such as using declarative memory to make creative use of procedural memory. The lesson that intuitive interruptions theory can take from this is that the degree to which intuitive interruptions increase decision quality might depend on how well one mixes inferential intuition and holistic intuition to benefit from their complementarities. These ideas are also offered for future research.

3.3 DISCUSSION

In this chapter I illustrate the role of intuitive interruptions in two entrepreneurial actions: opportunity discovery and improvisation. Drawing from extant research on entrepreneurial cognition, I apply the theory of intuitive interruptions and derive how inferential and holistic intuitions can help entrepreneurs navigate the often ambiguous entrepreneurial environment. I propose that intuitive interruptions are an entrepreneurial expertise cultivated by the entrepreneurial environment (cf. Sarasvathy, 2008)—that is, the frequency and mastery of intuitive interruption would distinguish entrepreneurs from non-entrepreneurs, more successful entrepreneurs

from less successful entrepreneurs, and expert entrepreneurs from novice entrepreneurs.

3.3.1 THEORETICAL IMPLICATIONS

The key contribution of this chapter to entrepreneurial cognition research is the proposal of intuitive interruptions as a new framework for studying entrepreneurial intuition. The uniqueness of this framework, compared to previous proposals such as Mitchell *et al.*'s (2005), is the emphasis on the combined use of intuition and analysis—how intuitions interrupt and rejuvenate analytic processes—instead of solely relying on intuition. This is consistent with recent studies that provide empirical evidence suggesting that analysis and intuition are dual processes instead of two extremes along a single continuum (Hodgkinson, Sadler-Smith, Sinclair, & Ashkanasy, 2009). Entrepreneurs, and any individuals, can tap into both. I draw from the latest advances of intuition research that specify two different types of processing—inferential and holistic—that both produce intuitions. This new development in the intuition literature potentially reconciles previous research on expert intuition and creative intuition as well as many other streams of research, including entrepreneurial intuition (see Chapter 2).

3.3.2 METHODOLOGICAL IMPLICATIONS

Managerial intuition research has not yet resolved the problem of measurement. Psychometric scales have been employed in most empirical research, but they only measure preference or the perceived use of intuition, at best (J. R. Mitchell et al., 2005). Pioneering studies have tried to capture the actual use of intuition through concurrent verbal protocol (Ericsson & Simon, 1984); however, it is still unclear in this method which recorded thoughts can be categorised as intuition, as opposed to analytic thoughts, which can be captured in a number of known forms (e.g., Schweiger et al., 1985). The subconscious nature of intuitive processing makes it impossible to articulate. Once it has surfaced into the consciousness, it is so instantaneous and blended into the analytic process that individuals sometimes do not notice that it is in fact an intuitive thought. Recently, Blume and Covin (2011) proposed an alternative approach: Understanding an entrepreneur's attribution to intuition can be just as pertinent to entrepreneurship research as the actual use of intuition. This observation offers a good starting point for studying intuitive interruptions in entrepreneurial cognition.

3.3.3 PRACTICAL IMPLICATIONS

Given the benefits of intuition as proposed by the current theory and all other intuition theories, an important question remains: How do we cultivate intuition? As intuition comes to mind in fleeing moments, one obvious suggestion is to allow random thoughts into the thinking process and not to fixate on logical analysis. Seemingly illogical ideas can be exactly the kind of intuition that changes the direction of thinking or injects new possibilities into the stagnant analysis. Dane (2011) recently proposed mindfulness—being and feeling present (Brown & Ryan, 2003)—as an aid for capturing fleeing intuitions. He argued that intuitions easily slip through our mind without receiving consideration. Being mindful implies attending to both internal and external stimuli. These are untested propositions offered for future research.

3.4 CONCLUSION

This chapter has offered a new framework of entrepreneurial intuition that has the potential to synthesise previous research on experts' intuition, creative intuition, and the emerging research on entrepreneurial intuition. It is hoped that this work can help researchers accept intuition as a valid construct which can serve to enhance our understanding of entrepreneurial cognition.

Chapter 4 Escalation of Commitment: A study of hope

This study was designed to examine the role of hope in escalation decision making. It was hypothesised that, when faced with continuous negative feedback in an unfavourable situation, teams who remain hopeful persist (at an increasing cost), engage in the situation, and worry about the future. Hope is defined and measured as a mix of emotion and cognition, while engagement and worry are captured as video-coded behavioural displays. A longitudinal simulation design is employed, in which teams underwent multiple rounds of feedback and investment. Data from 66 teams reveal that the likelihood of teams quitting the simulation task is lower when teams experience hope. Displayed engagement and worry mediated the relationship between hope and the likelihood of teams quitting the course of action. Theoretical and practical implications of the findings are discussed at the end of this chapter.

How and why do people choose to continuously invest resources into a failing course of action against negative signals? Extant research offers economic and behavioural explanations for the phenomenon of escalation of commitment. People who see chances in recovering current losses in the future (Bazerman, Giuliano, & Appelman, 1984) and want to avoid wastefulness (A Tversky et al., 1985) escalate their commitment rationally. People who feel personally responsible and the need to justify their initial decisions escalate their commitment and persist in unfavourable situations irrationally (B. M. Staw, 1981; B. M. Staw, Hall, & Pondy, 1976; B. M. Staw & Ross, 1987). In these prevailing explanations of escalation of commitment, an underlying factor seems to be missing: What is the mentality that people rely on when framing the situation as a smaller future loss instead of a sure loss now? When faced with sunk cost, how can wastefulness possibly be avoided? What is being expected of the future such that the initial decision to enter the course of action can be justified? The fundamental element missing from the discussion thus far is a positive, but not necessarily rational, belief about the future.

This study aims to fill this gap in escalation of commitment research by proposing a new driver of escalation of commitment, hope, which focuses on the positive thinking and feeling about future prospects. Drawing from Snyder's (2002) and Lazarus's (1999)

theories, hope is defined as a positive psychological state about the future—that is, the belief that the currently unfavourable situation will improve. In an escalation situation, hope entails the expectation of turning the situation around (Brockner, 1992). It is only when the future turns out better can the current loss be recovered and a gain becomes possible, can sunk cost not be wasteful, and can the eventually positive outcome justify the initial decision to enter the course of action.

Historically, behavioural explanations to escalation of commitment have been pitched against economic explanations. Although an interaction between these two has been proposed by escalation researchers, it remains under-researched (B. M. Staw, 1981, 2005). In this paper, I propose that hope, as a positive psychological state, implies people's beliefs about project economics, which was previously positioned as an economic reason of escalation. I argue that, in unfavourable, uncertain situations, this belief is rarely rational. Moreover, hope is the latent factor of previous behavioural explanations. As a result, I contribute to the literature by offering a new explanation for escalation of commitment. To this end, I will demonstrate empirically the effect of hope above and beyond the known social-psychological drivers and discuss how the hope theory of escalation complements and potentially underlies previous explanations. I will start by reviewing the literature on escalation of commitment and hope, followed by deriving hypotheses of the effect of hope on escalation tendency and the mediating mechanisms.

4.1 ESCALATION OF COMMITMENT

Over the past 35 years, research on the phenomenon of escalation of commitment examined the psychological, social, and structural factors leading to individuals' choice to persist in a losing course of action (Bowen, 1987; Brockner, 1992; Brockner et al., 1986; Brockner & Rubin, 1985; Staw, 1981, 2005; Staw, Barsade, & Koput, 1997; Staw & Ross, 1987). Since the initial study by Staw (1976), this stream of research has been ground-breaking in demonstrating how irrational individuals are when investing additional resources into an obviously failing course of action. For instance, when personally responsible for the decision and action, individuals will continue a failing course of action just to prove that they were right (B. M. Staw et al., 1976). They are also inclined to attribute failure to external reasons (B. M. Staw & Ross, 1978) and believe that additional resources will improve the situation, regardless of negative feedback (B.

M. Staw & Fox, 1977). These psychological factors are more powerful than economic factors such that individuals' continuous investment is rarely a rational effort. The self-justification explanation presented in Staw's three studies is rooted in dissonance theory (Festinger, 1954) and focused on the individual level. Two of Staw's subsequent studies (Fox & Staw, 1979; B. M. Staw & Ross, 1980) examined social factors behind leaders' escalation of commitment. People who are facing job insecurity and policy resistance are more likely to persist in an action involving an increasing cost (Fox & Staw, 1979); the social norm of being consistent also adds to the pressure to persist (B. M. Staw & Ross, 1980).

In 1981, Staw proposed the first comprehensive theoretical framework of escalation of commitment, in which he proposed the four major determinants of escalation behaviour: motivation to justify previous decisions, norms for consistency, probability of future outcomes, and value of future outcomes—the former two are behavioural and irrational, corresponding to his previous work, whereas the latter two are economic and rational, corresponding to classic economic explanations such as sunk cost and prospect theory (B. M. Staw, 1981). A key distinguishing logic behind this contrast is retrospective rationality versus prospective rationality. Decision makers in prospect theory behave according to their framing of situations, particularly the perception of losses (Whyte, 1986). People who frame the situation as some chance to have a smaller loss, no loss, or even a gain in the future are likely to persist and invest more whereas people who frame the situation as a sure loss now are be more likely to cut losses and exit (Bazerman et al., 1984). Similarly, those who perceive prior investment as sunk cost engage in actions to avoid wastefulness and therefore persist (Arkes & Blumer, 1985). These explanations are different from behavioural explanations (e.g., self-justification) in that decision makers look into the future rather than the past.

In this original formulation, escalation of commitment was positioned as a decision bias, in contrast to rationally committing more resources. Staw (1981) was modest in the way he positioned the behavioural drivers against the economic ones as it was still highly controversial to describe decision makers as irrational. He stated that, "many researchers may object to the inclusion of 'non-rational' elements in a decision framework and prefer to think of commitment strictly as a function of probabilities and valences in an expectancy theory sense" (p. 585). Nevertheless, as proposed by Staw (1981), not only are the effects of behavioural drivers forceful, but they also seem to mix

with the effects of economic drivers, making it difficult to draw a line between them. Subsequent research began to address this issue.

In a case study of the world's fair Expo 1986 in Vancouver, Ross and Staw (1986) found a more complex picture of escalation of commitment. Project factors (consideration of economic value of a project) and psychological factors such as self-justification are strong drivers of behaviour in the early stages of escalation whereas structural factors such as the tremendous impact at the societal level that exceeds the project itself and the belief that the decision maker's political reputation is at stake become forceful drivers of escalation (B. M. Staw & Ross, 1987). The implication of this more complex picture is two-fold. First, behavioural factors and economic factors seem to interact such that escalation behaviour is not clearly rational or irrational, but a mix of both. Second, the interplay of micro and macro factors is also at work.

Almost simultaneously, a stream of research emerged that focused on the phenomenon of "entrapment", paralleling escalation of commitment. Joel Brockner and his colleagues conducted a series of studies and found a number of contributing factors to persistence and escalating behaviour, such as modelling behaviour (Brockner et al., 1986; Brockner, O'Malley, Hite, & Davies, 1987), audience and face saving effect (Brockner et al., 1982; Brockner, Rubin, & Lang, 1981) and self-identity protection (Brockner et al., 1986; Sandelands, Brockner, & Glynn, 1988).

Although self-justification is the most prominent paradigm in escalation research, a number of critiques have been made by scholars who propose opposing or complementary theoretical views. Northcraft and Wolf (1984) argued that rational decision makers should ignore sunk costs as they are irrelevant to the return on future allocation of resources. They suggested that determining whether a continuous investment decision is rational or irrational can simply be a matter of assessment using the calculation of time-adjusted rate of return (TARR). They also argued that psychological explanations of escalation can only make contributions to knowledge in economically inadvisable situations. The authors pointed out two situations in which TARR is inappropriate: (1) when actions are taken for reasons other than being cost-effective and (2) when the benefits of a project are not quantifiable. More fundamentally, it seems that this proposal is based on the assumption of zero uncertainty: Sunk costs and negative financial feedback are explicit, as is the entire

revenue picture of the future. Whyte (1986) proposed that prospect theory can more readily explain escalation behaviour than self-justification. He argued that, in a continuous decision-making process, the framing of a subsequent decision will reflect the success or failure of the previous decision. Individuals in a gain framing (from previous success experience) will be risk adverse whereas individuals in a loss framing (from previous failure experience) will be risk seeking, which naturally manifests in the escalation of commitment (i.e., further investment). Bowen (1987) positioned escalation of commitment as a decision dilemma instead of a decision error: Equivocal feedback, as defined and manipulated in previous laboratory studies, renders that decision makers simply cannot prejudge the future effectiveness of continuing or discontinuing any course of action. The ambiguity of feedback resides in the lack of predictive power of future performance and credible criteria or standards against which to compare feedback. He concluded that "one technically cannot err in an ill-structured situation" (p. 63). Brockner (1992) reviewed empirical evidence supporting the self-justification theory and proposed that alternative explanations—particularly situational and individual factors derived from the literature on group polarization, modelling, and self-presentation theory—should complement it, rather than replace it.

Regardless of the paradigm adopted, further experimental studies continued to discover additional contributing factors and demonstrate interaction effects. For example, Whyte (1993) found that the effects of sunk cost and self-justification co-exist. Garland and colleagues (1998) in a series of studies demonstrated that sunk cost has been confounded with the need for completion in previous experimental studies. In a more recent study, Moon (2001) demonstrated an interaction between sunk cost and the need for completion: Sunk cost has a greater impact on commitment when the level of project completion is high. As demonstrated, escalation research, in line with its origin, is predominantly based on experimental studies, which are powerful in isolating driving factors. However, other approaches such as quantitative tests and case studies have also been instrumental in the theoretical development of escalation literature. In their field study, Staw *et al*. (1997) demonstrated the effect of personal responsibility through naturally occurring data on bank loan write-offs and the turnover of senior managers. Staw (2005), also in reflection, stressed the importance of the case studies of large-scale government projects (Ross & Staw, 1986, 1993) in revising the conceptual models (summarised in Staw, 1981, 1997a; Staw & Ross, 1989). The escalation of commitment has also been applied to other fields of studies to explain behaviour in different contexts,

such as failing software projects (Keil, 1995; Keil, Mann, & Rai, 2000; Keil, Wei, Saarinen, Tuunainen, & Wassenaar, 2000) and entrepreneurial ventures (Guler, 2007; McCarthy, Schoorman, & Cooper, 1993).

One specific branch of escalation research of particular relevance to the current study examines escalating behaviour in groups. Bazerman *et al*. (1984) found escalation behaviour in both individuals and groups. More specifically, they found that dissonance processes underlie escalation decision making. Whyte (1993) took a prospect theory approach and found that people in groups are more likely to escalate their commitment to failing courses of actions than individually. Moon *et al*. (2003) found that divergent views of individuals in a group promote group escalation. Another relevant branch of research relates to additional psychological factors at the individual level. For example, a set of recent studies demonstrated the effect of general negative affect (Wong, Yik, & Kwong, 2006) and experienced, imagined, and anticipated regret (Hoelzl & Loewenstein, 2005; Ku, 2008; Wong & Kwong, 2007) on escalation tendency. Individual differences in self-efficacy and self-esteem have also been found to be related to escalation tendency (Sivanathan, Molden, Galinsky, & Ku, 2008; Whyte & Saks, 2007; Whyte, Saks, & Hook, 1997). Ultimately, in escalation research, group escalation and emotion-related drivers are two under-researched areas.

4.2 HOPE

Hope is the positive psychological state stemming from the non-rational belief that the current situation will improve in the future. Defined as such, hope comprises both cognition and emotion. The cognition of hope (i.e., hopeful thinking) reflects two types of goal-oriented cognition: pathways through which goals can be attained and the willpower to implement them (Snyder, 2002). The emotion of hope springs from unsatisfactory current circumstances and uncertainty in the future: “We are concerned about what is going to happen and hope that there will be a change for the better. But because the future is uncertain, we cannot know what is going to happen with any confidence” (Lazarus, 1999, p. 654). Taken together, hope is a positive motivational state (Snyder, 2002) in which people experience a sense of certainty internally (i.e., knowing what to do and are driven to do so), yet uncertainty externally (i.e., not knowing what future holds). In contrast to thinking and feeling hopeful, experiencing hopelessness and despair is the result of the thinking that the currently unsatisfactory

circumstances will not improve in the future; this state implies that people are unmotivated to achieve goals (Abramson, Metalsky, & Alloy, 1989; Seligman, 1975).

The chosen definition clearly distinguishes hope from other constructs. The most discussed, closely related construct is optimism (M. Scheier, Carver, & Bridges, 1994; M. F. Scheier & Carver, 1985, 1987). Optimism is the belief people hold that they are less likely than others to suffer bad outcomes and more likely to enjoy good outcomes (Weinstein, 1980). Hope differs from optimism in that it (1) is a state rather than a trait and (2) focuses on future improvement of a currently unfavourable situation rather than a general positive perception of the situation. Recent research in positive psychology includes hope—alongside optimism, self-efficacy and resilience—as a dimension of psychological capital—a reserve of state-like,[8] positive psychological characteristics that help people achieve goals and overcome obstacles in life (Luthans, Avolio, Avey, & Norman, 2007; Luthans, Youssef, & Avollo, 2007).

4.3 HYPOTHESES

Previous theories of escalation of commitment dictate that such escalation would be a rational choice when there are clear economic reasons—that is, anticipated economic benefits from the project (Northcraft & Wolf, 1984). In a context with perfect information, such benefits can be calculated and evaluated against predetermined criteria, thereby allowing for rational decisions to be made. In a context of uncertainty, imperfect information means that decision making largely relies on individuals' perception of the probability of future outcomes and the expected value of the potential outcomes; these economic factors tend to interact with behavioural factors (e.g., need for self-justification), which in turn drive individuals to escalate their commitment to failing projects (B. M. Staw, 1981, 2005).

When continuous, unequivocal (Bowen, 1987) negative feedback is given, logically, individuals' perception of project economics should change negatively. However, non-objective factors might influence the search for and processing of information,

[8] Can be developed through training and practice.

subsequently influencing individuals' perceptions (B. M. Staw, 2005). The psychological state of hope is one such non-objective factor. In a hopeful state, people think and feel positively that the currently unsatisfactory situation will improve. More specifically, knowing that the future is uncertain, they are motivated to achieve their goals and are confident that they can do so. In this mentality, negative feedback might be interpreted in a positive light and transform into a positive perception of project economics. One such interpretation is trial-and-error learning—namely, current losses are necessary tuition to learning and conquering the system over time (B. M. Staw, 2005). Another possible interpretation comes from distrust in the system, which results in deeming negative feedback to be inaccurate and of little relevance to performance. Consequently, people who experience hope are willing to persist in a currently unfavourable situation even under continuous negative feedback because—for whatever reason—they believe the situation will turn around. In contrast, people with little hope feel lost, not knowing how to and feeling unable to take actions to improve the current situation. There is no reason for them to "keep trying" without thinking and feeling that things will get better.

Hypothesis 1: In uncertain situations, teams that experience hope are less likely to quit a failing project. In event history terms, a team's hope is negatively related to the hazard of quitting.

