Exploring entrepreneurs' adaptive toolbox: The relationship between the environment, decisions, and decision-making

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Declaration

I, Sonia-Cristina Codreanu, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

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Abstract

Entrepreneurship is becoming an ever more popular career choice for individuals worldwide, and this trend has been encouraged by policy-makers given the economic, technological, and social benefits associated with entrepreneurship (Van Praag & Versloot, 2007). Thus, understanding how individuals can successfully build and grow new ventures is a topic of significance, with both academic and practical implications. The most promising area of research on the role of the individual in entrepreneurship has focused on entrepreneurs' cognitions and decision-making. Whereas a variety of perspectives have emerged, effectuation theory (Sarasvathy, 2001a) has established itself in the literature as one of the most prominent frameworks for understanding how entrepreneurs make decisions during new venture creation. Nevertheless, when and why entrepreneurs rely on effectual or causal logics to make decisions is still poorly understood (S. Read, Sarasvathy, Dew, & Wiltbank, 2016). To address this gap, this thesis introduces a micro-level investigation of the role that the environment plays in driving entrepreneurs' use of effectuation and causation. It integrates effectuation theory with insights stemming from ecological rationality theory (Gigerenzer & Gaissmaier, 2011; Todd, Gigerenzer, & The ABC Research Group, 2012) and action theory (Hacker, 2003; Suchman, 1987). The findings show that entrepreneurs' perceptions of the environment in which they operate – in particular, perceptions of decision structure (chapter 2) and perceptions of different types of missing information about the environment (chapter 4) – drive their use of effectuation and causation. This thesis also makes a methodological contribution to the effectuation literature by developing and validating a scenario-based measure of effectuation, which assesses entrepreneurs' use of effectual logics for specific

decisions in the new venture creation process (chapter 3). Thus, this research contributes to our understanding of the antecedents of effectuation, and proposes a novel approach to studying entrepreneurial decision-making that integrates effectuation and insights from psychological theories.

Impact statement

This thesis contributes to our understanding of how entrepreneurs come to create new ventures, and specifically the decision-making processes and actions that help them achieve this goal. The research presented firstly clarifies what drives entrepreneurs to select particular strategies for specific decisions and environmental conditions, and illustrates the ecological rationalities of these strategies – how they fit with and help entrepreneurs navigate different challenges in the new venture creation process. Thus, this thesis contributes significantly to our understanding of the antecedents that underpin entrepreneurs' use of distinct decision-making strategies and actions. Secondly, the thesis also provides more clarity on how entrepreneurs use and combine distinct strategies and action principles in the process of new venture creation. Specifically, the research presented clarifies the relationship between two contrasting strategies to entrepreneurial decision-making and action, namely causation (a prediction-based strategy) and effectuation (a control-based strategy), and shows how entrepreneurs can either adaptively switch between these strategies or combine them depending on the particular decision or environmental condition they encounter. Thirdly, this thesis provides a methodological contribution to the entrepreneurship field by developing a novel assessment of entrepreneurial decision-making that seeks to better capture the interaction between the decision-maker and the environment in which they operate. This situated, scenario-based measure of decision-making can extend the field of research on entrepreneurial decision-making in multiple directions, for instance by future research investigating in more detail the individual-level antecedents and outcomes associated with distinct decision-making strategies, bettering our understanding of specific principles underpinning

entrepreneurs' decision-making, and investigating the role of heterogeneity in the decision-making strategies used by new venture team members.

In terms of practical contributions, this thesis highlights how entrepreneurs can better respond to the different challenges they encounter in the new venture creation process. Rather than relying on the same decision-making strategy throughout new venture creation, or in particular stages of the venture, entrepreneurs can benefit from using decision-making strategies that fit the content and structure of the specific decisions they are faced with. The insights presented in this thesis also have implications for entrepreneurship education, and suggest that entrepreneurship education should train the whole range of effectual and causal principles for decision-making to enable entrepreneurs to make use of their adaptive toolbox. Lastly, the newly introduced measure of entrepreneurial decision-making could also be used as a self-assessment and developmental tool to make entrepreneurs more aware of the strategies they tend to rely on most often, and the strategies they can further leverage in their decision-making. The use of critical incidents as a basis for the development of the measure could be used to teach and illustrate the concept of decision fit – choosing the decision-making strategy that fits with the particular demands and characteristics of a given decision or environment.