As hope entails motivation, it is unlikely that people persist and passively wait for the situation to improve. Instead, they actively participate in the task and exert effort. Previous research shows that task engagement entails a mix of energy, motivation, and concentration (Matthews *et al*., 2002). In personnel psychology, personal engagement or employee engagement represents a state in which workers invest personal energy and emotionally connect with their work (Christian, Garza, & Slaughter, 2011; Macey & Schneider, 2008). In an unfavourable situation, people who experience hope are more likely to engage in the current task as they believe they know where to focus effort ("pathway" thinking) and are driven to do so ("agency" thinking). When involved in interdependent team tasks, they are also more likely to engage in teamwork to strive together with team members. Consequently, when engagement is high, people are less likely to consider quitting as an option even if it is made explicit to them. Indeed, feeling "on track" does not signify need for withdrawal. Entrepreneurship research has found that passion can fuel drive, energy, and the tenacity to pursue a goal—in this case, venture creation—thereby creating an absorption effect (Cardon, Wincent, Singh, &

Drnovsek, 2009). In contrast, disengaged people are more likely to ignore feedback, thinking that it does not reflect their actions or simply not being able to explain it. In team decision tasks, disengagement can be a result of boredom or a lack of "team-ness" (Cohen, 1997). Unengaged people are likely to favour withdrawal, guided by their passive attitude towards the task and performance as well as the team itself.

Hypothesis2a: Engagement partially mediates the relationship between a team's hope and the likelihood of teams quitting a failing project.

Hope does not necessarily manifest itself in a positive light in unfavourable situations. After all, people continuously face negative feedback about performance and an uncertain future. Indeed, the cognitive side of hope manifests in engagement, which entails pathway and agency thinking. In contrast, the emotional side of hope, as defined herein, entails a sense of uncertainty which, in combination with prioritised allocation of attention, should manifest in a heightened state of cognitive concern. In simple words, one is concerned when one cares and feels unsure. In psychology research, worry has been defined as the cognitive component of anxiety (Doctor & Altman, 1969; Mathews, 1990) and is linked to procrastination and rumination (Muris, Roelofs, Rassin, Franken, & Mayer, 2005; Stöber & Joormann, 2001). In addition, worry is future oriented: People tend to worry about the future, but not the present or the past (Borkovec, 1983). In unfavourable situations, those who experience hope persist and actively pursue their goals while simultaneously remaining concerned and worry about the future.

Hypothesis2b: Worry partially mediates the relationship between teams' hope and the likelihood of teams quitting the failing project.

4.4 RESEARCH DESIGN

To examine the relationship among hope, engagement, worry, and escalation tendency, I employ a longitudinal, interactive computer-based simulation design similar to the studies of Boone, Van Olffen, and Van Witteloostuijn (2005), Seo and Barrett (2007), and Audia, Locke and Smith (2000). Teams were allowed to make continuous investment decisions freely for a given task in a controlled environment (i.e., the simulation) such that the decision processes unfolded in a natural manner. These decisions are situations in which resources are allocated to one alternative over others and in which there is a stream of anticipated costs and revenues (Northcraft & Wolf, 1984; Whyte, 1986).

Specific designs about continuous investments were introduced to capture the focal phenomenon of escalation of commitment (see Section 5.4.2).

4.4.1 THE DECISION TASK

A business simulation about new venture creation in the highly competitive personal computing (hardware) industry was chosen as the study instrument. In the simulation, players make a wide array of business decisions ranging from daily operations to business strategy. Each decision has both time and financial consequences, which jointly influence the venture's performance. The simulation runs using the concept of "month." In each month, players make a set of decisions and "run the month". The programme then simulates the market results (inquiries, orders, sales) which entail venture performance. Players are allowed to proceed at their own pace and spend as much or little time in each month of decision making. In this study, they were also allowed to stop and leave the simulation whenever they wished. There was no predetermined number of months that the participants had to fulfil.

The simulation is well suited for studies of complex decision processes because it requires a variety of cognitive skills and knowledge, and the optimal result (i.e., high profit) can be achieved through different routes. It is also suitable for studies of team decision making as the one-laptop design allows little delegation and requires team members to discuss and make decisions together.

4.4.2 PROCEDURE

Participants formed their own teams when they signed up to participate in the study. At least one day before the experiment, recruited participants completed a battery of psychometric tests that covered a number of individual traits. On the experiment day, upon arrival at the lab, the teams first had a 1-hour practice coached by the experimenter, followed by the 2-hour simulation. Performance feedback was given at the end of every round, after which teams answered items about their current team's hope. As part of the escalation study design, it was made explicit to participants that they had the opportunity to exit at the end of every month; teams had to make this decision—namely, whether to quit or continue—jointly. This resulted in the different number of months teams played (ranging from 3 to 21; mean 8.3). After the simulation, they answered another set of items covering their reasons for staying in the simulation up until the point they quit.

Specifically, for the purpose of the study of escalation of commitment, a set of conditions was introduced, adapted from Brockner *et al.*'s (1986) design: (a) Costs are mounting at an increasing speed for staying in the simulation. (b) The decision process is continuous (decision-feedback–decision-…), and there is an opportunity to exit at each decision point. (c) Feedback on teams' current standing in the simulation is given at the end of every round. The ultimate goal was to achieve high profits in a short amount of time. Based on numerous trials, I set this goal to be a cumulative profit of £25,000 in the simulation, which is highly challenging for inexperienced players. A prize of £300 would be awarded to the team who achieves this goal.[9] Each team received £6 at the end of the training session as compensation for their time in the practice. Then they were told they could use this money to kick start the simulation, but once they have gone over, they need to start paying with their own money in order to stay in the simulation. It should be noted that this paying situation is an experimental manipulation: Teams were first led to believe that they had to pay the experimenter not on site, but at a later point in time[10] before they were eventually informed that they actually did not need to pay.[11] A detailed script of exactly how the money situation was explained to the participants can be found in Appendix 1.

4.4.3 THE SAMPLE

The sample consisted of 66[12] teams of student subjects from postgraduate study programmes (MSc in Management-Entrepreneurship and MSc in Investment Management) and undergraduate programmes (BA in Business Studies and BA in Informatics). As part of the university culture, the students come from diverse ethnic backgrounds and nationalities. The mean age of the sample was 22.09 (SD = .23); 45% of

[9] In the end, one team achieved this goal and was rewarded and excluded from the study for not satisfying the condition of escalating commitment in a "failing" course of action.

[10] This was ensured by an IOU note signed by the team and the experimenter.

[11] However, this was done at a later point in time, after data collection had been concluded. As our participants were mostly from the same study programme, it was necessary to prevent them from revealing the experimental condition to each other.

[12] As documented in Chapter 1, excluding the pilot teams and those who opted out after the training session, 72 teams were included in the sample. In terms of the escalation of commitment, 6 further teams were excluded for having participated in the research session but quitting the simulation without owing the experimenter any money (i.e., they stayed within the £3000 spending allowance in the simulation).

the participants were male, and 55% were female. Each team had a fixed size of three members.

4.4.4 VIDEO CODING

Three trained video coders were instructed to look for specific facial expressions and body movements in the team that correspond to engagement and worry (listed in detail in the measure section below). The video was silenced, and sound signals were inserted to identify the coding points. The minimum interval between coding points was 30 seconds; the maximum was 5 minutes.

Video coding is a valid method to use in organisational behaviour research (Barsade, 2002). It has been found to be particularly strong in providing non-biased data of emotion and behaviour. The basis of this method is that our emotional and behavioural displays are socially constructed: We smile, frown, and make hand gestures because, through social learning processes, we expect how these expressions will be perceived. Previous research supports the validity and reliability of the coded data (Ekman & Friesen, 1975; Gump & Kulik, 1997).

4.4.5 JUSTIFICATION FOR METHODOLOGICAL CHOICES

Instead of an experimental or quasi-experimental design, I chose to use a simulation to create a controlled decision-making environment and allow all other factors to vary freely. This methodological choice was made for several reasons: (1) I intended to study the main independent variables, hope and its behavioural manifestations, engagement and worry, as integral (i.e., being elicited by the current task). Previous studies (e.g., Ku, 2008) have focused on incidental emotions (i.e., emotions that are carried over from other situations); therefore, an experimental manipulation of emotions was appropriate. (2) It was difficult, if not impossible, to find natural ways to capture the escalation phenomenon across a sample of teams in a field setting.

Previous research shows that simulation games and role-playing create a realistic and engaging setting for research participants and guarantee high internal reliability similar to that of experiments (Chesney & Locke, 1991; Curren, Folkes, & Steckel, 1992; Greene, 1960; Kidron, 1977; Schweiger *et al.*, 1985). Moreover, a longitudinal design is suitable for a study of decision-making processes with changing factors at different points in time, such as cognition and emotion (Maitlis & Ozcelik, 2004; Venkatesh & Speier, 1999). By employing a longitudinal design, this study answers calls in the escalation literature

for more precisely capturing escalation of commitment as a continuous process and not isolated simple choices (B. M. Staw, 1981). A critique of escalation research is that most of our understanding of the phenomenon is based on laboratory studies using one-off scenarios (Kirby & Davis, 1998). These scenarios suffer a number of potential setbacks. First, participants are often put into an imaginary role that is distant from their reality (e.g., student participants as executives of some firm being asked to spend millions of dollars) (Fox & Staw, 1979; B. M. Staw & Fox, 1977; B. M. Staw & Ross, 1978; A Tversky et al., 1985). Second, previous investment is assumed rather than experienced: "X amount of money has been spent, if you want to continue you need to spend Y amount more…". It can be argued that such scenarios only measure intention to escalate rather than actual escalation of commitment. Third, in one-off decisions the cumulative nature of escalation (i.e., round by round continuous investment) cannot be fully captured (Moon, 2001a; B. Staw, 2002).

The current design tries to counter these weaknesses in a number of ways. First, the simulation performance was (perceived as) a direct outcome of participants' decision making and actions. They made decisions in the simulation, and the algorithm of the simulation returned results. The simulation design was not more realistic in terms of what the algorithm is about, but rather how decision makers perceived this causal relationship between inputs and outcomes. Compared to previous research, the current design is more realistic (i.e., ecological validity is higher) as participants escalated their commitment to an actual course of action in which they participated and were responsible for the outcome. Second, the increasing cost for persisting was dependent on the team's performance as they continued in the simulation; this cost was material and significant. However, as the simulation game only served to provide a context, the current design did not provide higher external validity as to how entrepreneurial the teams were in the venturing process.

4.5 MEASURES

4.5.1 CONTROL VARIABLES

Common factors related to emotion, including age, Big-5 personality (The 44-item BFI; John & Srivastava, 1999), gender, trait PA (The well-being scale; Tellegen, Watson, & L. A. Clark, 1999; Cronbach's alpha = .74), trait NA (The stress scale; Tellegen, Watson, & L. A.

Clark, 1999; Cronbach's alpha = .86), and general self-efficacy (Chen, Gully, & Eden, 2001; Cronbach's alpha = .85) were included. Second, factors potentially relevant to individuals' performance in the business simulation and reaction to the research design were included—namely, cognitive intelligence, general self-efficacy, worth of money, years of work experience, whether English is their mother tongue, whether they have a previous business degree, and whether they have an entrepreneurial background (i.e., parents being entrepreneurs). Conscientiousness, one of the Big-5 personalities, has been found to be related to escalation tendency (Moon, 2001b). Openness to experience is also relevant to persistence in a negative situation from a learning perspective. Entrapment ("I had already been in for so long that it seemed foolish not to continue"; "Once I had stayed as long as I did I decided to keep going. Otherwise all of the previous effort would have been a waste of time and money"; Cronbach's alpha = .73) and self-justification ("I wanted to prove that my decisions were right from the beginning"; "I wanted to confirm that I have been playing the game in the right way"; Cronbach's alpha = .80) were found to be major drivers of escalation in previous studies (Brockner & Rubin, 1985; B. M. Staw, 1981; B. M. Staw & Ross, 1987). Desire to recoup losses ("I wanted to recoup any lost money") and desire to win more money ("I wanted to win more money") as possible reasons for escalation are relevant in a situation when actual money is involved (Brockner *et al*., 1986). Considering the intensity and length of interaction during the coaching session, desire to help experimenter ("I wanted to help the experimenter with the research") was also included as a control variable. Consistent with Brockner *et al*.'s (1986) study, these variables were measured on a 5-point scale (1: not important to slightly important to 5: very important) on the post-simulation questionnaire as reasons for which participants remained in the simulation until they decided to leave.

4.5.2 INDEPENDENT VARIABLES

Hope was measured in the end-of-round questionnaire using three selected[13] items from the Snyder *et al*.'s (1996) state hope scale: "At the present time, we are

[13] The three items were chosen through a comparison of the factor loading of items from the pilot study. As the interval between measurement was extremely short in this study (as short as 2 minutes), it was necessary to keep the number of items to the minimum such that the questionnaire could be the least intrusive and cognitively demanding possible.

energetically pursuing our goals in the game"; "My team feels hopeful that we will succeed in the game"; and "Right now my team sees ourselves as being pretty successful in the game" (Cronbach's alpha = .80) on a 5-point scale (not at all, a little, somewhat, quite a lot, very much). The hope data for 569 total months of simulation from 66 teams were then aggregated to the team level for analysis[14]. The ICC(1) among team members is 722.

Engagement and *worry* data were produced by coders. Specifically, coders rated the data using a 5-point scale (1: bored, 3: neutral, 5: engaged for engagement; not at all, a little, somewhat, quite a lot, very much for worry) based on the team's display of a lack of engagement (leaning backward, looking away from laptop, not paying attention to team mates) compared to engagement (leaning forward toward laptop, focusing on laptop, paying attention to teammates when they speak) as well as their display of worry (frowning, mouth pulled down). The engagement and worry data for 1,852 total coding points in 569[15] total months of simulation from 66 teams were then aggregated to the team level for analysis. Coders' ICC was .610 and .510, respectively.

4.5.3 DEPENDENT VARIABLE

The dependent variable is the hazard rate, a function of the probability that the event (quitting the simulation) will happen at a particular time. Parameters of the hazard rate model are states (quit or continue), time spent in those states (how many months of the simulation they played), and the rates of movement from state to state (how long before a given percentage of teams quit).

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[14] Data were originally collected as individual responses to items phrased with a group referent (i.e., "We…"). According to Klein and Kozlowski (2000),

> This data collection procedure allows the researcher to assess the extent to which constructs are indeed shared as predicted. If individual-level data do reveal substantial within-group agreement or homogeneity, individual-level data are aggregated to the team level of analysis to represent the shared team construct. (p.216).

The ICC in this case justifies the aggregation of data to the team level.

[15] The actual number of coding periods are 635 (= 569+66) as there was an extra piece of coding after teams ran the last month.

4.6 ANALYSES

4.6.1 CHOICE OF MODEL

Event history analysis was chosen as it considers the effect of time and is particularly suited for a longitudinal design that focuses on the occurrence of a single event—here, quitting the simulation. There was no left-censoring in these data, as data were collected from the start for all teams. There was no right-censoring issue; all teams quit the simulation in the end.[16] As the data were organised by month, a discrete time model was chosen.[17] The Cox regression, also known as the proportion odds model or the proportional hazard model, was chosen for the present study. Semi-parametric models, such as the Cox regression, are more appropriate for the current study than parametric models, given the need to allow predictors to be entered into the regression, or non-parametric models, given the need not to require assumptions about the shape of baseline hazard function.

4.6.2 DATA STRUCTURE

The unit of analysis is "team-month". Data were organised in such a way that each row represented a team-month. The number of rows depended on the number of months the given team had played (Min: 3, Max: 21). One column contained the "quit" event, with a value of 1 for the last month and a value of 0 for all months before. Other columns contained the control variables and independent variables (hope, engagement, and worry). Finally, it should be noted that quitting the simulation was in essence not escalating. Given the nature of event history analysis, in the following I will adopt the terminology of "hazard to quit" for ease of illustration. In the discussion, I will return to the notion of escalation of commitment for interpreting the results.

4.7 RESULTS

[16] Most teams quit before the end of the 2 hours scheduled except for 3 teams who were allowed extra time, but eventually quit the game.

[17] It is also possible to, instead of using monthly data, use data by the second and fit continuous time models. However, this possibility was not pursued at this time.

4.7.1 DESCRIPTIVE STATISTICS

Table 4-1 and Table 4-2 summarise correlations among the study variables and descriptive statistics. Figure 4-1 and Figure 4-2 illustrate the overall trend of performance, hope, engagement, and worry of teams still persisting in the simulation. For most teams, the start of the simulation cumulative profit followed a steady downward trend; so did hope, engagement, and worry. Monthly profits fluctuated, yet remained mostly negative throughout the simulation. By the end of Month 11, 57 of the original 66 teams (86%) had left the simulation.