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Conference presentations

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[1] Chapter 2 has been adapted from the version of the paper that was submitted for review.

Paper presented (oral presentation) at the Research in Entrepreneurship (RENT) Conference, Berlin, Germany.

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Chapter 1 Introduction

Entrepreneurship is considered as one of the main drivers of economic, technological, and social progress (Van Praag & Versloot, 2007). Furthermore, more and more individuals are choosing to start their own ventures rather than work within large, established organisations. In the United Kingdom alone, the number of new ventures created has nearly doubled from 2002 to 2017, and the country has witnessed the highest number of new ventures created in the world in recent years (OECD, 2017). As such, understanding firstly, how new ventures come to be, and secondly how individuals can successfully build and grow new businesses is a topic of significance, with both academic and practical implications.

The role of individuals within entrepreneurship has been studied for the past 55 years (M. Frese & Gielnik, 2014; Gorgievski & Stephan, 2016). However, there was a break in the momentum of research at the individual-level due to non-conclusive results showing that individual differences did not play a significant role in the prediction of entrepreneurial phenomena and outcomes (Gartner, 1989). Nevertheless, there has been a revival of individual-level research in entrepreneurship that investigates the cognitive processes underpinning entrepreneurship (Mitchell, Busenitz, Mcdougall, Morse, & Smith, 2002). In particular, research on entrepreneurial decision-making, defined as the choices that entrepreneurs make when faced with opportunities to create future goods and services (Shane & Venkatamaran, 2000; Shepherd, Williams, & Patzelt, 2015), has been particularly prolific. This literature outlines a number of theories that have advanced our understanding of how entrepreneurs leverage particular strategies and approaches to help them mitigate and adapt to a highly uncertain environment, and in turn make progress in the creation of

their new ventures. Specifically, theories in psychology and cognitive sciences have a long tradition in influencing research on entrepreneurs' decision-making, which has sought to apply and extend these domain-general theories to the entrepreneurship domain. In particular, approaches inspired by the heuristics-and-biases (Tversky & Kahneman, 1986), expertise (K. Anders Ericsson & Charness, 1994), and information processing (Neisser, 1967; S. J. Read, 1987) literatures have made significant inlays into understanding how entrepreneurs make decisions.

Despite important advancements in the understanding of entrepreneurial cognition and decision-making, significant gaps still exist. In particular, existing research and theories fail to understand decision-making within the context and environment in which it occurs. Whereas the role of uncertainty is highlighted in many theories and accounts of entrepreneurial decision-making (Haynie, Shepherd, Mosakowski, & Earley, 2010; Sarasvathy, 2001a; Shepherd et al., 2015), this construct is particularly problematic as different researchers adopt different definitions and operationalisations of uncertainty. As a result, empirical studies find contradictory patterns in terms of the relationship between uncertainty and decision-making (Jiang & Tornikoski, 2019; McKelvie, Haynie, & Gustavsson, 2011; S. Read, Dew, Sarasvathy, Song, & Wiltbank, 2009; Sarasvathy, 2001a). Furthermore, a number of other environmental factors, such as lack of resources (Karami, Wooliscroft, & McNeill, 2020), the presence and influence of other stakeholders (e.g., investors, co-founders) (Nummela, Saarenketo, Jokela, & Loane, 2014; Reymen et al., 2015), as well as the stages of development of a venture (Berends, Jelinek, Reymen, & Stultiëns, 2014) have also been found to have an impact on entrepreneurs' decision-making, however precisely what their role is and how they impact decision-making is poorly

understood. As such, the understanding of the antecedents of entrepreneurial decision-making is still lacking in clarity, thus making researchers unable to predict precisely when, and why, entrepreneurs make decisions and act in particular ways in the process of new venture creation.