Table 4-1 *Descriptive Statistics and Correlations of Study Variables*

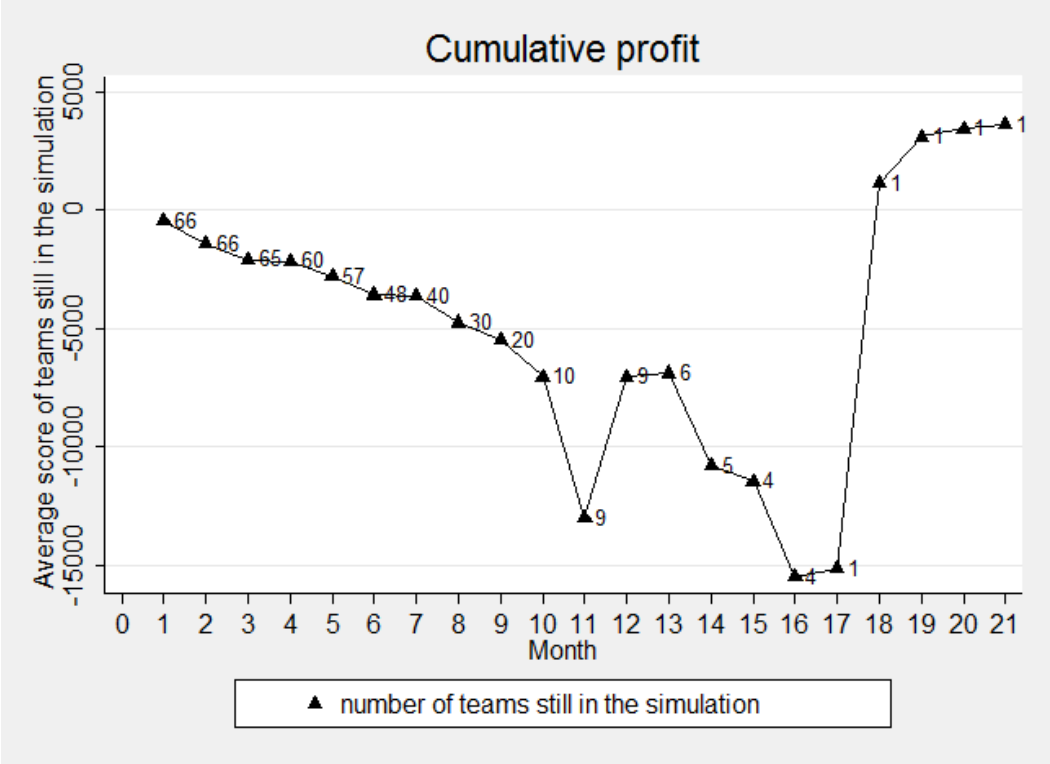
		Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Age	22.11	1.82														
2	Years of entrepreneurship experience	0.25	0.5	-0.04													
3	Strategy game experience	2.02	0.59	-0.17	0.11												
4	BIG5-extraversion	22.32	8.67	-0.67	0.08	0.15											
5	BIG5-greeableness	23.37	9.12	-0.68	0.01	0.13	0.93										
6	BIG5-conscientiousness	26.1	10.34	-0.7	0.04	0.14	0.95	0.97									
7	BIG5-emotionalstability	21.44	7.71	-0.71	0.06	0.22	0.94	0.93	0.93								
8	BIG5-opennesstoexperience	25.58	11.55	-0.69	0.07	0.18	0.95	0.96	0.97	0.92							
9	Trait PA	39.58	3.48	-0.06	0.15	0.3	0.26	0.13	0.14	0.21	0.14						
10	Trait NA	38.63	5.69	0.1	-0.03	-0.16	-0.09	-0.01	-0.01	-0.27	0.02	-0.1					
11	Cognitive intelligence	5.46	1.15	0.03	0.06	-0.02	0.08	0.01	0.02	0.04	0	-0.02	-0.11				
12	General self-efficacy	31.75	2.21	-0.2	0.19	0.27	0.28	0.2	0.27	0.22	0.26	0.43	-0.1	0.01			
13	Worth of £6	2.27	0.55	-0.09	0.02	0.27	0.04	0.09	0.06	0.1	0.04	0.1	0.03	-0.23	0.12		
14	Worth of £100	3.51	0.54	-0.23	0.08	0.26	0.25	0.23	0.25	0.28	0.21	0.23	-0.06	0.01	0.2	0.74	
15	Worth of £300	4.16	0.49	-0.28	0.05	0.18	0.25	0.29	0.29	0.28	0.22	0.12	0.06	0.08	0.12	0.57	0.84
16	Years of work experience	1.24	0.95	0.12	0.23	0.16	0.15	0.14	0.19	0.17	0.15	0.18	-0.19	-0.07	0.2	0.1	0.06
17	Gender	0.51	0.34	-0.2	-0.22	-0.33	0.15	0.26	0.23	0.11	0.19	-0.07	0.28	0	-0.09	-0.03	0.02
18	English as mother tongue	0.79	0.29	0.14	-0.01	-0.15	-0.11	-0.14	-0.14	-0.16	-0.13	-0.04	0.17	0.43	-0.24	-0.4	-0.25
19	Business degree	0.59	0.38	-0.63	0.1	0.18	0.6	0.6	0.6	0.61	0.64	-0.01	-0.04	-0.06	0.15	0.07	0.22
20	Entrepreneurial background	0.37	0.31	-0.01	-0.15	-0.05	0.13	0.21	0.19	0.13	0.15	-0.16	0.06	0.15	-0.04	-0.03	-0.07
21	Self-evaluation of performance	2.69	0.85	0.03	-0.09	-0.06	-0.21	-0.21	-0.19	-0.12	-0.23	0.13	-0.22	-0.07	0	0.11	0.11
22	Personal responsibility	3.6	0.48	-0.01	0.09	0.13	0.02	0.01	0.04	0.04	0.03	0.15	-0.08	0.25	0.11	0.08	0.26
23	Entrapment	2.77	0.72	-0.02	0	0.03	-0.13	-0.04	-0.05	-0.1	-0.07	-0.11	0.09	0.08	0	0.23	0.21
24	Self-justification	3.24	0.6	0.32	-0.16	0.07	-0.09	-0.14	-0.13	-0.14	-0.12	0.17	0.05	0.18	0.07	-0.03	0.02
25	To win money	2.85	0.89	0.18	-0.14	-0.01	-0.06	-0.05	-0.05	-0.09	-0.07	-0.1	0.02	-0.03	0.01	0.24	0.26
26	To help experimenter	2.73	0.67	0.28	0.17	-0.17	-0.26	-0.27	-0.24	-0.3	-0.26	0.19	0.28	0.02	-0.11	0.06	0.03
27	Game being engaging	3.8	0.63	-0.05	-0.08	-0.07	0.16	0.17	0.18	0.19	0.13	0.05	-0.04	0.24	0.01	0.1	0.28
28	To recoup losses	3	0.93	0.05	-0.23	-0.2	-0.07	-0.03	-0.05	-0.06	-0.11	0.05	-0.11	0.03	-0.12	0.06	0.06
29	Hope	3.05	0.76	-0.02	0.05	0.13	0.12	0.1	0.1	0.15	0.09	0.16	-0.17	-0.06	0.18	0.09	0.16
30	Engagement	3.84	0.5	0.14	0.06	0.02	-0.09	-0.11	-0.13	-0.09	-0.12	0.04	0.06	0.15	-0.1	0.12	0.15
31	Worry	3.05	0.45	-0.04	-0.05	-0.09	0.12	0.13	0.1	0.13	0.11	-0.1	-0.05	0.21	-0.22	-0.21	-0.07

Note: $n = 635$. Correlations with absolute values greater than .08 are significant at $p < .05$; values greater than .11 are significant at $p < .01$

Table 4-2 *Descriptive Statistics and Correlations of Study Variables (cont'd)*

		15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	Age																
2	Years of entrepreneurship experience																
3	Strategy game experience																
4	BIG5-extraversion																
5	BIG5-greeableness																
6	BIG5-conscientiousness																
7	BIG5-emotionalstability																
8	BIG5-opennesstoexperience																
9	Trait PA																
10	Trait NA																
11	Cognitive intelligence																
12	General self-efficacy																
13	Worth of £6																
14	Worth of £100																
15	Worth of £300																
16	Years of work experience	0.08															
17	Gender	0.21	-0.09														
18	English as mother tongue	-0.26	-0.38	0.22													
19	Business degree	0.21	0.08	0.12	-0.09												
20	Entrepreneurial background	0.03	0.05	0.11	-0.14	0.08											
21	Self-evaluation of performance	0.08	0.08	0.2	0.05	-0.2	-0.09										
22	Personal responsibility	0.26	0.16	0.07	0.06	0.02	0.07	0.44									
23	Entrapment	0.27	0.16	-0.14	-0.12	-0.08	0.15	-0.08	0.19								
24	Self-justification	0.04	0.04	0.04	0.21	-0.18	-0.06	0.24	0.12	0.07							
25	To win money	0.31	0.29	0.09	-0.22	-0.14	0.01	0.25	0.09	0.08	0.19						
26	To help experimenter	0.13	0.11	-0.11	0.05	-0.33	-0.01	0.03	0.12	0.37	0.07	0.09					
27	Game being engaging	0.29	0.15	0.04	0	0.02	-0.03	0.19	0.3	0.16	0.23	0.06	0.01				
28	To recoup losses	0.14	0.14	0.08	-0.1	-0.16	0.08	0.31	0.19	0.09	0.31	0.35	0.01	0.19			
29	Hope	0.1	0.14	-0.12	-0.09	0.01	-0.01	0.25	0.11	-0.01	0.05	0.15	-0.02	0.13	0.15		
30	Engagement	0.18	-0.07	-0.05	0.07	-0.11	-0.05	0.1	0.06	0.09	0.24	0.12	0.21	0.14	0.09	0.37	
31	Worry	0	0.07	0.08	0.15	0.1	0.13	-0.01	0.05	0.01	0.05	-0.04	-0.06	0.11	0.15	0.25	0.16

Note: $n = 635$. Correlations with absolute values greater than .08 are significant at $p < .05$; values greater than .11 are significant at $p < .01$



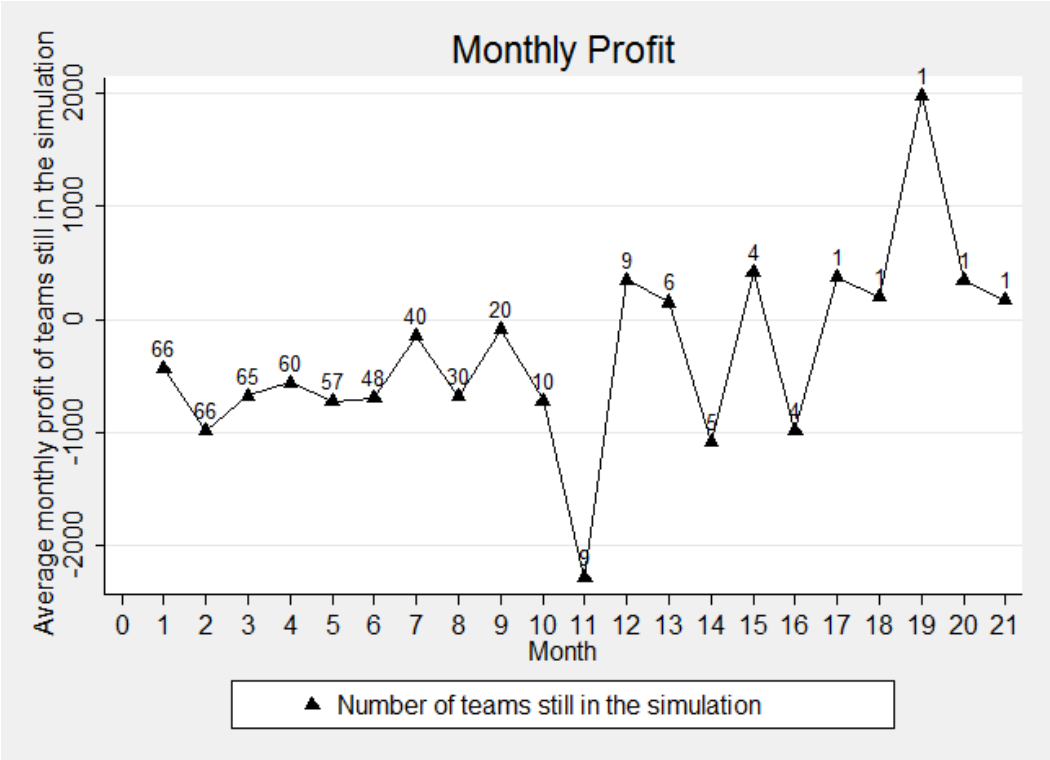


Figure 4-1 Simulation performance by month

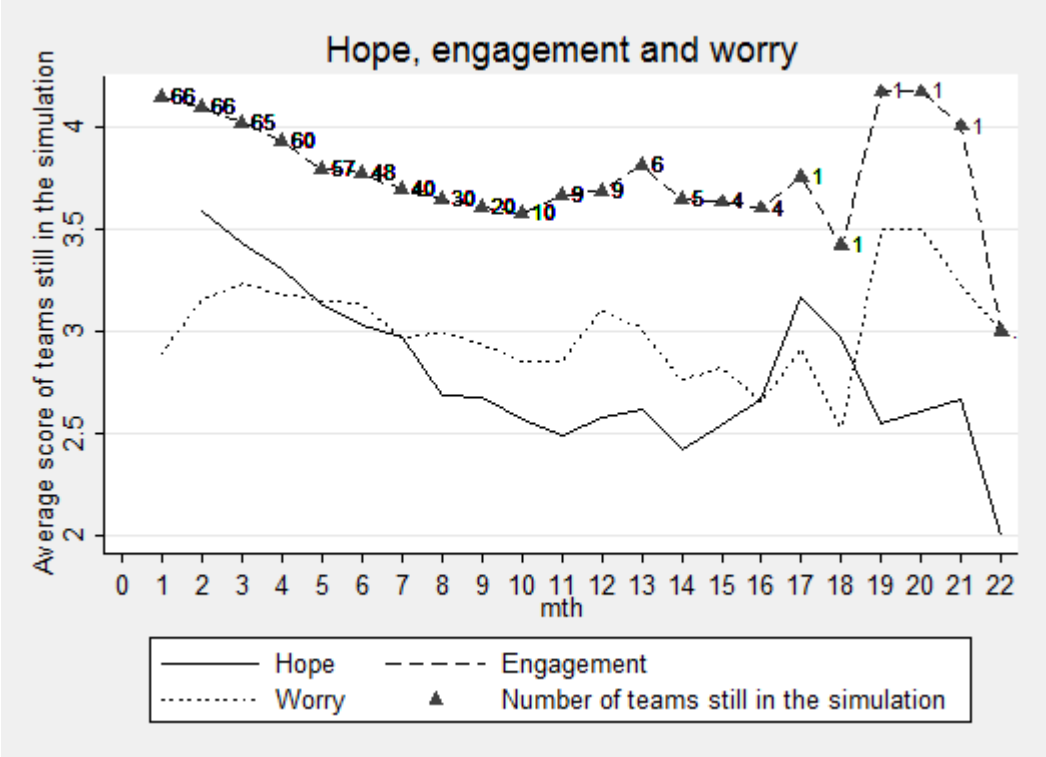


Figure 4-2 Hope, engagement, and worry by month

The downward trend of performance continued with the remaining nine teams, who remained somewhat hopeful, engaged, and worried. The plummeting performance that occurred in Month 11 did not seem to affect them much. From Month 12, the cumulative performance continued to drop for the remaining nine teams, signifying smaller chances of reaching the target. At the end of Month 17, three badly performing teams quit, leaving only one team that was actually performing well. This caused an immediate boost to the average cumulative performance as well as the subsequent inverse of engagement and worry, but not hope. Eventually, the last persisting team lost hope and quit the simulation at the end of Month 21. Across teams, hope at the end of the simulation (Mean: 2.27, SD: .10) was on average lower than at the beginning of the simulation (Mean: 3.47, SD: .06); this difference was significant (t = -10.83, df = 65, p < .001).

Figure 5-3 shows the Kaplan-Meier survival function, which describes the probability of not observing teams quitting before a given month. Consistent with the previously discussed results, a steady decrease of survival likelihood continued until Month 10.

From Month 11 to Month 21, the decrease was slower as only a few teams were left in the simulation.

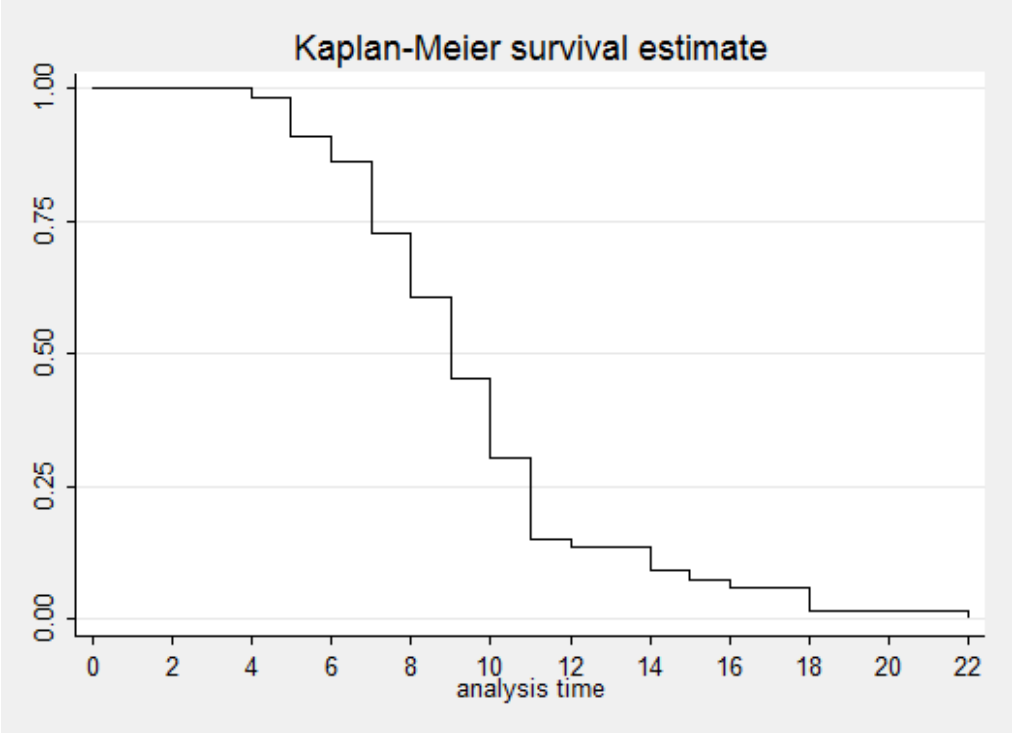


Figure 4-3 Kaplan-Meier survival function

4.7.2 HYPOTHESIS TESTING

To test Hypothesis 1, the main effect of hope on hazard to quit, I first entered the control variables into the model (Model 1). Having a net worth of £6 (B = -1.63, p < .01, hazard ratio = 0.20) and an entrepreneurial background (B = 1.18, p < .05, hazard ratio = 3.25) significantly predicted hazard to quit, but the overall model was not significant ($\chi^2(28)$ = 29.34). In Model 2, hope was entered (B = -.12, p < .01, hazard ratio = 0.88), which resulted in a significant improvement in fit ($\Delta\chi^2(29)$ = 64.73, p<.001). The sign for the coefficient of hope was negative, indicating that higher hope is associated with a lower hazard to quit. The hazard ratio indicates that teams that experienced hope had a 12% smaller hazard of quitting. Thus, Hypothesis 1 was supported.

A number of control variables also yielded interesting results. The net worth of money variables predicted hazard to quit: Teams that assigned a higher value to £6 had an 85% smaller hazard of quitting whereas teams that had not quit and assigned a higher value to £100 had nine times (907%) the probability of quitting by the next month. The teams that assigned a higher value to £300 had a 78% smaller hazard of quitting (p < .10).

Teams who perceived that they were performing well also had a higher hazard (HR = 2.55, $p < .01$) of quitting. Consistent with previous research, teams with team members who felt personally responsible had a lower hazard of quitting (HR = .32, $p < .05$). Contradicting previous research, teams that felt trapped had a higher hazard of quitting (HR = 1.77, $p < .10$). The implications of these results are discussed in the section on theoretical implications.