In the present thesis, I propose a new framework at the intersection between psychology, cognitive sciences, and entrepreneurship for understanding what drives entrepreneurial decision-making and actions. Empirically, I investigate several decision-level (content, complexity, and costs) and firm-level (state, effect, and response uncertainty) antecedents to entrepreneurs' use of effectuation and causation. Theoretically, I integrate ecological rationality theory (Gigerenzer & Gaissmaier, 2011; Todd & Gigerenzer, 2012), action theory (Hacker, 2003; Suchman, 1987), and effectuation theory (Sarasvathy, 2001a) to help us understand how changing perceptions of the environment in which entrepreneurs make decisions and act drive their adaptive use of effectuation and causation. Thus, this thesis contributes firstly to the effectuation literature by expanding our understanding of the antecedents of effectuation and the mechanisms driving entrepreneurs' use of specific decision-making logics and actions. Secondly, the thesis also aims to make a contribution to the ecological rationality literature by proposing a finer-grained conceptualisation of the environmental structures in which decision-making occurs.

In the remainder of the introduction, I will review the literature on entrepreneurial decision-making, in particular the different frameworks and theories that have been proposed to understand how entrepreneurs make decisions in the new venture creation process. Subsequently, I will focus on effectuation theory as a

framework that highlights the role of the context in which entrepreneurial decision-making occurs, and will propose a new approach that extends effectuation theory. I suggest that a focus on the interaction between the decision-maker and the environment in which they operate is key to advancing our understanding of entrepreneurial decision-making. Finally, I outline the structure of the thesis and give a brief overview of the studies conducted within the thesis.

1.1 Literature review

1.1.1 Entrepreneurial decision-making

Cognitive research in entrepreneurship has a long tradition (Mitchell et al., 2002), with past research mainly focusing on how entrepreneurs (or expert entrepreneurs more specifically) differ from other groups of individuals in their judgment and decision-making processes (Baron, 2004; Baron & Ensley, 2006; Busenitz & Barney, 1997; Mitchell, Smith, Morse, Peredo, & McKenzie, 2002). Underlying this stream of literature is the assumption that "entrepreneurship concerns itself with distinctive ways of thinking and behaving" (Mitchell et al., 2007, p.3). In other words, processes that underpin entrepreneurs' decisions to identify, evaluate and exploit opportunities to bring future goods and services into existence (Shane & Venkatamaran, 2000) are different from processes that underpin everyday decision-making and warrant a unique and distinct field of enquiry. Overall, research into entrepreneurial decision-making has sought to identify entrepreneurs' distinctive cognitions and decision-making processes by studying the strategies, knowledge structures, and types of processes used by entrepreneurs when making decisions under uncertainty. In the sections below, I briefly review the most prominent research strands answering this question.

1.1.2 Heuristics and biases

Heuristics refer to simplifying strategies and decision shortcuts that enable individuals to make decisions quickly, without engaging in costly search and optimisation processes (Tversky & Kahneman, 1971, 1986). In this tradition, heuristics are seen as strategies that decision-makers engage in due to limitations in their information processing capacity (Gigerenzer & Brighton, 2009). Thus, inherent to this approach is the assumption that the use of heuristics results in errors in decision-making, or biases that could be avoided if more resource-intensive logically rational processes were used.

This perspective has been applied to the study of entrepreneurial decision-making, and in particular to investigate whether entrepreneurs use heuristics more often than other groups, given the increased uncertainty and complexity of the environment in which they make decisions (Mitchell et al., 2007). Past research has found that entrepreneurs tend to overestimate their ability to make correct predictions (i.e., overconfidence), overgeneralise from limited information at hand (i.e., representativeness or belief in the law of small numbers), and believe they can control largely uncontrollable events (i.e., illusion of control) (Busenitz & Barney, 1997; M. Simon, Houghton, & Aquino, 2000). When compared to managers within large organisations (Busenitz & Barney, 1997), as well as managers of new ventures that are not founders (Forbes, 2005), entrepreneurs are found to be more likely to fall prey to these biases. Furthermore, entrepreneurs in smaller, younger firms who introduce pioneering products to the market are more likely to exhibit illusion of control, law of small numbers, and reasoning by analogy (M. Simon & Houghton, 2002).