Table 4-3 *Event History Models*

	(1) Control model			(2) Main effect of hope		
VARIABLES	B	se	HR	B	se	HR
Age	0.13	0.20	1.14	0.29	0.19	1.34
Years of entrepreneurship experience	0.10	0.34	1.10	0.34	0.35	1.41
Strategy game experience	0.48	0.40	1.62	0.91**	0.40	2.48**
BIG5-extraversion	0.10	0.09	1.10	0.11	0.09	1.11
BIG5-greeableness	0.06	0.10	1.06	0.12	0.10	1.12
BIG5-conscientiousness	0.06	0.10	1.06	-0.04	0.10	0.96
BIG5-emotionalstability	-0.06	0.11	0.94	0.04	0.12	1.04
BIG5-opennesstoexperience	-0.11	0.09	0.89	-0.12	0.09	0.89
Trait PA	-0.05	0.07	0.95	-0.08	0.07	0.92
Trait NA	0.02	0.05	1.02	0.07	0.06	1.07
Cognitive intelligence	-0.02	0.17	0.98	-0.07	0.17	0.94
General self-efficacy	-0.04	0.08	0.96	0.04	0.09	1.04
Worth of £6	-1.63***	0.57	0.20***	-1.90***	0.58	0.15***
Worth of £100	1.20	0.87	3.32	2.20**	0.89	9.07**
Worth of £300	-0.33	0.82	0.72	-1.50*	0.85	0.22*
Years of work experience	-0.09	0.26	0.91	-0.19	0.29	0.82
Gender	1.17	0.80	3.21	1.28*	0.75	3.61*
English as mother tongue	-0.57	0.95	0.57	-0.63	0.99	0.53
Business degree	0.24	0.56	1.27	0.32	0.61	1.38
Entrepreneurial background	1.18**	0.58	3.25**	1.02*	0.59	2.76*
Self-evaluation of performance	0.46	0.28	1.59	0.93***	0.30	2.55***
Personal responsibility	-0.44	0.45	0.65	-1.12**	0.48	0.32**
Entrapment	0.36	0.30	1.43	0.57*	0.30	1.77*
Self-justification	-0.19	0.32	0.83	-0.37	0.32	0.69
To win money	0.16	0.22	1.17	0.20	0.22	1.22
To help experimenter	0.21	0.32	1.23	0.41	0.31	1.51
Game being engaging	-0.20	0.27	0.82	0.13	0.27	1.13
To recoup losses	-0.20	0.22	0.82	-0.01	0.22	0.99
Hope				-0.12***	0.02	0.88***
Engagement						
Worry						
MODEL SUMMARY						
Observations	635.00			569.00		
chi-squared	29.34			64.73		
Log-likelihood	-207.30			-189.60		
Df	28.00			29.00		
pseudo r-squared	0.07			0.15		

*$p < .1$, ** $p < .05$, *** $p < .01$

To test Hypothesis 2, the mediation effects of engagement and worry on the relationship between hope and hazard to quit were estimated separately. Engagement was first entered into the model (Model 3). The presence of engagement (B = -.14, p < .01, hazard ratio = .87) significantly reduced the effect of hope. However, hope remained a significant predictor of hazard to quit (B = -.10, p < .01, hazard ratio = 0.90). The sign for the coefficient of engagement was negative, indicating that higher engagement was associated with a lower hazard to quit. The overall model fit was improved ($\Delta\chi^2(30)$ = 77.71, p < .001). When worry was entered into the model (Model 4), the effect of hope was also significantly reduced (B = -.08, p < .01, hazard ratio = 0.92). Worry was a significant predictor of hazard to quit (B = -.26, p < .01, hazard ratio = 0.77). The overall model fit was improved ($\Delta\chi^2(30)$ = 109.30, p < .001). Taken together, the hazard ratios indicated that those who seemed engaged and worried had a lower probability of quitting.

Mediation effects of engagement and worry were estimated using the product of coefficients (αβ) (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002) and tested using the Sobel test recommended for logistic regression models (Krull & MacKinnon, 1999; Martinez, Sher, Krull, & Wood, 2009). First, the *a* paths were obtained by separately regressing the mediators (engagement and worry) on hope. Second, the *b* paths were estimated by regressing the dependent variable (hazard of quitting) and mediator (engagement or worry). The resulting path model is depicted in Figure 4-4. The Sobel statistics were then computed using the following equation: z-value = a*b/SQRT(b2*sa2 + a2*sb2). The indirect effect of engagement was 3.28 (p < .01). The indirect effect of worry was 4.40 (p < .001). Thus, both Hypotheses 2a and 2b were supported.

Table 4-4 *Event History Models (cont'd)*

	(3) Mediating effect of engagement			(4) Mediating effect of worry		
VARIABLES	B	se	HR	B	se	HR
Age	0.29	0.19	1.34	0.07	0.19	1.07
Years of entrepreneurship experience	0.26	0.37	1.30	-0.39	0.37	0.68
Strategy game experience	0.96**	0.40	2.60**	0.75*	0.41	2.12*
BIG5-extraversion	0.16*	0.09	1.17*	0.18*	0.09	1.19*
BIG5-greeableness	0.13	0.10	1.14	0.16	0.11	1.17
BIG5-conscientiousness	-0.07	0.10	0.93	-0.25**	0.11	0.78**
BIG5-emotionalstability	0.06	0.12	1.06	0.14	0.12	1.15
BIG5-opennesstoexperience	-0.17*	0.09	0.85*	-0.08	0.09	0.92
Trait PA	-0.13*	0.08	0.88*	-0.12	0.07	0.89
Trait NA	0.09	0.06	1.09	0.10*	0.05	1.10*
Cognitive intelligence	0.07	0.18	1.07	0.31*	0.19	1.37*
General self-efficacy	0.03	0.09	1.03	0.02	0.10	1.02
Worth of £6	-1.69***	0.57	0.18***	-2.62***	0.60	0.07***
Worth of £100	2.16**	0.89	8.63**	2.62***	0.89	13.80***
Worth of £300	-1.34	0.88	0.26	-1.24	0.85	0.29
Years of work experience	-0.14	0.29	0.87	0.25	0.30	1.28
Gender	1.22	0.80	3.38	1.11	0.76	3.04
English as mother tongue	-0.44	1.05	0.64	-0.20	0.91	0.82
Business degree	0.33	0.61	1.39	-0.07	0.58	0.93
Entrepreneurial background	0.90	0.61	2.46	1.44**	0.63	4.21**
Self-evaluation of performance	1.05***	0.31	2.86***	1.01***	0.32	2.74***
Personal responsibility	-1.61***	0.52	0.20***	-1.19**	0.51	0.30**
Entrapment	0.64**	0.30	1.90**	0.27	0.29	1.31
Self-justification	-0.15	0.32	0.86	-0.26	0.35	0.77
To win money	0.22	0.22	1.25	-0.10	0.23	0.91
To help experimenter	0.55*	0.33	1.74*	0.44	0.33	1.55
Game being engaging	0.00	0.27	1.00	-0.07	0.28	0.93
To recoup losses	-0.10	0.21	0.90	0.08	0.22	1.09
Hope	-0.10***	0.02	0.90***	-0.08***	0.03	0.92***
Engagement	-0.14***	0.04	0.87***			
Worry				-0.26***	0.05	0.77***
MODEL SUMMARY						
Observations	569.00			569.00		
chi-squared	77.71			109.30		
Log-likelihood	-183.20			-167.40		
Df	30.00			30.00		
pseudo r-squared	0.18			0.25		

* $p < .1$, ** $p < .05$, *** $p < .01$

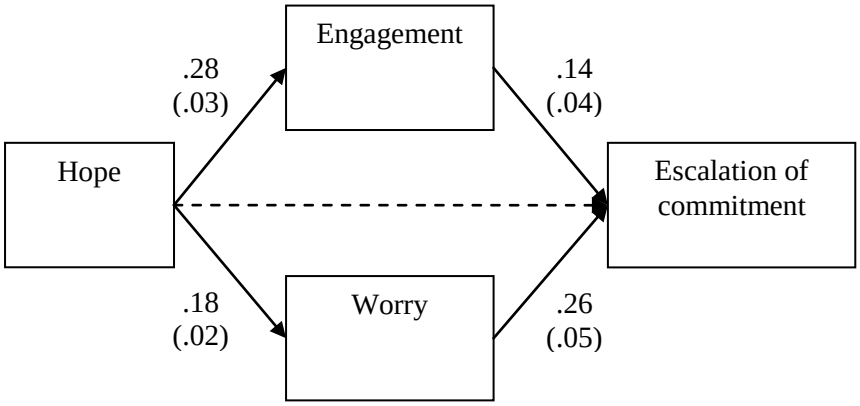


Figure 4-4 Path model

4.7.3 ROBUSTNESS CHECK

The same regression models were run with (1) a sub-sample of 47 teams that paid more than £6; (2) a sub-sample of 46 teams including dispositional optimism (LOT-R, Cronbach's alpha = .61; Scheier *et al*., 1994) as a control variable; and (3) a sub-sample of 63 teams with a desire not to lose face, a driver of escalation of commitment found in previous studies (Brockner *et al*., 1981) as a control variable. The results remained unchanged. Optimism was a significant predictor of hazard to quit (B = -.39, p < .10, hazard ratio = 0.68) when it was included in the model along with hope; however, its effect became insignificant when engagement or worry was included. Losing face was not a significant predictor of hazard to quit.

4.8 DISCUSSION

This study provides the first direct test of the effect of hope on escalation of commitment. Hope as a positive psychological state about the future—both cognitively and emotionally charged—was hypothesised to be negatively related to the hazard of teams quitting a failing course of action, thereby indicating that it is positively related to persistence at an increasing cost. Engagement and worry were hypothesised to mediate this relationship. All hypotheses were supported in the present study.

Throughout the simulation, most teams had consistently unsatisfying performances, as demonstrated in Figure 4-1. Those who remained hopeful—and therefore actively engaged in the course of action and worried about the outcome—persisted longer until

they quit. Hope significantly predicted a team's escalation tendency above and beyond the drivers found in previous research.

4.8.1 THEORETICAL IMPLICATIONS

This study contributes to the literature of escalation of commitment by providing a new explanation of escalation of commitment: In a failing course of action, those who remain hopeful persist. Hope manifests itself behaviourally as both engagement in the task and worry about the future. The effects of hope are significant when other drivers of escalation are controlled for. In essence, hope is the positive perception of project economics—defined by Staw (1981, 2005) as an economic reason for escalation. However, hope, as demonstrated in the current study, focuses on the non-rational belief of a positive future prospect. In the simulation, clear and negative feedback was provided to the teams, but how teams interpreted it was subject to their cognitive and group processes. Escalation of commitment would have been a rational act if such belief about the probability of future outcomes and the value of future outcomes had been accurate; however, it was not. What has been traditionally positioned as a rational driver of escalation is in reality non-rational and behavioural, just like self-justification and social preference for consistency in previous theories. A further implication of the current finding is that the prospective rationality underlying the economic explanations of escalation is not at all possible in reality as one can never be certain about the future.

In the current study, quitting or staying was voluntary, and teams were fully aware of the mounting cost. They persisted and invested more money, hoping that the unfavourable situation would turn around. Eventually they lost hope, disengaged, and quit. This picture is quite different from the one in which individuals feel trapped and stuck in the current situation, yet blindly and unwillingly continue. Contrary to previous studies, the current results indicated that teams who perceived that they were performing well also had a higher hazard of quitting. It must be noted that teams responded to the questionnaire items after they had concluded the simulation (i.e., after they had quit). As such, this can be explained as post-rationalisation of their performance: Those who quit early tended not to suffer a big loss and therefore rated their performance as satisfactory.

Consistent with previous research, teams whose team members felt more personally responsible had a lower hazard of quitting. This result complements previous research on group escalation (Moon *et al.*, 2003; Whyte, 1993). It is possible that these team

members, through their group interactions, pushed their teams to escalate. The underlying mechanism of how individuals feel personally responsible in a team task and how this translates into group cognition and action is a potential avenue for future research. Contradicting previous research, teams that felt trapped had a higher hazard of quitting, meaning that those who persisted longer did not feel much entrapped. Again, it must be noted that team members rated how trapped they felt after they had already quit the simulation. Thus, alternatively, the current result can be interpreted as those who quit the simulation early felt that being trapped was a major reason for them to continue until the point they quit (i.e., "I had already been in for so long that it seemed foolish not to continue" and "Once I had stayed as long as I did I decided to keep going. Otherwise all of the previous effort would have been a waste of time and money"). In addition, the worth of money variables predicted hazard to quit. Teams that assigned a higher value to £6 had an 85% smaller hazard of quitting, which can be interpreted as, once they had decided to participate, they were investing the £6 carefully (i.e., planning their spending in the simulation using discretion to "get their money's worth"). Conversely, teams that assigned a higher value to £100 had nine times (907%) the probability of quitting, which explains teams' withdrawal when the mounting cost reached a level too great to bear (i.e., £100). Finally, teams that assigned a higher value to £300 had a 78% smaller hazard of quitting, which can explain those who were driven by the £300 reward and persisted in the hopes of reaching the performance target. These results paint an interesting picture, with implications for prospect theory in terms of how people frame an investment differently when the consideration of both cost and potential gain is involved.

In general, the findings of the current study corresponded well to the behavioural motives proposed by Brockner (1992): (a) economic considerations (people may have felt that they were "making the economically prudent decision under equivocal circumstances"); (b) curiosity ("an additional opportunity to permit a strategy to work"); (c) the need to make a greater effort to see if it will bring the project to fruition; or (d) the need to learn about the phenomenon ("to allow for the collection of additional data and the passage of time which might promote an increased understanding of the situation"). Being unfamiliar with the simulation, teams might have persisted in the simulation due to not feeling certain that they were "failing". They might also have exerted effort and invested money in order to learn how it worked. In all possible

scenarios, the underlying psychology was still hope, such that the situation could turn around and they would master how it worked.

The findings of this study also complement previous research about the effect of anticipated regret in escalation (Hoelzl & Loewenstein, 2005; Wong & Kwong, 2007). Hope and anticipated regret are positively related as they both require positive prospects of future outcome. Indeed, the thinking "what if the situation turns around later and I've already quit" creates anticipated regret. In other words, the hope that the currently unfavourable situation will turn around in the future is embedded in anticipated regret. Simply, when there is no hope, there cannot be anticipated regret.

The current findings also indicate the potential to update the definition of the escalation phenomenon. It does seem completely irrational when people knowingly pour resources into something that is obviously failing. Indeed, when people persist in a course of action with no hope and no desire of turning the situation around, it makes sense that they are just trying to save face or persisting for reasons bigger than the project itself (e.g., the fate of a nation in the midst of war) (Northcraft & Wolf, 1984). Bowen (1987) proposed that the feedback is often not "negative" enough for people to grasp the situation. In the current design, the simulation captured the initial ambiguity just as teams started the task, which allowed room for curiosity and learning. However, factual, negative feedback (i.e., distance to goal) was soon made very salient to the teams; even so, how teams interpreted this information was non-rational. Bowen (1987) proposed that, for feedback to be unequivocal, two conditions must be satisfied: (a) the existence of some credible criterion(ia) or standard(s) against which to compare raw feedback data; and (b) feedback must predictably indicate that future performance will meet, exceed, or not meet the outcome standards in the future. Condition (a) was clearly satisfied in the current design while condition (b) seems to bear further implications when considered in the current context. Feedback is about past performance, from which individuals can draw logical inferences for future performance. However, feedback itself does not directly predict the future such that teams can still remain hopeful about the situation turning around, that learning and mastery of the simulation will be obtained, or about developing just plain luck in the future in the face of negative feedback of current performance. Just as argued by Brockner (1992), "decision makers may deny or distort the negative feedback they receive concerning their initial resource allocations, in an attempt to convince themselves that things do not look so bad" (p. 54).

In addition, the definition of failure is highly context specific. For instance, entrepreneurial failure has been defined as insolvency or "the residual value of the business being low or negative" (Shepherd, Wiklund, & Haynie, 2009, p. 137). Should entrepreneurs abandon their ventures whenever there is a sharp fall in revenue or the venture is operating in a deficit? In reality, many entrepreneurs would claim that they have persisted under such inferior circumstances which led to their eventual success. Northcraft and Wolf (1984) presented a staged model of investment where costs were realised before revenues in the initial stages—exactly the reality of entrepreneurship. According to this theory, continuous investment in a venture that is not yet profiting is not irrational because business takes time to cultivate. In reality, echoing Bowen (1987), this poses a question as to whether escalation of commitment should be defined as a true decision error or just an inevitable manifestation of bounded rationality. Most importantly, it is not passive and helpless. People persist in seemingly failing courses of action hopefully and positively; given the uncertainty in the future, they well could be just doing the right thing (i.e., waiting for the eventual fruition).

The post-hoc interpretation of escalation situations is often biased by the outcome. For instance, there is a known "hero" effect for those leaders who persist and gain eventual success (B. M. Staw & Ross, 1980). A similar effect is perhaps not expected for those who quit early and avoid loss, and those who persist and fail are often just seen as fools. It is difficult to dispute that the classical cases of escalation (e.g., the Vietnam War and Expo 86) are indeed disastrous, considering the scale of deficit. However, in other contexts, such as entrepreneurship, the interpretation of persistence versus escalation is often biased by the level of achievement of the individual in question. For those who persist and succeed in the end, we will say that such persistence is necessary; for those who fail in the end, they are merely escalating irrationally. It seems that, whether escalation of commitment occurs or not does not have one uniform definition and is subject to biased post-hoc interpretation. Nevertheless, it cannot be denied that continuously committing time, money, and effort to a course of action that is seemingly failing in the hopes of improving results is in essence persistence, which is a quality valued in many contexts. Previous escalation of commitment research has focused on the erroneous side of this phenomenon. Recent research has begun to reconcile such findings with research on persistence, exploring its potentially positive side. For instance, Wang and Wong *(In Press*) found that, in human capital investment, it might be beneficial for a firm to have a

manager who has a tendency to "overly commit" to a losing course of action. In conclusion, the updated view of escalation of commitment should emphasise that escalation is not necessarily dysfunctional. Persistence could be the most rational thing to do in the face of uncertainty (B. M. Staw & Ross, 1978).

4.8.2 LIMITATIONS AND FUTURE RESEARCH

This study is not without limitations. First, although the realism in simulation is one of the strengths of the current design, the time limit and lack of right censoring (i.e., teams that never quit) imposed by lab schedules were artificial. As participating teams were constantly reminded about the time limit, the consideration of remaining time was expected to be part of their decision making. This was done intentionally to reinforce the difficulty of the performance target. However, in reality, rather than an imposed time limit, real-life decision makers are more likely to have a time limit set by themselves, such as reaching a certain sales target in a number of months or breaking even in a number of years. This is sometimes combined with "budgeting" (Thaler, 1999) such that, if by a certain time, a certain amount of money is invested but additional goals are not achieved, they will terminate the business. Previous research on mental budgeting has found that having a mental budget before entering a course of action prevents people from persisting irrationally. In contrast, those without a pre-set budget are more likely to escalate their commitment (Heath, 1995). Further research can combine these elements by forcing pre-simulation budgeting, both in terms of time and money, in an experiment.

Second, the current study, along with most other escalation studies, only focused on the duration of the escalation, but not the magnitude. One would expect a difference between persisting for a long time but at a low cost and persisting for a shorter time but at a great cost. Moreover, perhaps the expected accumulative nature of escalation, which was not observable from the duration in the current design, can be found in the magnitude, such that the more being invested, the less likely people will quit, which is consistent with the sunk cost explanation.

This study provides a preliminary examination of hope in escalation situations. It is recognised that data from naturally occurring escalation situations are difficult to access. Success in tracking large-scale public projects as demonstrated in seminal studies relied on rich, publicly accessible archival data. Other success was found in studying software

development and banking (Keil, 1995; Keil, Mann, et al., 2000; Keil & Robey, 1999; Keil, Wei, et al., 2000; B. M. Staw et al., 1997). Researchers should find more meaningful contexts in which psychological factors can be continuously measured during the process. An in-depth understanding of decision makers' thinking and behaviour is equally important in studying the effect of hope in escalation. Consistent with Staw and Ross (1987), I expect social (e.g., behavioural norms, peer pressure) and structural (e.g., organisational policy) drivers to kick in after the psychological driver of hope. It is possible that, in the beginning, an individual hopefully strives and persists but, once hope is depleted, other drivers come into play, forcing disengaged individuals to persist unwillingly. Not expecting the situation to improve, these people will be unlikely to engage in the task; thus, failure becomes a self-fulfilling prophecy.