Whereas this literature highlights important cognitive processes that may explain why entrepreneurs decide to take the plunge and found new ventures even though the chances of success of a new venture are very low (Mitchell et al., 2007; M. Simon et al., 2000), it does not help elucidate how entrepreneurs manage to *successfully* create and grow new ventures *despite* these biases. In other words, if entrepreneurs' use of heuristics results in errors of judgment, how do some entrepreneurs still manage to create successful ventures? Some authors contend that successful entrepreneurs may have a better ability to balance the advantages (e.g., quick and frugal decision-making, expedited learning) and disadvantages (e.g., potential errors in judgment) of using heuristics (Baron, 2004). Furthermore, critics of the heuristics-and-biases school (Gigerenzer & Brighton, 2009; Gigerenzer, Todd, & The ABC Research Group, 1999) have more recently presented compelling evidence that heuristics may provide decision-makers advantages not only in terms of speed and frugality, but also in terms of decision quality in particular environments (e.g., high uncertainty). However, these propositions have not been investigated empirically in the entrepreneurship domain. I discuss these ideas in more detail later on in the chapter. A different stream of literature, that of expert scripts (Baron & Henry, 2010), addressed the question of what differentiates successful (or expert) entrepreneurs in terms of their decision-making, and we turn to this perspective next.

1.1.3 Expert scripts

The expert scripts literature seeks to identify whether there are key differences in decision-making between expert entrepreneurs (i.e., entrepreneurs who have both the experience and the proven ability to own and manage successful ventures) and other groups of individuals (e.g., non-entrepreneurs, novice entrepreneurs). In

particular, it explores the scripts - knowledge structures about a specific field or domain, (S. J. Read, 1987) - that experts develop as a result of years of deliberate practice, defined as intense, prolonged, and highly focused effort to improve current performance (Baron & Henry, 2010; K. A. Ericsson, Krampe, & Tesch-Romer, 1993). These scripts enable expert entrepreneurs to use information in significantly better ways, thus resulting in improved decision-making (Mitchell et al., 2007; Neisser, 1967).

Comparisons between novice and expert entrepreneurs' scripts reveal that there are significant differences in the content and the structure of the scripts that they use during decision-making. For instance, expert entrepreneurs' scripts in relation to potential business opportunities were more defined, richer in content, and focused on the factors and conditions necessary for starting and running a new venture compared to novices (Baron & Ensley, 2006). Furthermore, scripts related to arrangements (i.e., relationships, resources, assets), willingness (i.e., commitment to starting a new venture), and ability (i.e., the capabilities, skills, knowledge, and attitudes required to start a new venture) were found to relate to venture creation decisions in a sample of entrepreneurs from seven different countries (Mitchell, Smith, Seawright, & Morse, 2000), and to differentiate between entrepreneurs and non-entrepreneurs in a sample of entrepreneurs from eleven countries (Mitchell, Smith, et al., 2002). This evidence suggests that entrepreneurial scripts are universal, and that they are not driven by culture but rather the entrepreneurial task, thus providing support for the study of scripts specific to entrepreneurship. In addition to universal entrepreneurial scripts, more specific scripts tied to particular tasks within the new venture creation process have also been documented. For instance, different scripts related to terminating an

unsuccessful initiative or project were found in corporate entrepreneurs, summarised as undisciplined termination, strategic termination, and innovation drift. The strategic termination script was most reliably associated with subsequent learning, thus demonstrating the differential effectiveness of the scripts in this task (Corbett, Neck, & Detienne, 2007).