In experimental settings, a number of possible treatments can be introduced. First, hope and engagement can be studied on the individual level to contrast the team results. Pioneering studies show that people in groups escalate their commitment more than people making decisions alone in terms of both frequency and magnitude (Seibert & Goltz, 2001; Whyte, 1993). However, Whyte (1991) also found that the escalation effect occurred less frequently and less severely when people in a group shared responsibility for a decision. The hope theory could offer a new explanation for the contrast between individual and group escalation: It is possible that, due to emotional contagion (Barsade, 2002), hopeful people in groups can be even more hopeful while hopeless people even more hopeless and therefore are more or less likely to persist in a failing course of action than alone. Second, personal stakes can be varied. In the current design, teams were not aware of the £6 participation reward before agreeing to participate in the simulation. Research shows that windfall gains such as lottery proceeds and unexpected bonuses are spent more readily than other types of assets (Arkes, Joyner, Pezzo, & Nash, 1994). Observations during the simulation revealed that many teams initially planned to spend the £6 "fun money", but then re-evaluated the situation before deciding whether to continue or quit. Future research can, for example, investigate the interaction effects of windfall gains and budgeting on escalation decision making. Third, feedback can be varied. In the current study, the feedback was timely, clear, and unambiguous. Previous research found that experiment participants who received ambiguous feedback about their performance invested more than those who received less ambiguous feedback (Brecher & Hantula, 2005; Hantula & DeNicolis Bragger, 1999). It would be interesting to see whether, when no feedback is provided, as is often the case in reality, teams

would become completely immersed, blinded by the positive group affective state, or become more cautious under higher uncertainty. Fourth, there can be no need for consensus in quitting. As in real life, individuals leave teams. When team members cannot agree on whether to persist or give up, there is the possibility of disbanding the team. This could be a potential explanation to de-escalation. Moon (2001d) found that the two elements of conscientiousness affect individuals' escalation in opposite ways: duty drives de-escalation while achievement-striving drives escalation. In the context of teams, conscientiousness can manifest itself in quitting in order to prevent fellow team members from losing more money or in persisting "as a team" to overcome great difficulties together. Finally, the current study focused on intra-group processes rather than inter-group dynamics. Previous research has shown that competitive arousal is a driver of auction bidders' escalation (Ku, Malhotra, & Murnighan, 2005). Future research can examine the effect of inter-team competition on hope and escalation tendency.

4.9 CONCLUSION

The starting point of this research was that the escalation of commitment literature is missing a crucial element in the psychological explanations for escalation decision processes—that is, a positive belief about the future. This study found that, in a failing course of action, when teams felt hopeful about the future outcome, they actively engaged in the decision making and worried about the outcome, which together led to their escalation of commitment. The novelty of this finding is that it identifies identifying the missing element of hope as a non-rational perception of project economics, which has traditionally been positioned as a rational driver of escalation. By proposing the new explanation of hope, this study departs from the passive nature of escalation of commitment and offers a new perspective for future escalation research.

Chapter 5 Performance and Dynamic Efficacy in a Team Decision Task

This study was designed to study the dynamic nature of efficacy belief—changes in task-specific self-efficacy and team efficacy when there are multiple rounds of decision making and performance feedback. Simulation gaming was used to create a decision-making environment where goal attainment was unlikely. Based on data from 72 teams, the results indicate that changes in self-efficacy and team efficacy measured at the end of each round of decision making are positively related to performance of the round. Specifically, the relationship between negative performance and the decrease in efficacy is mediated by depressive realism—namely, team members' negative forecast that is true to reality. Theoretical and practical implications are discussed.

A rich stream of psychology research is dedicated to the construct of efficacy (for reviews, see Gibson, Randel, & Earley, 2000; Gist, 1987; Gist & Mitchell, 1992). Self-efficacy is essentially what one believes one can achieve. Results from numerous studies have shown that self-efficacy predicts performance (Stajkovic & Luthans, 1998). Individuals with strong beliefs that they can attain a certain level of achievement set higher goals, make more effort, and persist longer in courses of action, in turn enjoying better performance (Bandura, 1997; Gist & Mitchell, 1992; Gully, Incalcaterra, Joshi, & Beaubien, 2002). Although the relationship between self-efficacy and individual performance has been extensively researched, the relationship between previous performance and efficacy belief is less known. On one hand, efficacy belief is based on different sources of information. Gist and Mitchell (1992) proposed that, in a novel task situation, initial efficacy is formed through an assessment of task requirements, one's own abilities, and situational resources and constraints. However, once experience is obtained, past performance becomes the most prominent source of efficacy information. For instance, Feltz and Lirgg (1998) found that hockey players' efficacy beliefs in their performance are rival-specific (i.e., affected by a previous win or loss to the same team). On the other hand, efficacy belief is theorised to be malleable (Lee & Klein, 2002). Taken together, the dynamic nature of efficacy belief—namely, when and to what extent people update their efficacy beliefs according to performance feedback—remains an empirically under-researched area (Gibson & Earley, 2007; Whyte, 1998). In addition,

the concept of efficacy has rarely been simultaneously examined on the individual and team levels despite the fact that all teams are made up of individuals and it is likely that people hold different beliefs about the self and others on the team. Gibson (2001) studied the self-efficacy and group efficacy of nurses and found differential effects regarding goal-setting training and effectiveness. Except for this initial finding, our knowledge about the co-existence of self- and team task-specific efficacy beliefs is limited.

Attempting to fill these gaps, this study examines the relationships among self-efficacy, team efficacy, and performance feedback in a longitudinal simulation design where continuous feedback is provided and multiple measurements of efficacy is administered. Self- and team efficacy beliefs toward the same task are examined simultaneously using a within-individual design. I chose to focus on the impact of negative feedback on efficacy as post-failure reactions are in general less known in management research. To simulate the high failure rate, new venture founding as a context for team decision making was chosen for the purpose of this study. This is a context characterised by high uncertainty, constraint in resources, and adversity in the founding stage. A cognitive mechanism—depressive realism—is proposed to mediate the relationship between negative feedback and the decrease of efficacy beliefs. Depressive realism is the sadder-but-wiser thinking (Alloy & Abramson, 1979; B. M. Staw & Barsade, 1993) through which people comprehend negative feedback and relate it to their own capabilities. I aim to contribute to the literature by providing the first direct test of the dynamic nature of efficacy beliefs. In addition, I specify the mechanisms through which efficacy beliefs adjust according to performance feedback. This is also the first attempt to explain how people internalise performance feedback and relate it to themselves. Moreover, by highlighting the differences between self- and team efficacy I hope to help establish team efficacy as a stand-alone construct (Gibson, 2001).

In the following, I first review research on efficacy and depressive realism to provide a theoretical background for the study. I then draw from previous research to hypothesise how teams adjust their efficacy beliefs in a process with continuous feedback and explain how depressive realism mediates the performance-efficacy relationship. I test these hypotheses with data collected from a longitudinal team simulation. Finally, I discuss implications and limitations of the study and make suggestions for future research.

5.1 SELF-EFFICACY AND TEAM EFFICACY

Efficacy is an essential psychological construct in explaining human behaviour (Bandura, 1967, 1977; Bandura, Blanchard, & Ritter, 1969). At the individual level, self-efficacy is defined as individuals' judgments of their own capabilities to organise and execute the courses of action required to attain designated types of performances (Bandura, 1982). Previous research has found self-efficacy to be a good predictor of human performance (Judge & Bono, 2001). Indeed, how one's belief about expected performance translates into actual performance has motivated a rich stream of research, with particular concentration in contexts such as competitive sports (Feltz & Lirgg, 1998; Feltz, Short, & Sullivan, 2008; Moritz, Feltz, Fahrbach, & Mack, 2000) and education (Bandura, 1993; Zimmerman, 2000). Such research has found that people who think they can perform well on a task actually do better than those who think they will fail (Stajkovic & Luthans, 1998) because higher efficacy leads to higher performance through the setting of higher goals, more effort, and more persistence (Gist & Mitchell, 1992).

The concept of efficacy also exists at the team level. Collective efficacy is a group's belief in their joint capabilities to produce given levels of attainment (Bandura, 1982, 1997). Group efficacy is partly based on the self-efficacy of team members and partly a product of group processes. Therefore, team efficacy is better captured by aggregating team members' judgments of the efficacy of their team as a whole (Bandura, 1997) or having the team formulate one consensus score through discussion (Gibson *et al*., 2000) rather than aggregating individuals' judgment of their own efficacy (Bandura, 1997). Compared to the individual level, less is known about the relationship between group efficacy and group performance. In fact, to date only one study has examined the relationship between team efficacy and performance in management teams (A. Srivastava, Bartol, & Locke, 2006, p. 1243). Previous research shows that, in highly interdependent team sports where performance depends on how well team members work together, team successes and failures influence members' team efficacy judgments to a greater degree than self-efficacy (Feltz & Lirgg, 1998).

Looking at the self-efficacy and team efficacy literature, two areas have been less researched. First, efficacy research is more concerned with success than failure as researchers have been more interested in manipulating people's self-efficacy beliefs in

various contexts such that better performance can be attained. Second, our knowledge is concentrated on the efficacy–performance relationship. As previously mentioned, only one study to date has examined the performance–efficacy relationship, which was not the main focus of the study (Feltz & Lirgg, 1998).

5.2 DEPRESSIVE REALISM

Depressive realism states that depressed[18] individuals are more accurate in their predictions of future outcomes and more realistic about their chances for success (Alloy & Abramson, 1979). They are less influenced by social comparison processes (e.g., self-serving bias) and therefore can remain objective when processing feedback and evaluating the situation (Alloy & Ahrens, 1987). This "sadder-but-wiser" thesis is consistent with the mood congruence theory of emotion–cognition interaction (Bower, 1981; Bower & Forgas, 1987; Mayer, Gaschke, Braverman, & Evans, 1992). In negative affective states, people are more likely to engage in effortful analysis as an attempt to "repair" their mood (Elsbach & Barr, 1999; Erber & Erber, 1994) whereas, in positive affective states, people are more likely to use effortless heuristics in order to "maintain" their current mood (Clark & Isen, 1982; Isen, 1984). In unfavourable situations, depressive realism is particularly helpful as people's unbiased evaluation of their own capability—or incapability—can help them avoid further mistakes, thereby minimising the time and resources wasted. In other words, it is "pessimism as realism", and the depressing thoughts serve as "reality checks" or "wake-up calls".

Depressive realism, or predictive pessimism (Alloy & Ahrens, 1987), is particularly interesting when examined in contrast to optimism. Optimism is defined as a generalised tendency (i.e., a trait) to overestimate the prospect of positive outcomes and underestimate the prospect of negative outcomes. In an economic sense, optimism can be captured by the discrepancy between forecast and the actual performance, which is lower than the forecast (e.g., Dushnitsky, 2009). Depressive realism, on the other hand, is about how depressed (state) individuals make more realistic estimations of future prospects than non-depressed individuals. Optimistic people may enter the situation in

[18] As a state rather than a trait.

a positive default mode but, as the process unfolds, the initial overestimation of positive outcomes and underestimation of negative outcomes might be revised towards more accurate estimations in light of the continuously negative feedback. This is exactly the functions of depressive realism.

5.3 HYPOTHESES

In unfavourable situations, negative signals manifest in many forms. Expectancy theory dictates that people are only motivated when they expect effort to lead to performance, which can translate into rewards. When these expectations cannot be met, individuals become unmotivated and readjust their expectations for the task as well as themselves. Similarly, in business investment situations, the expected eventual return drives people to continuously invest even given the currently negative revenue picture (Northcraft & Wolf, 1984). One clearly negative signal is the speed and magnitude at which cost accumulates when still no return can be seen. More importantly, such costs are perceived as sunk (i.e., forgone) and can only be recovered by future returns. When faced with such negative investment performance, a change of efficacy beliefs requires relating such negative results to the self and team. Moreover, as efficacy is defined as the likelihood of attaining a certain level of achievement, there must be a realisation that this likelihood is constant and cannot be improved. This requires attributing the failure to stable causes rather than unstable causes. An external, stable cause of failure is the difficulty of the task itself whereas an internal, stable cause of failure is the self's or team's lack of skills in performing the task. When attributing the negative performance to these stable causes, individuals derive the thinking that "things will continue to be bad", coupled with "the task is too hard" and/or "I/we do not have the abilities to perform the task". The combined effect of this "learned helplessness"—that is, comprehension of the disassociation between responses and outcomes (Alloy & Abramson, 1979) and losing money—leads to a realistic evaluation of the situation that future returns are unlikely and, thus, a loss is expected. This depressing yet unbiased evaluation of their incapability to change the unfavourable situation leads them to adjust their efficacy beliefs realistically—that is, downward.

Hypothesis 1: Sunk cost is negatively related to self-efficacy through the depressive realism about eventual returns.

Hypothesis 2: Sunk cost is negatively related to team efficacy through the depressive realism about eventual returns.

Another clearly negative signal is how little progress is being made towards the goal. Goal-setting theory dictates that specific and challenging goals motivate people to achieve higher performance (E. A. Locke & Latham, 2002). However, as expectancy theory predicts, if performance and rewards become less likely to attain when more effort (or time and money) is exerted, people should take it as clearly negative feedback and become unmotivated. The mechanism through which this negative feedback influences efficacy beliefs is similar to that of accumulating cost. A learned helplessness builds upon the low likelihood that the situation will improve either due to task difficulty or one's own abilities. This thinking is depressing, yet realistic; due to these stable causes, goal attainment is unlikely. This depressing "reality check" leads people to adjust their efficacy beliefs downward.

Hypothesis 3: Current progress towards the goal is negatively related to self-efficacy through the depressive realism about goal attainment.

Hypothesis 4: Current progress towards the goal is negatively related to team efficacy through the depressive realism about goal attainment.

As the process unfolds, it is reasonable to expect performance feedback to have differential effects on team members' self-efficacy and team-efficacy beliefs. One pioneering study examined the dynamic nature of efficacy beliefs and found that prior team performance has a stronger effect on team efficacy than on self-efficacy (Feltz & Lirgg, 1998). The ego-protection mechanism is at work such that individuals avoid relating negative results to themselves more than to the team. Another plausible explanation is that, in interdependent tasks, performance to a greater extent depends on how well the team works together. Therefore, attributing the performance to the team as a whole rather than as individuals is often more accurate.

Hypothesis 5: Under continuous negative performance and feedback, team efficacy decreases faster than self-efficacy.

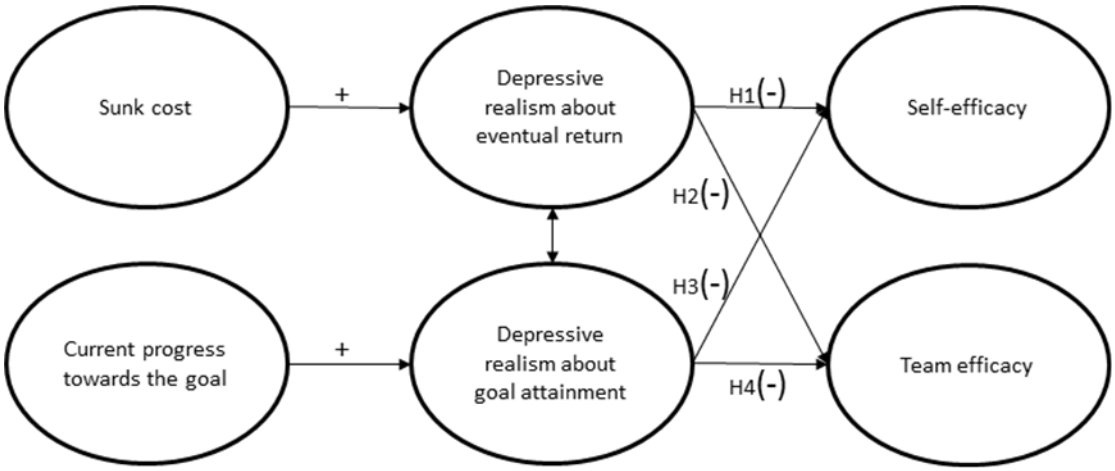


Figure 5-1 Conceptual model

5.4 METHODOLOGY

New venture creation was chosen as the context for this study. This context is characterised by dynamic environments, constraint in resources, and adversity in the founding stage. Due to the high level of uncertainty in the environment, not much is known for sure for serial and nascent entrepreneurs alike. It is a highly competitive field, and the failure rate is known to be high. Most importantly, stakes are high, as are rewards. In order to create a realistic and engaging investment situation, I chose a venturing business simulation game and introduced a set of rules such that money in the simulation is linked to money in reality. The first link lies in the goal: a profit target in the simulation. A cash prize was to be awarded to the teams reaching the goal. As participants were new to the simulation and the simulation was highly complex (i.e., difficult to master in a short period), this goal was highly challenging. The second link lies in the cost for continuing in the simulation, which was to be paid by participants out of their own pockets. Teams were allowed to quit the simulation at any time.

5.4.1 PARTICIPANTS

The sample consisted of 72 teams of students from postgraduate (PG) study programmes in management and finance as well as undergraduate (UG) programmes in business studies and informatics (33 UG teams, 39 PG teams). The mean age of the sample was 22.33 (SE = 2.10); 45% of the participants were male, and 55% were female. Each team had a fixed size of three members.

5.4.2 PROCEDURE

Student participants formed their own teams when they signed up to participate in the study. At least one day before the simulation, recruited participants completed a pre-simulation questionnaire that covered a number of personality traits. Teams reported to the behavioural lab for their scheduled lab session. They first had a 1-hour practice session, coached by the researcher, followed by the 2-hour task session. No participant had previous experience in the simulation. During the task, they answered a number of items about their depressive realism, self-efficacy, and team efficacy. The context of the simulation is venturing in the PC industry, specifically providing hardware solutions to different businesses over a spectrum of segments (e.g., large vs. small, high-end vs. low-end). The chosen simulation is well suited for studies of efficacy because it requires a variety of complex cognitive skills and desirable results (i.e., high profit) can be achieved through different routes (Bandura, 1997; Gibson, 2001). The simulation was "month"-based. Performance feedback was given in the form of profitability figures and operation efficiencies at the end of every month. The goal was to achieve a cumulative profit of £25,000 in the simulation, which is highly challenging for inexperienced players of the simulation. A cash prize of £300 was to be awarded to the team who achieved this goal.[19] There was also a cost of staying in the simulation. For every £1,000 of cost in the simulation, teams had to pay the experimenter £1. There was no minimum or maximum number of months that teams had to play. Teams had opportunities to exit the simulation at the end of any month during the simulation.

5.4.3 MEASURES

Efficacy measures. Self-efficacy and team efficacy (ICC = .458, Rwg = .812 across team members) were measured at the end of every month, after teams reviewed their performance for the month. Each team member indicated their own answers to two questions—At this point in time, how capable do you think <u>you</u> are of effectively playing the SimVenture game? At this point in time, how capable do you think <u>your team</u> is of effectively playing the SimVenture game?—on a 5-point scale (incapable, not so capable, neutral, quite capable, highly capable). Team efficacy in the simulation, following Bandura (1997), was measured by aggregating team members' judgments of the efficacy

[19] In the end, one of the 72 teams achieved the goal.

of their team as a whole. Another possibility was the group discussion (i.e., consensus score method), which was not chosen due to time constraint in the simulation. In addition, the certainty score measure commonly used in previous research was found to be impractical for the current design and therefore not chosen. Essentially, the items, "I am x% certain that my team will achieve…" and "I am y% certain that I will achieve…" cannot be logically administered together. Given the time constraints between rounds (Min: 2 minutes) and the cognitive demand of the certainty score measure, the brief measures in the current study precisely captured the concept of efficacy in the context of the simulation on individual and team levels simultaneously.

Depressive realism measures. Two types of depressive realism were measured in the end-of-round questionnaire. Depressive realism about eventual returns was measured with "My team is scared of losing a lot of money in the end"; depressive realism about goal attainment was measured with "My team is worried that we will not reach our goal in the game". Team members indicated their answers on a 5-point scale (not at all, a little, somewhat, quite a lot, very much).

Performance feedback. Two forms of performance feedback in the simulation were studied. The first was the current total debt participants owed to the experimenter (i.e., sunk cost), incurred from the cost in the simulation. This information in cash terms was recorded and presented to the teams on a white board at the end of every month. The other form was the current cumulative profit (i.e., current progress towards the goal). The monthly profit information was available during the simulation while the cumulative figure was presented on the white aboard alongside the debt information.

Control variables. Variables that may have an impact on efficacy beliefs in the simulation were included as control variables, including age, years of entrepreneurship experience, level of simulation game experience (none or close to none, little, some, quite a lot), general self-efficacy (Chen *et al*., 2001; 8-item scale, Cronbach's alpha = .85), having a business degree or not, and having an entrepreneurial family background or not.

5.4.4 JUSTIFICATION FOR METHODOLOGICAL CHOICES

A simulation setting is suitable for this study of dynamic efficacy for a number of reasons. First, previous research has found that efficacy expectations are more accurate in laboratory settings (Chen et al., 2001). Given that the purpose of this study is to test the dynamic changes of efficacy in a process, it is necessary to have a well-defined task

such that the task-specific efficacy beliefs reflect performance feedback on a task. This is only possible in a controlled, laboratory-like setting. Moreover, a simulation guarantees that the study variables can be frequently measured during the process and provide psychological realism and internal validity similar to laboratory experiments (Boone et al., 2005; Seo & Barrett, 2007). In addition, the current design ensures that the task was novel to all participants. As proposed by Gist and Mitchell (1992), novel tasks should be where changes in efficacy beliefs due to performance feedback can most likely be observed. Finally, the laboratory-like setting enabled me to introduce conditions linking money in the simulation to money in reality. The inclusion of monetary stakes and rewards served two functional roles in this study. Conceptually, as the interest of the current study was to examine the cognitive mechanism through which performance feedback information is processed by people and related to their own abilities, it was more appropriate to focus on factual rather than evaluative feedback (e.g., you are not doing well). This way, changes in efficacy beliefs were a result of individuals' evaluation of the money-related negative signals, not an echo of the given evaluative feedback. Methodologically, the involvement of "real money" granted the simulation higher realism. Participants no longer perceived the simulation as a mere "game" to which they had little self-identification and personal significance.

5.5 ANALYSES

Data were analysed at the individual level. The structure was multilevel: Panel data were nested in individuals while individuals were nested in teams. Control variables (i.e., traits) were included at the individual level. Independent variables (i.e., performance feedback) formed a team-level panel. Mediators (i.e., depressive realism) and dependent variables (i.e., self-efficacy and team efficacy) formed an individual-level panel. Performance measures were initially centred on teams' means to eliminate between-team differences and standardised to facilitate interpretation of the regression coefficients. In the regression models, a team dummy variable was included to capture the team-specific effects.

Hierarchical regression analysis was used to identify mediating effects (R. M. Baron & Kenny, 1986). First, to test the main effects between performance and efficacy, self-efficacy and team efficacy were regressed on the control variables. Current debt (i.e.,

sunk cost) as a predictor was then entered into the models. Separately, current cumulative profit (i.e., current progress towards the goal) was entered as another independent variable. Next, depressive realism about eventual return and goal attainment as mediators in the relationship between performance feedback and efficacy beliefs were tested by regressing depressive realism on the control variables along with performance feedback, and then regressing self-efficacy and team efficacy on both performance feedback and depressive realism. The path diagram depicted in Figure 5–1 explains the relationship graphically.

5.6 RESULTS

5.6.1 DESCRIPTIVE STATISTICS

Table 5-1 reports correlations among the study variables and the descriptive statistics, reported using individual means. A few correlation coefficients and their signs provided preliminary checks that relationships were consistent with predictions. Performance was largely unfavourable. The unstandardised mean for current cumulative profit was -3376.54 (SE: 6797.06; Min: -63,772, Max: 5,991), while the unstandardised mean for current debt was £9.87 (SD: 23.86; Min: 0, Max: 175). This confirms that the study design of a highly challenging goal was effective. In addition, debt and cumulative profit were negatively correlated with each other at -.70. In terms of the mediators, depressive realism about eventual return was negatively correlated with self- (r = -.18, p < .01) and team efficacy (r = -.21, p < .01) while depressive realism about goal distance was negatively correlated with self- (r = -.25, p > .01) and team efficacy (r = -.26, p < .01). In addition, they were highly correlated with each other at .82.

5.6.2 TESTS OF HYPOTHESES

Table 5-2 and Table 5-3 present the regression models for self- and team efficacy, respectively. As predicted, both current debt (B = -.17, p < .001) and current cumulative profit (B = .15, p < .001) were significant predictors of self-efficacy. Current debt was a significant predictor of team efficacy (B = -.19, p < .001), as was current cumulative profit (B = .15, p < .001). The mediating effect of depressive realism about eventual return can be established as (1) current debt was significantly related to depressive realism about eventual returns (B = .30, p < .001) and (2) the effect of current debt on efficacy was reduced or eliminated when depressive realism about eventual return was

added to the model, given that current debt is a significant predictor of efficacy. Similarly, the mediating effect of depressive realism about goal distance could be established when (1) current cumulative profit was significantly related to depressive realism about goal distance (B = -.26, p < .001) and (2) the effect of current cumulative profit on efficacy was reduced or eliminated when depressive realism about goal distance was added to the model, given that current cumulative profit is a significant predictor of efficacy.

Table 5-1 *Descriptive Statistics and Correlations of Study Variables*

	Mean	S.D.	Min	Max	1	2	3	4	5	6	7	8	9	10	11
1 Age	22.52	2.2	19	29											
2 Years of entrepreneurship experience	0.21	0.75	0	5	-0.08										
3 Simulation game experience	1.95	0.97	1	4	-0.18	0.03									
4 General self-efficacy	31.82	3.78	16	40	-0.15	0.09	0.17								
5 Business degree	0.59	0.49	0	1	-0.26	0.02	-0.04	0.03							
6 Entrepreneurial background	0.48	0.5	0	1	0.04	-0.11	0.1	-0.02	0.09						
7 Sunk cost (unstandardised)	9.87	23.86	0	175											
8 Depressive realism about eventual return	2.59	1.15	1	5	-0.05	0	-0.08	-0.03	0.02	-0.06	0.18				
9 Current progress towards the goal (unstandardised)	-3376.54	6797.06	-63772	5991							-0.62	-0.1			
10 Depressive realism about goal attainment	2.86	1.15	1	5	-0.02	0.03	-0.06	-0.01	0.01	-0.08	0.17	0.62	-0.14		
11 Self-efficacy	3.36	0.99	1	5	-0.14	-0.08	0.1	-0.06	0.01	0.09	-0.12	-0.18	0.08	-0.25	
12 Team efficacy	3.35	0.97	1	5	-0.14	-0.04	0.08	-0.07	0.05	0.02	-0.14	-0.21	0.09	-0.26	0.82

Note 1: N = 1,698. Correlations with absolute values greater than .06 are significant at $p < .01$

Note 2: Mean, S.D., Min, and Max for sunk cost and current progress towards the goal are the original (i.e., before group) mean centred.

Table 5-2 *Regression Models for Self-efficacy*

DV: Self-efficacy	controls		IV1: Current debt		MV1: Depressive realism eventual return		IV2: Current cumulative profit		MV2: Depressive realism about goal distance	
	B	SE	B	SE	B	SE	B	SE	B	SE
Age	-0.07	0.02 ***	-0.07	0.02 ***	-0.07	0.02 ***	-0.07	0.02 ***	-0.07	0.02 ***
Years of entrepreneurship experience	-0.24	0.04 ***	-0.24	0.04 ***	-0.25	0.04 **	-0.24	0.04 ***	-0.23	0.04 ***
Business simulation game experience	0.10	0.03 **	0.10	0.03 **	0.09	0.03 **	0.10	0.03 **	0.09	0.03 **
General self-efficacy	-0.03	0.01 ***	-0.03	0.01 ***	-0.03	0.01 **	-0.03	0.01 ***	-0.03	0.01 ***
Business degree	-0.21	0.06 ***	-0.21	0.06 ***	-0.20	0.06 ***	-0.21	0.06 ***	-0.19	0.06 **
Entrepreneurial family background	-0.25	0.06 ***	-0.25	0.06 ***	-0.24	0.06 ***	-0.25	0.06 ***	-0.24	0.06 ***
Sunk cost (standardised)			-0.17	0.03 ***	-0.15	0.03 ***				
Depressive realism about eventual return					-0.09	0.02 ***				
Current progress towards the goal (standardised)							0.14	0.04 ***	0.11	0.04 ***
Depressive realism about goal attainment									-0.14	0.02 ***
df	71, 1626		72, 1625		73, 1624		72, 1625		73, 1624	
R^2	0.281		0.296		0.304		0.288		0.309	
Adjusted R^2	0.250		0.265		0.273		0.257		0.278	
ΔR^2			0.015		0.008		0.007		0.021	
ΔF	8.958		34.803 ***		17.899 ***		16.729 ***		48.264 ***	

N = 1,698 * p < .05, ** p < .01, *** p < .001

Table 5-3 *Regression Models for Team Efficacy*

DV: team efficacy	controls		IV1: Current debt		MV1: Depressive realism about eventual return		IV2: Current cumulative profit		MV2: Depressive realism about goal distance	
	B	SE	B	SE	B	SE	B	SE	B	SE
Age	-0.07	0.02 ***	-0.07	0.02 ***	-0.07	0.02 ***	-0.07	0.02 ***	-0.07	0.02 ***
Years of entrepreneurship experience	-0.18	0.04 ***	-0.18	0.04 ***	-0.19	0.04 ***	-0.18	0.04 ***	-0.17	0.04 ***
Business simulation game experience	0.08	0.03 **	0.08	0.03 **	0.07	0.03 *	0.08	0.03 **	0.08	0.03 **
General self-efficacy	-0.03	0.01 ***	-0.03	0.01 ***	-0.03	0.01 ***	-0.03	0.01 ***	-0.03	0.01 ***
Business degree	-0.11	0.06	-0.11	0.06	-0.09	0.06	-0.11	0.06	-0.09	0.06
Entrepreneurial family background	-0.32	0.06 ***	-0.32	0.06 ***	-0.31	0.06 ***	-0.32	0.06 ***	-0.30	0.06 ***
Sunk cost (standardised)			-0.19	0.03 ***	-0.15	0.03 ***				
Depressive realism about eventual return					-0.12	0.02 ***				
Current progress towards the goal (standardised)							0.15	0.03 ***	0.11	0.03 **
Depressive realism about goal attainment									-0.16	0.02 ***
df	71, 1626		72, 1625		73, 1624		72, 1625		73, 1624	
R^2	0.281		0.301		0.316		0.290		0.318	
Adjusted R^2	0.250		0.27		0.286		0.258		0.288	
ΔR^2			0.020		0.015		0.009		0.028	
ΔF	8.966		44.676 ***		37.408 ***		19.598 ***		67.727 ***	

N = 1,698 * p < .05, ** p <.01, *** p < .001

Results indicate that Hypothesis 1 was supported: The negative relationship between current debt and self-efficacy was partially mediated by depressive realism about stakes (indirect effect -.0017671, bias-corrected bootstrap 95% CI: {-.0026997, -.0010817}). Hypothesis 2 was also supported: The positive relationship between current cumulative profit and self-efficacy was partially mediated by depressive realism about goal distance (indirect effect -.0020467, bias-corrected bootstrap 95% CI: {-.0030163, -.0013284}).

In regard to team efficacy, the main effect of current debt was established. Depressive realism about goal attainment as a mediator to this relationship was also supported (indirect effect -.0023160, bias-corrected bootstrap 95% CI: {-.0032916, -.0015333}). Thus, Hypothesis 3 was supported. The main effect of the current cumulative profit was established. Depressive realism about goal attainment as a mediator to this relationship was supported as well (indirect effect -.0024212, bias-corrected bootstrap 95% CI: {-.0034101, -.0016162}). Thus, Hypothesis 4 was also supported.

In terms of Hypothesis 5, a simple linear regression illustrated that performance, self-efficacy, and team efficacy share a downward trend.

$$\text{Cumulative profit (standardised)} = .46 - .086mth$$
$$\text{Debt} = -12.27 + 4.016mth$$
$$\text{Team efficacy} = 3.55 - .053mth$$
$$\text{Self-efficacy} = 3.48 - .039mth$$

As the intercepts demonstrate, the mean level of team efficacy started off being higher than self-efficacy. Over time, team efficacy decreased faster than self-efficacy, as shown by the slopes. Figure 5-2 graphically presents the linear fit of self-efficacy and team efficacy over the course of the simulation. Drawing from the regression results, it seems that the faster downward trend of team efficacy compared to self-efficacy was a result of the stronger effect of negative performance feedback. Thus, Hypothesis 5 was supported.

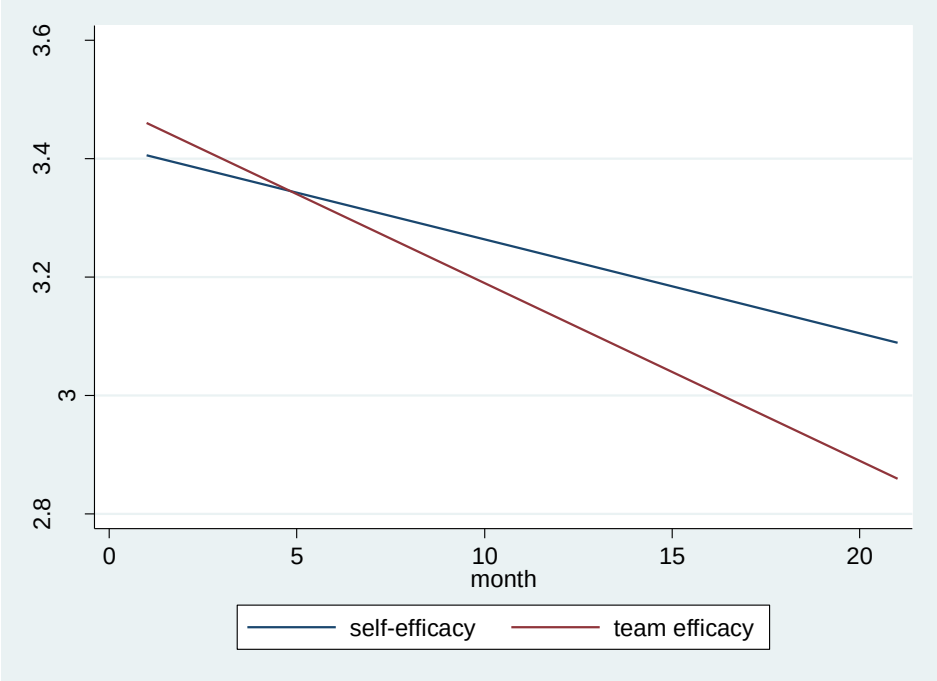


Figure 5-2 Self-efficacy and team efficacy over time

5.7 DISCUSSION

The purpose of this study was to test the theoretically derived relationships among performance feedback, self-efficacy, and team efficacy, as mediated by depressive realism about eventual returns and goal distance. The results indicated that, in an unfavourable situation, continuous negative feedback decreases individuals' self- and team-efficacy belief through two types of depressive yet realistic thoughts: the eventual return being low and the goal being too far away. As hypothesised, negative feedback about sunk cost was negatively related to self- and team efficacy through the depressive realism about eventual return. Negative feedback about current progress towards the goal was negatively related to self-efficacy through the depressive realism about goal distance. As such, negative feedback in the two different forms was found to have a differential impact on the self-efficacy and team efficacy beliefs individuals hold towards the same task: Under negative feedback, team efficacy decreases faster than self-efficacy. Implications for both theory and practice, based on the current results, are discussed in the following section.

5.7.1 THEORETICAL IMPLICATIONS

First and foremost, this study confirmed that efficacy belief is dynamic and performance feedback is an important source of change. People realistically adjust beliefs about their own capabilities in specific tasks according to performance feedback. Furthermore, the dynamicity, or malleability (Gist & Mitchell, 1992), of efficacy beliefs is high such that significant changes occur in as little as 1 to 2 hours. The findings of this study enhance our understanding of the performance–efficacy relationship while previous research concentrated on the efficacy–performance relationship. Indeed, the formation of efficacy belief should is as important as its consequences to performance (Gibson & Earley, 2007). Lindsley, Brass, and Thomas (1995) conceptualised downward and upward spirals of continuous performance-feedback-efficacy-performance processes across levels of individuals, groups, and organisations; however, these relationships have not been tested empirically (Chen et al., 2002). The situation that teams faced in the current study resembled a downward spiral—namely, continuously worsening performance as well as efficacy beliefs and the reciprocal relationships between them.

Second, I demonstrated that team efficacy and self-efficacy simultaneously held by individuals in the same task were two positively correlated but different constructs. In unfavourable situations, they both declined, albeit at different speeds, with team efficacy declining faster than self-efficacy. This outcome hints at the idea that the formations of self-efficacy and team efficacy share common sources (e.g., evaluation of abilities, prior experiences), but are different in terms of how negative feedback on performance is processed and internalised as a source of efficacy information. From previous research, we know that team efficacy predicts team performance better than self-efficacy; from the current study, we now know that team efficacy is more responsive to (negative) team performance. These findings together establish group efficacy as an important emerging construct in the workplace (Gibson & Earley, 2007).

Third, in a study of hockey players, Feltz and Lirgg (1998) found that team performance has a greater impact on subsequent team efficacy than self-efficacy. This cross-sectional finding was extended by the current study such that team efficacy declined faster than self-efficacy in unfavourable situations longitudinally. Findings from this study can potentially be explained by self-serving biases: Individuals tend to attribute negative results externally such that, in unfavourable situations, initial self-efficacy belief is more persistent than team efficacy—that is, it starts off higher and declines more slowly. Applying self-serving bias in success attribution, in favourable situations (i.e., success

and good performance), self-efficacy should increase faster than team efficacy. Further research can test this hypothesis.

5.7.2 LIMITATIONS

First, the measurement of efficacy is somewhat uncommon, and some might criticise its simplicity. At this point, it might be worthwhile to examine one again how efficacy was measured in previous research in contrast it to the current study. The most common measure used has been the certainty score measure, originally proposed by Locke and Frederick (1984). This measure asks subjects to rate how certain they are (in percentage) that they can attain a certain level of achievement on a specific task. There are usually several items, indicating low to high levels of achievement. A composite score is computed by averaging the certainty scores across different levels of achievement. Using the certainty score format, different efficacy measures have been designed by researchers for the specific tasks with which they are concerned . Despite the technical issue regarding self vs. team formulation as discussed in the methodology section, the measure in the current study differs from the certainty score measure in more fundamental ways. The certainty score measure defines achievement for subjects whereas the measure in the current study does not. In job-related efficacy studies (e.g., nurses' quality of care for patients; Gibson, 2001), what constitutes achievement is often known. However, in novel tasks, as in the current study, subjects are unsure about what determines performance. Employing the certainty score measures risks, forcing definitions of achievement on individuals and obstructing the formulation of efficacy beliefs. In our case, there was a goal; teams that achieved the goal would be handsomely rewarded. However, achievement should not be defined solely by whether teams ultimately reach the goal. In fact, what reflects the process and possibly drives teams' performance is perceived efficacy in the process. In other words, in the current study, efficacy was measured as a perception rather than as an objective assessment.

Second, the current study embodied a specific situation in which there was a mounting cost while only performance hitting the target would be rewarded at the end. In other words, before hitting the target, there was only cost but no monetary gain. However, this narrow task definition is not expected to limit the generalisability of findings. In fact, the current task is simply a more stringent situation than those in which people are rewarded along the way. The findings should be generalisable to any context where

there is continuous negative feedback and task performance is of significance—although not necessarily in monetary terms—to individuals and teams. Negative feedback in other forms might trigger stable attribution and induce depressive realism about that specific form, eventually leading to an adjustment of efficacy belief.

Third, the depressive realism measures were formulated only to be team-centric (i.e., my team is worried...; my team is scared…). Therefore, findings from the current study cannot be used to predict if team-centric and self-centric depressive realism will have differential effects on team efficacy and self-efficacy. This question offers the possibility for future research to shed light on the me vs. us difference (Gibson, 2001). However, researchers should use caution when mixing self-centric and team-centric items in repeated measures. It might be overly demanding for subjects to answer multiple items formulated with "I…" and "My team…", particularly in short time intervals, as in the current study. Subjects failing to react to the difference between them will result in inferior data.

Finally, although attribution to stable causes was used as the main explanation for the link between performance feedback and depressive realism, attribution was not directly measured in the current study. Similarly, self-serving bias (i.e., people's inclination to attribute success to self and failure to others) was used to explain the difference between the slopes of self- and team efficacy over time, but was not directly measured either. Studying attribution is a possible extension to the current study.

5.7.3 FUTURE RESEARCH

This study provides a number of potential routes for further investigation. First, the current study focused on negative feedback and declining efficacy. More understanding of the effect of positive feedback on efficacy is needed, particularly if the upward spiral does lead to overconfidence and becomes just as detrimental as the downward spiral (Lindsley et al., 1995). In addition, Whyte et al. (1997) suggested the need to study the "recovery" of efficacy belief after a series of failures. In the current study, if the teams had been offered another chance immediately after the frustrating experience, would they have taken it or refused it? The emotional reaction to failure might be so strong that they would seek to escape from the situation, but after some time of remuneration, they might regain their confidence and become willing to try again, equipped with the experience. This is a question worth further empirical effort as it has strong implications

for how people learn from failure. Indeed, "helplessness" comes from attributions of failure in stable causes such that individuals come to believe that their actions will have no impact on the situation (Seligman, 1975). This thinking will eventually lead to permanent withdrawal such that people decide to never try again. Rebuilding efficacy belief is crucial in avoiding helpless thinking so that people are willing to try new things, possibly fail, and try again.

Second, as pointed out in the discussion of the limitations, attribution seems to have potential for generating important insights into team efficacy. As described by previous researchers and as evident in the current study, the stable attribution of success and failure is related to self-efficacy (Bond, Biddle, & Ntoumanis, 2001; Gernigon & Delloye, 2003). In addition to stability, another dimension of Weiner's (1985) attribution theory is the focus of attribution (internal vs. external). The hierarchy of attribution becomes more complicated when applied to the team level: The self is clearly internal while the team as a whole and other teammates seem to be to some extent both internal and external. Self-serving bias has been used to explain the different speeds at which self- and team efficacy declined. Using this line of logic, the self is internal and the team is external. However, could there be a possible difference between attributing failure and success to the team as a whole or just other teammates? These questions might deserve future research effort.

Finally, the current study is concerned with novel tasks, in which people have little grounding for their self-efficacy and are more opened to adjustments (Gist & Mitchell, 1992). Future research can investigate efficacy beliefs in familiar tasks, particularly if the beliefs are more persistent and if overconfidence in new tasks is caused by false associations with past success experiences.

5.8 CONCLUSION

This study confirmed the performance–efficacy relationship and found that self-efficacy and team efficacy adjust downward according to continuous negative feedback through depressive thoughts about future outcomes due to the attribution of failure to stable causes. Team efficacy decreases faster than self-efficacy, which can be explained by self-serving bias. Findings from this study add to our knowledge about efficacy as well as motivate further research in this area.

Chapter 6 Summary of Findings

This thesis was designed to examine two non-rational decision approaches: intuition at the individual level and emotion at the team level. It is assumed that real-life decision makers are always boundedly rational who use non-rational approaches to aid their decision making. The individual-level component examined intuition. In Chapter 2 (Paper 1), a normative theory about how people should allow intuition to interrupt their analytic processes in complex decision-making processes was proposed. I drew from extant literature to explain how interrupting intuitions merit complex decision processes in an ambiguous environment. Decision makers enjoy the benefit of holistic intuitions redirecting the stagnant analysis in an environment with low determinacy but high quantity. They also benefit from inferential intuitions focusing the stagnant analysis in an environment with high determinacy but low quantity. Switching as a concept was introduced to illustrate how intuitive interruptions manifest in decision-making processes. The novelty of this proposal lies in that no theory to date explicitly addresses how intuition and analysis can function together. Intuition research tends to focus on, and sometimes overstates, the benefits of intuition. Decision research following a rational tradition often finds ways to dispute intuition as cognitive biases. The current proposal bears the potential to reconcile these two camps of research and reposition intuition as a non-rational decision approach that is particularly helpful under ambiguity.

In Chapter 3 (Paper 2), the intuitive interruptions theory was applied to the entrepreneurial context as a framework of entrepreneurial intuition, which has the potential of synthesising previous research on experts' intuition, creative intuition, and the emerging research on entrepreneurial intuition. Drawing from extant research on opportunity recognition and improvisation, I argued that intuitive interruptions help entrepreneurs navigate the often ambiguous environment. This elaborate thought experiment (Sarasvathy, 2001) offers many possibilities for future research on entrepreneurial intuition.

The team-level component examined the impact of team emotion and cognition in decision making under adversity using a longitudinal simulation design. Chapter 4 (Paper 3) documented the findings on escalation of commitment and the effect of hope. It was found that, when faced with continuous negative feedback, teams that remain

hopeful strive and persist at an increasing cost. Displayed engagement and worry mediate the relationship between hope and escalation tendency. Hope was defined and measured as a mix of cognition and emotion (i.e., hopeful thinking and hopeful feelings). This study contributes to the literature of escalation of commitment by providing a new explanation for escalation of commitment—namely, hope as a non-rational belief about positive project economics—which is traditionally positioned as an economic (i.e., rational) driver. This explanation provides a less passive view of escalation of commitment compared to previous explanations of entrapment and self-justification, in which individuals feel "stuck" in the situation, but blindly and unwillingly continue.

In Chapter 5 (Paper 4), the performance-efficacy relationship was examined. Specifically, changes in self-efficacy and team efficacy beliefs in a team task of multiple rounds of decision making and performance feedback were examined. Results indicated that the relationship between negative feedback and decreased efficacy is mediated by depressive realism—that is, the realistic negative expectations of future outcomes. The most important contribution of this study is that it provides empirical support to the dynamic nature of efficacy belief and shows that performance feedback is an important driver of change. In addition, it was demonstrated that team efficacy and self-efficacy in the same task, when held simultaneously by individuals, are two highly correlated but different constructs as they decrease at different speeds. Depressive realism makes people focus on negative information about eventual return and goal attainment. It is a non-rational approach to decision making without full information processing.

In conclusion, this thesis finds that non-rational approaches facilitate decision making by filling in the gaps, colouring the tone, and changing the course of thinking where exhaustive information processing (i.e., full analysis) is not possible due to constraints in information availability and cognitive capacity. As proposed in this thesis, employing non-rational approaches can be either a deliberate choice (as in Chapters 2 and 3) or a reaction of human nature (as in Chapters 4 and 5). Employing non-rational approaches does not necessarily yield favourable (i.e., having a faster speed and higher decision quality, as in Chapters 2 and 3), unfavourable (i.e., escalating commitment to a failing course of action, as in Chapter 4), or neutral results (i.e., changing beliefs about one's abilities, as in Chapter 5). However, it is expected that non-rational approaches are largely involved in the decision-making process. Drawing from the propositions and findings in this thesis, a boundedly rational decision is one that is sensible, is adaptive,

and takes into consideration available information, cognitive capacity, and time. In today's world, we are often faced with imperfect information and limitations in ourselves; thus, recognising the virtue and necessity of non-rational decision approaches is crucial to decision makers of the modern age.

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Appendices

Appendix 1. LAB PROTOCOL

Time	Dura-tion (min)	Activity/Event
00:01	1	The team arrives at the lab and be greeted by the experimenter
00:02	1	The experimenter tells the team "Pick your own seats. The person in the middle will be controlling the mouse". Members of the team choose their own seats. The experimenter marks them as A, B, C from left to right.
00:07	5	The experimenter hand the team the consent form and ask them to read and sign. The experimenter check with the participants if they have played SimVenture before. If yes, for approx. how many hours.
00:10	3	The experimenter explain the following lab rules to the team: • Please follow the instructor's directions • Do not click on anything on the Windows Task bar or try to access any applications other than SimVenture. You might interrupt the data collection and cause data loss. • Do not take anything from the lab with you when you leave • Do not switch seats with your team members • Do not leave the room during the session. There is a short break at the end of the first hour. • Food is not allowed in the lab. Drink is ok. • If you need to take notes, blank sheets are provided (The experimenter hand them the sheets.) • Please switch off your mobile phone. • Please speak only English during the game.
00:15	5	The experimenter explains the schedule of the session: "In the first hour you will play a practice game. Try to explore all functions and familiarize yourselves with the game. You can experiment freely with this practice game. In the second stage you will start fresh with a new game. If you have questions I will be available to help. I will stop you when time's up. Then you can have a quick break before we enter the second stage. I will explain in greater details later. Do not leave the room during the practice game. There's no video recording or questionnaire during this time". The experimenter checks if the team has any questions.
00:45	30	A laptop with a pre-loaded game ("Practice") is already in front of the team. The team begins the practice game. No video recording, no in-game questionnaires at this time. The team is allowed to ask the experimenter questions about the game. But the experimenter will not go beyond explaining the basic functions, e.g. help the team with their strategy. The experimenter gives the team reminders 10 minutes before the end time. During the time the team practices, the experimenter checks the angle of the cameras to make sure all three participants are properly captured.
00:50	5	The experimenter stops the practice game. The team is told they could take 5 minute break and they must return to the lab on time. The experimenter prepares the game, checks the cameras, and activates the screencast programme during this time.
00:51	1	The experimenter explains about the experiment rules: • The experimenter will not answer questions about the game except

		technical problems. • Before the session ends, they should not leave the room.
01:01	10	The experimenter explains about the investment situation: "Thank you for participating in the first hour of the session. Actually we have prepared a small compensation for your time. Here is 6 pounds for the whole team. This money is yours now. You can decide by yourself how you would like to split it." "Before we begin the second stage, I have to explain to you about something very important. Please pay attention to what I say. If you don't understand, please ask." "Just like in real life, to play the SimVenture game to win 300 pounds you have to make investments, that is, by paying your own money to play the game." "Let me explain how it works. In the beginning of the game, you have a 3,000 allowance. Think of it as some money your family gave you to support your venture. Once you go over this 3,000, you need to start paying out of your own pocket. That is, in real life, for every 1,000 you spend in the game you have to pay me 1 pound." "The 6 pounds is yours now. You can take it and walk away now without playing the real game at all. Or you can use it along with your own money and try to make 300 pounds. It is your choice. Also remember, during the game at the end of every round you have an opportunity to quit. Your team should make this decision together." "During the game I will highlight the information of on this tracking board—total costs on the left hand side, cumulative profit on the right hand side. So you will be able to see where you currently stand in relation to the 25,000 goal. You will also see how much you owe me. You don't have to hand me cash round by round. We will keep track of it and calculate the final balance at the end." "When you finish playing, if you reach the goal and win the 300 pounds. You will get it right away. Here is the cheque (*The experimenter shows the team the cheque). If you owe me money, I will calculate how much it is and ask you to pay. However because of school regulations I can only collect up to 6 pounds today. So if you actually owe me more than that, I will ask you to sign an IOU note and collect the money from you later. (*The experimenter shows the participants the IOU note). "Let me give you an example to illustrate how the money situation works. If the cumulative cost figure becomes 3,000, you do not have to pay me yet. But you might start thinking about because when it reaches 4,000 you start paying the first pound." "For example, if you reach the 25,000 cumulative profit goal when the cumulative cost is 28,000. This means that you get the 300 pounds reward and you pay me 25 pounds for the investment you made." "Again I have to emphasize, you can always quit. Remember, how many rounds you want to play, how much money you are willing to invest IS YOUR CHOICE." The experimenter checks with the participants if they have questions. The experimenter continues to explain until the participants fully understand the rules.
01:02	1	The experimenter explains how they *should not* use the "raising money" function": "Do not use the raising money function in the finance section. This function is banned in this session. You should not need to borrow money since we have put 100,000 in your account. That should be more than enough for you to run the venture."
01:05	3	The experimenter explains to the team about the steps the repeat every round: 1. run the month

		2. Monthly report appears on the screen. The game remains on this screen while doing the following steps. 3. The experimenter writes the tracking board. During this time the team should not discuss. After writing the information, the experimenter points to the board and says "This is how much money you owe me now, and this is where you stand in terms of the goal." 4. The team writes the personal decision item. The experimenter collects the paper immediately. 5. The experimenter tells the team to engage in discussion to decide if they should continue playing or not. In this discussion the team should focus on their current standing in the game, how close/far they are from the goal, and if they want to continue playing. 6. The team informs the experimenter that they are ready. The experimenter asks the team "Team X, do you want to continue playing or quit?" The team answers. 7. The team writes the items about hope vs. fear, self-efficacy, group efficacy, and engagement. During this time the experimenter approaches the laptop and saves the game. 8. The experiment collects the questionnaire. The team continues or ends the game The experimenter says "It's okay if you can't remember the steps. I will remind you what you should do. Just follow my instructions." The experimenter checks with the team if they have any questions.
02:55	110	A laptop with a pre-loaded game ("Cass") is already in front of the team and they are told to begin playing. The proposed 8 steps are repeated until the team quits or time is up. During this time, the experimenter marks the current time and the end time on the white board to remind the team every round how much time they have left. If and when the team decides to quit, the experimenter asks the team two questions: "If I give you more time now, would you continue?" "Assuming that you continue to play, how far do you think you will go in terms of how much the cumulative cost becomes, i.e. what number would stop you?" The experimenter extends the game for a maximum of 30 minutes if the team wishes to.
03:00	5	Once the game is finished, the experimenter hands the team the post-game questionnaire. They are asked to write the questionnaires individually and not talk to each other. During this time the experimenter saves the game and switch off the camera. The experimenter calculates the final balance of how much the team owes or earned. The experimenter collects the post-game questionnaires.
03:05	5	The experimenter informs the team the final balance and says "This is the total amount of money you owe me from playing the game. However as I mentioned I can only collect the initial 6 pounds from you due to school regulations. I'm going to ask you to sign this IOU note. I will keep a copy and you will keep one too. I will collect the remaining amount at a later point of time and you will all be contacted by email regarding time, location, and payment method. Please confirm that your email addresses are correct so I can reach you." The experimenter and the team sign the IOU note.
03:10	5	The experimenter hands the team the debriefing form and say "Here's some information about the study. Please read and give it back to me when you're done." The experimenter gives feedback to the team on their decision processes, strategies, and group dynamics; and check if the team has any questions.
03:15	-	The experimenter thanks the team for coming and sends them out. The experimenter saves the game and the screencast.

Appendix 2. PRE-SIMULATION QUESTIONNAIRE

Basic information

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This questionnaire takes approximately 30 minutes to complete. Please answer every question.

Surname

First name

Email address

City student login (e.g. abcd123)

Demographics

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Age

Gender

- Male
- Female

Is English your mother tongue?

- Yes
- No

What is your nationality?

Do you have one or more degree(s) in business/management-related fileds on undergraduate or postgraduate level?

- Yes
- No

How many years of work experience have you had?

Did you grow up in an entrepreneurial family, i.e. has one or both of your parents started their own business?

- Yes
- No

Do you have entrepreneurship experience yourself, i.e. have you started your own business?

- Yes
- No

How many years of entrepreneurship experience do you have?

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What would you say about your experience in strategy PC games (e.g. The Football Manager, SimCity, Civilization, the tycoon series, or other commercial/educational business simulation games)?

- ○ None or close to none
- ○ Little
- ○ Some
- ○ Quite a lot

BFI

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Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who likes to spend time with others? Please indicate the extent to which you agree or disagree with each statement.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1. Is talkative	○	○	○	○	○
2. Tends to find fault with others	○	○	○	○	○
3. Does a thorough job	○	○	○	○	○
4. Is depressed, blues	○	○	○	○	○
5. Is original, comes up with new ideas	○	○	○	○	○
6. Is reserved	○	○	○	○	○
7. Is helpful and unselfish with others	○	○	○	○	○
8. Can be somewhat careless	○	○	○	○	○
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

9. Is relaxed, handles stress well	○	○	○	○	○
10. Is curious about many different things	○	○	○	○	○
11. Is full of energy	○	○	○	○	○
12. Starts quarrels with others	○	○	○	○	○
13. Is a reliable worker	○	○	○	○	○
14. Can be tense	○	○	○	○	○
15. Is ingenious, a deep thinker	○	○	○	○	○
16. Generates a lot of enthusiasm	○	○	○	○	○
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
17. Has a forgiving nature	○	○	○	○	○
18. Tends to be disorganized	○	○	○	○	○
19. Worries a lot	○	○	○	○	○
20. Has an active imagination	○	○	○	○	○
21. Tends to be quiet	○	○	○	○	○
22. Is generally trusting	○	○	○	○	○
23. Tends to be lazy	○	○	○	○	○
24. Is emotionally stable, not easily upset	○	○	○	○	○
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
25. Is inventive	○	○	○	○	○
26. Has an assertive personality	○	○	○	○	○
27. Can be cold and aloof	○	○	○	○	○
28. Perseveres until the tasks is finished	○	○	○	○	○
29. Can be moody	○	○	○	○	○
30. Values artistic, aesthetic experiences	○	○	○	○	○
31. Is sometimes shy, inhibited	○	○	○	○	○
32. Is considerate and kind to almost everyone	○	○	○	○	○
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
33. Does things efficiently	○	○	○	○	○
34. Remains calm in tense situations	○	○	○	○	○

35. Prefers work that is routine	○	○	○	○	○
36. Is outgoing, sociable	○	○	○	○	○
37. Is sometimes rude to others	○	○	○	○	○
38. Makes plans and follow through with them	○	○	○	○	○
39. Gets nervous easily	○	○	○	○	○
40. Likes to reflect, play with ideas	○	○	○	○	○
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
41. Has few artistic interests	○	○	○	○	○
42. Likes to cooperate with others	○	○	○	○	○
43. Is easily distracted	○	○	○	○	○
44. Is sophisticated in art, music, or literature	○	○	○	○	○

Trait PA/NA

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The following statements may or may not describe you. Read each statement and then mark the appropriate number next to that statement as to how much you agree or disagree that the statement describes you:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
It is easy for me to become enthusiastic about things I am doing.	○	○	○	○	○
My mood often goes up and down.	○	○	○	○	○
I live a very interesting life.	○	○	○	○	○
I usually find ways to liven up my day.	○	○	○	○	○
Most days I have moments of real fun or joy.	○	○	○	○	○
Often I get irritated at little annoyances.	○	○	○	○	○
I often feel sort of lucky for no special reason.	○	○	○	○	○
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

I am too sensitive for my own good.	○	○	○	○	○
Everyday interesting and exciting things happen to me.	○	○	○	○	○
I often find myself worrying about something.	○	○	○	○	○
In my spare time I usually find something interesting to do.	○	○	○	○	○
For me life is a great adventure.	○	○	○	○	○
I always seem to have something pleasant to look forward to.	○	○	○	○	○
I suffer from nervousness.	○	○	○	○	○
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
I sometimes feel "just miserable" for no good reason.	○	○	○	○	○
Occasionally I experience strong emotions--anxiety, anger--without really knowing what causes them.	○	○	○	○	○
Every day I do some things that are fun.	○	○	○	○	○
I am easily startled by things that happen unexpectedly.	○	○	○	○	○
I sometimes get myself into a state of tension and turmoil as I think of the day's events.	○	○	○	○	○
Minor setbacks sometimes irritate me too much.	○	○	○	○	○
I often lose sleep over my worries.	○	○	○	○	○
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
There are days when I'm "on edge" all of the time.	○	○	○	○	○
My feelings are hurt rather easily.	○	○	○	○	○
I sometimes change from happy to sad, or vice versa, without good reason.	○	○	○	○	○
I often feel happy and satisfied for no particular reason.	○	○	○	○	○

GRE

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In this section there are 3 sets of questions. Each set of questions is based upon a specific passage or upon a set of conditions. To answer the questions, you may find it useful to draw a diagram or chart. Select the best answer to each question.

Five men, Jared, Anthony, Eric, Kato, and Bob, are seated in six chairs in a row in the theater.

I. Anthony cannot sit next to Kato but must have persons on both sides of him.
II. Bob sits in either the first seat or the last seat.
III. Eric sits three spaces to the left of Bob.
IV. There are two spaces between Jared and the empty seat.
V. Kato is in seat five.

Which seat is empty?

- First
- Second
- Third
- Fourth
- Fifth

Which of the following represents the order in which the men will be sitting, from right to left?

- Bob, Kato, Eric, Anthony, Jared
- Jared, Anthony, Eric, Kato, Bob
- Kato, Bob, Eric, Jared, Anthony
- Bob, Kato, Anthony, Eric, Jared
- Anthony, Jared, Eric, Kato, Bob

From which of the following statements did you deduce in which seat Bob sits?

- I and II
- I and III
- II and III
- I only
- I, II, and III

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Edgar is richer than Roxanne but poorer than Julie.
Glenn is less rich than Lauren.
Roxanne is richer than Glenn but less rich than Julie.

Which of the following must be true?

- Roxanne is richer than Edgar.
- Glenn has no money.
- Edgar is richer than Lauren
- Julie is richer than Glen.
- Lauren has more money than anyone else.

If the additional information "Lauren is richer than Julie" is added, what is the order of persons from poorest to richest?

- Glenn, Roxanne, Edgar, Julie, Lauren
- Lauren, Julie, Edgar, Roxanne, Glenn
- Glenn, Roxanne, Julie, Lauren, Edgar
- Lauren, Julie, Roxanne, Glenn, Edgar
- Glenn, Julie, Roxanne, Edgar, Lauren

Which of the following pieces of information is superfluous*?
*=redundant

- Edgar is richer than Roxanne.
- Glenn is less rich than Lauren.
- Roxanne is richer than Glenn.
- Roxanne is less rich than Julie.
- Julie is richer than Edgar.

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Two persons must be of different genders to model together.
Two models working together must have different colored hair.
Female models of agency R have brown hair. Male models of agency R have red hair.
Male models of agency B have blond hair. Female models of agency B have red hair.
Male models of agency Y have blond hair. Female models of agency Y have red hair.

Which of the following combinations of models is not possible?

- ○ R agency female, R agency male
- ○ B agency female, Y agency female
- ○ Y agency male, R agency female
- ○ R agency female, Y agency male
- ○ B agency male, R agency female

With whom could a male model of agency R pose?

- ○ Female model of agency B
- ○ Female model of agency R
- ○ Female model of agency Y
- ○ Male model of agency B
- ○ Male model of agency Y

With whom could a male model of agency B pose?
I. Female model of agency R
II. Female model of agency B
III. Female model of agency Y

- ○ I only
- ○ II only
- ○ III only
- ○ I and III only
- ○ I, II, and III

Efficacy

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The following statements describe how you feel about yourself. Please circle a number on the scale according to how well it describes you.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
I will be able to achieve most of the goals that I have set for myself.	○	○	○	○	○
When facing difficult tasks, I am certain that I will accomplish them.	○	○	○	○	○
In general, I think that I can obtain outcomes that are important to me.	○	○	○	○	○
I believe I can succeed at most any endeavor to which I set my mind	○	○	○	○	○
I will be able to successfully overcome many challenges	○	○	○	○	○
I am confident that I can perform effectively on many different tasks	○	○	○	○	○
Compared to other people, I can do most tasks very well	○	○	○	○	○
Even when things are tough, I can perform quite well	○	○	○	○	○

Misc.

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The following question asks about the worth of money to you. Please circle a number on the scale to indicate your answer.

	Almost nothing	Little	A moderate amount	Quite a bit	A Lot!
In general, how much is £6 worth to you?	○	○	○	○	○
In general, how much is £100 worth to you?	○	○	○	○	○
In general, how much is £300 worth to you?	○	○	○	○	○

How would you describe the relationship between you and your team mates?
*The order of the two team mates does not matter. Just rate one, and then the other.

	Acquaintance	-	Somewhat close friends	-	Very close friends
Team member A	○	○	○	○	○
Team member B	○	○	○	○	○

LOT-R

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Please be as honest and accurate as you can throughout. Try not to let your response to one statement influence your responses to other statements. There are no "correct" or "incorrect" answers. Answer according to your own feelings, rather than how you think "most people" would answer.

	I disagree a lot	I disagree a little	I neither agree nor disagree	I agree a little	I agree a lot
In uncertain times, I usually expect the best.	○	○	○	○	○
It's easy for me to relax.	○	○	○	○	○
If something can go wrong for me, it will.	○	○	○	○	○
I'm always optimistic about my future.	○	○	○	○	○
I enjoy my friends a lot.	○	○	○	○	○
It's important for me to keep busy.	○	○	○	○	○
I hardly ever expect things to go my way.	○	○	○	○	○
I don't get upset too easily.	○	○	○	○	○
I rarely count on good things happening to me.	○	○	○	○	○
Overall, I expect more good things to happen to me than bad.	○	○	○	○	○

Appendix 3. IN-SIMULATION QUESTIONNAIRE

Lab ID: _____

Month: _____

- If you were playing this game by yourself, what would be your decision about continuing on in the venture
  A. Continue to play
  B. Quit now

	Not at all	A Little	Somewhat	Quite a lot	Very Much
1. At the present time, we are energetically pursuing our goals in the game.	(1)----------	(2)----------	(3)----------	(4)----------	(5)
2. We fear for the future of our venture.	(1)----------	(2)----------	(3)----------	(4)----------	(5)
3. My team feels hopeful that we will succeed in the game.	(1)----------	(2)----------	(3)----------	(4)----------	(5)
4. My team is scared of losing a lot of money at the end.	(1)----------	(2)----------	(3)----------	(4)----------	(5)
5. Right now my team sees ourselves as being pretty successful in the game	(1)----------	(2)----------	(3)----------	(4)----------	(5)
6. My team is worried that we will not reach our goal in the game.					

7. At this point in time, how capable do you think **you** are of effectively playing the SimVenture game?
   (1)Incapable (2)not so capable (3)neutral (4)quite capable (5)Highly capable

8. At this point in time, how capable do you think **your team** is of effectively playing the SimVenture game?
   (1)Incapable (2)not so capable (3)neutral (4)quite capable (5)Highly capable

9. In this round, how engaged have you been in playing the game?
   (1)Not engaged (2)not so engaged (3)neutral (4)quite engaged (5)Highly engaged

Appendix 4. POST-SIMULATION QUESTIONNAIRE

Lab ID: _____

1. How well do you think your team performed in the game?
   Not well(1)—okay(2) —neutral(3)—quite well(4)—very well(5)

2. When you think about your team's performance in the game, how do you account for it? Rate on the listed reasons based on their importance to your team's performance.

My team's effectiveness was based on:	Not important to slightly important	Somewhat important	Moderately important	Quite important	Very important
a. The game itself (being easy or difficult)	(1)----------(2)----------(3)----------(4)----------(5)				
b. Luck	(1)----------(2)----------(3)----------(4)----------(5)				
c. My own skills	(1)----------(2)----------(3)----------(4)----------(5)				
d. My team's skills	(1)----------(2)----------(3)----------(4)----------(5)				
e. My team mates' skills	(1)----------(2)----------(3)----------(4)----------(5)				
f. My effort	(1)----------(2)----------(3)----------(4)----------(5)				
g. My team's joint effort	(1)----------(2)----------(3)----------(4)----------(5)				
h. My team mates' effort	(1)----------(2)----------(3)----------(4)----------(5)				
i. The mood I was in	(1)----------(2)----------(3)----------(4)----------(5)				
j. The mood my teammates were in.	(1)----------(2)----------(3)----------(4)----------(5)				

3. How personally responsible do you feel for your team's performance?
   Not responsible at all(1)—not so responsible(2)--neutral(3)—quite responsible(4)—Highly responsible(5)

Please turn to the next page

Lab ID: _____

4. Until you decided to the leave the game, what were your motive(s) to stay in the game? Rate on the reasons based on their importance to your decision.

		Not important to slightly important	Somewhat important	Moderately Important	Quite important	Very important
a.	I had already been in for so long that it seemed foolish not to continue	(1)	(2)	(3)	(4)	(5)
b.	Once I had stayed as long as I did I decided to keep going. Otherwise all of the previous effort would have been a waste of time and money	(1)	(2)	(3)	(4)	(5)
c.	I wanted to win more money	(1)	(2)	(3)	(4)	(5)
d.	I wanted to help the experimenter with the research.	(1)	(2)	(3)	(4)	(5)
e.	I wanted to prove that my decisions were right from the beginning	(1)	(2)	(3)	(4)	(5)
f.	I wanted to confirm that I have been playing the game in the right way	(1)	(2)	(3)	(4)	(5)
g.	I was hopeful that we could win the prize.	(1)	(2)	(3)	(4)	(5)
h.	I was confident that things will turn around at the end.	(1)	(2)	(3)	(4)	(5)
i.	I wanted to recoup any lost money.	(1)	(2)	(3)	(4)	(5)
j.	The game was engaging.	(1)	(2)	(3)	(4)	(5)
k.	I do not want to lose face in front of others in the class	(1)	(2)	(3)	(4)	(5)
l.	Other reasons: (please describe):					
	_____	(1)	(2)	(3)	(4)	(5)

Appendix 5. DEBRIEF FORM

DEBRIEFING FORM

Thank you for taking part in this study on team decision processes.

The purpose of this study is to take a closer look at how people, when faced with a highly challenging but highly rewarding goal, strive and persist against negative performance feedback. We are interested in how your team made its decisions to either quit or continue as well as how you, as an individual, felt and thought as part of the team.

We only gave you a brief idea at the beginning of the study of the experiment's purpose and process. Sometimes when we are studying how people make decisions (as in this experiment) we don't give people a full description of what we are studying. This helps us get natural responses from people. Not every psychology study does this. There are a few things about this experiment that we would like to explain.

The goal we set for you was extremely challenging. In fact, it is rarely achieved by inexperienced players. We were hoping to better understand how people respond to continuous negative feedback on their performance, if they choose to persist or quit, and how a team reaches such decisions. There really is no right or wrong decision. We were just interested in your feelings and thoughts in such situations.

We will be running this experiment for some time. We would deeply appreciate it if you would <u>not</u> talk to anyone about the study. Sometimes if people know what the study is about, that knowledge will influence their responses even when they don't mean for it to, and then the data are not valid.

If you have any complaints, concerns, or questions about this research, please feel free to contact, Tori Yu-wen Huang (tori.huang.1@city.ac.uk).

Thank you again for your participation!

Final debrief email

Dear all

Thank you for participating in the SimVenture game sessions at our behavioural research lab. Your participation has generated a great amount of valuable data which helped advance our research in team decision processes.

As part of the study we are waiving all outstanding debt incurred from participating in the game. You do not have to pay us anymore and please disregard the IOU note. As some students have already left Cass, the email addresses we have on file might be out of use. We are also going to follow-up, but please pass on this message to your classmates and friends if possible.

As was explained at the end of the sessions, the purpose of this study was to examine how people, when faced with a highly challenging but highly rewarding goal, strive and persist against negative performance feedback. We are interested in how your team made its decisions to either quit or continue as well as how you, as an individual, felt and thought as part of the team. We want to better understand this behavioural pattern in the context of entrepreneurship, and that's what the research design – the SimVenture game, the payment to Tori for investing into the business - helps simulate. The questionnaires you filled out before, during and after the game as well as the video recording of your decision processes will allow us to study what drives such behaviour. The amount of money you are willing to spend is also one of the study variables.

Also, we would like to take this opportunity to congratulate Cliff Wong, William Wang and Gabriel Wai (MSc in Management, Entrepreneurship stream) who participated in May 2009 for winning the prize!

We hope that you have all learned something and enjoyed the experience. Please contact Tori if you have any queries about our research.

Thank you again for your help with our research, we hope you enjoyed the experience and wish you best of luck to your studies and future careers.

Kind regards,
Prof. Vangelis Souitaris
Tori Y. Huang

Appendix 6. IOU NOTE

IOU note

Team _____, hereby declare that we owe Tori Y. Huang the amount of £_____, incurred on _____ (the date) from participating in the SimVenture game experiment. The total amount is to be paid in full on a later date TBD. Further notification will be made through email by Tori to the Team.
We confirm that the email addresses Tori has on file are correct.

Team member: _____ (print name), _____ (signature)

Team member: _____ (print name), _____ (signature)

Team member: _____ (print name), _____ (signature)

Tori Yu-wen Huang, _____

Date:_____

Appendix 7. CODING SHEET AND CODING GUIDE

Individual coding sheet

Coder		Team	

Time: ____:____:____		Unpleasant		Neutral		Pleasant
	A	1	2	3	4	5
	B	1	2	3	4	5
	C	1	2	3	4	5
		Low energy		Neutral		High energy
	A	1	2	3	4	5
	B	1	2	3	4	5
	C	1	2	3	4	5
		Bored		Neutral		Engaged
	A	1	2	3	4	5
	B	1	2	3	4	5
	C	1	2	3	4	5
		Not at all	A Little	Somewhat	Quite a lot	Very Much
Worried	A	1	2	3	4	5
	B	1	2	3	4	5
	C	1	2	3	4	5
Nervous	A	1	2	3	4	5
	B	1	2	3	4	5
	C	1	2	3	4	5
Fearful	A	1	2	3	4	5
	B	1	2	3	4	5
	C	1	2	3	4	5
Hopeful	A	1	2	3	4	5
	B	1	2	3	4	5
	C	1	2	3	4	5
		Sluggish/Dull/ Drowsy				Cheerful/ Energetic
	A	1	2	3	4	5
	B	1	2	3	4	5
	C	1	2	3	4	5
		Calm/Serene				Distressed/ Nervous/ Annoyed/ Irritable
	A	1	2	3	4	5
	B	1	2	3	4	5
	C	1	2	3	4	5

Team coding sheet

Coder		Team	

Time: ____:____:____	Unpleasant		Neutral		Pleasant
	1	2	3	4	5
	Low energy		Neutral		High energy
	1	2	3	4	5
	Bored		Neutral		Engaged
	1	2	3	4	5
	Not at all	A Little	Somewhat	Quite a lot	Very Much
Worried	1	2	3	4	5
Nervous	1	2	3	4	5
Fearful	1	2	3	4	5
Hopeful	1	2	3	4	5
	Sluggish/Dull/ Drowsy				Cheerful/ Energetic
	1	2	3	4	5
	Calm/Serene				Distressed/ Nervous/ Annoyed/ Irritable
	1	2	3	4	5

Coding guide

<table>
<tr>
<td>Pleasant
– Smile, grin, upward shaped mouth
– Laugh
– Arched/raised eyebrows
– Eye contact with team mates
– Physical contact with team mates
– Leaning forward
– More body movements and hand gestures
– Body poised to include team members
– Paying attention to team members when they speak</td>
<td>Unpleasant
– Downward shaped mouth
– Frowning
– Excessive blinking
– Droopy eyes
– Little or no eye contact with team mates
– Leaning back
– Little or no physical contact with team mates
– Slouching
– Little body movement and hand gestures
– Body orienting away from group
– Rubbing eyes
– Yawning
– Closed fists
– Finger tapping table
– Biting nails, picking skin
– Poised for action</td>
</tr>
<tr>
<td>High energy
– A lot of eye contact
– Open mouth
– Arched eyebrows
– Poised for action
– Startled
– Restless
– Fingers tapping table (+)
– More physical contact with team mates
– More body movements and hand gestures
– Leaning forward to the laptop
– Orienting toward group members</td>
<td>Low energy
– Little eye contact
– Closed mouth
– Little facial or body movement
– Slow movement
– Reclined position/leaning backward
– Yawning
– Rubbing eyes
– Resting head on hand</td>
</tr>
<tr>
<td>Engaged
– Leaning forward to laptop
– Focusing on laptop
– Paying attention to team mates when they speak</td>
<td>Bored
– Leaning backward
– Looking away from laptop
– Not paying attention to team mates</td>
</tr>
<tr>
<td colspan="2">Worried
– Frowning
– Mouth pulled downward</td>
</tr>
<tr>
<td colspan="2">Nervous
– Biting nails, picking skin, twirling hair
– Fingers tapping table
– Excessive blinking
– “Nervous smile”
– Closed, downward-shaped mouth (+)
– Frowning (+)
– Swallowing (+)</td>
</tr>
</table>

<table>
<tr><td colspan="2">Fearful
– Eyebrows raised, straightened, pulled together, and not arched
– Glare in eyes
– Tension in lips, mouth pulled downward</td></tr>
<tr><td colspan="2">Hopeful
– Energetic
– Determination
– Poised for action
– Nodding</td></tr>
<tr><td>Sluggish/Dull/Drowsy
– Slow or no body movement
– Little or no facial expression
– Droopy eyes
– Yawning
– Head resting on hand
– Staring away
– Withdrawing from team mates
– Leaning back forward</td><td>Cheerful/Energetic
– Smile
– Arched eyebrows
– Lots of eye contact
– A lot of body movement and hand gestures
– Poised for action
– Leaning forward
– Orienting toward team mates
– More physical contact with team mates</td></tr>
<tr><td>Calm/Serene
– Little body movement
– Little facial expression
– Mouth might be slightly upward
– Relaxed but oriented toward team mates</td><td>Distressed/Nervous/Annoyed/Irritable
– Eyebrows lowered, chin raised, mouth closed
– Intermittent eye contact
– Sneering
– Flushed face
– “Nervous smile”
– Clenched teeth
– Closed fists
– Hand tremors
– Poised for action
– Biting nails, picking skins, twirling hair</td></tr>
</table>