Overall, this stream of literature suggests that entrepreneurs rely on specific scripts (or knowledge structures) that enable them to make efficient decisions in the creation and development of new ventures. Nevertheless, whereas these early findings set the foundations towards understanding how entrepreneurs and especially expert entrepreneurs make decisions, they have not developed into an articulated theoretical framework that could be used for guiding further research and deriving testable hypotheses. A more fully developed theoretical framework of entrepreneurial decision-making was introduced by Sarasvathy (2001a), in a seminal article outlining effectuation theory. I describe this account of entrepreneurial decision-making next.

1.1.4 Effectuation theory

Effectuation theory proposes an account of entrepreneurial decision-making under Knightian uncertainty, when future events cannot be predicted and neither can their occurrence be associated with a probability distribution (Knight, 1921; Sarasvathy, 2001a, 2008). A context of high uncertainty has been deemed as one of the defining features of entrepreneurial decision-making (Shepherd et al., 2015). Thus, effectuation theory focuses on outlining a series of logics (i.e., strategies) and principles underpinning each logic that entrepreneurs use to help them decide in the face of uncertainty. Effectual and causal logics consist of four contrasting principles

describing the decision-maker's basis for action, their view of risk and resources, their attitude towards contingencies, and towards outsiders (Brettel, Mauer, Engelen, & Küpper, 2012; Fisher, 2012; Sarasvathy, 2001a). A summary of these contrasting principles can be found in Table 1-1.

Table 1-1: Effectual and causal principles

	Causal principles	Effectual principles
Basis for action	*Predict the future* and plan actions accordingly.	*Focus on means* already within control, direct actions towards creating new effects using these existing means.
View of risk and resources	*Maximise returns*: use predictions of future returns to establish size of investment; focus on the upsides of entrepreneurial investments.	*Affordable loss*: estimate what you would be willing and could afford to lose in a worst-case scenario; focus on the downsides of investment.
Attitude towards contingencies	*Avoid contingencies*, view these as endangering the effective and accurate execution of the business plan.	*Leverage contingencies*: keep decision-making approach flexible to adapt and gather information through such unexpected events.
Attitude towards outsiders	*Competitiveness*: stakeholders must be carefully selected and enrolled once a clear business plan has been established.	*Co-creation*: co-opt stakeholders early on through *partnership*s, allowing other actors (e.g., customers, suppliers, other strategic partners) to shape the strategy of the new venture.

Firstly, the logic underpinning entrepreneurs' actions differs between effectuation and causation. Entrepreneurs can either attempt to predict the future and plan their actions accordingly, or act on the things that are within their and their stakeholders' control while eschewing predictive information (Dew, Read, Sarasvathy, & Wiltbank, 2009). Under a causal logic, entrepreneurs will seek to first gather

information that will allow them to *predict the future*. Based on this information, entrepreneurs decide what they require in terms of further resource acquisition. Under an effectual logic, entrepreneurs *focus on means* already within their control, by answering the following questions: "who they are", "whom they know", and "what they know" (Sarasvathy & Dew, 2005). The entrepreneurs then direct their actions towards creating new effects using these existing means.

Secondly, effectual and causal logics also differ in relation to resource investment decisions. Whereas entrepreneurs guided by a causal logic use predictions of future returns to establish the size of their investments, entrepreneurs employing an effectual logic estimate what they would be willing and could afford to lose in a worst-case scenario (Martina, 2020). As such, the *maximise returns* principle focuses on the upsides of entrepreneurial investments, whereas *affordable loss* takes into consideration the downsides of these resource investments (Dew, Sarasvathy, Read, & Wiltbank, 2009).

Thirdly, effectual and causal logics differ in their approach to dealing with unexpected events or contingencies. Entrepreneurs deciding under a causal logic view contingencies as endangering the effective and accurate execution of the business plan, and as such seek to *avoid contingencies* at all cost (Perry, Chandler, & Markova, 2012). By contrast, the effectuation logic encourages entrepreneurs to *leverage contingencies*, by keeping their decision-making approach flexible enough to adapt and gather information about the environment through such unexpected events (Chandler, Detienne, Mckelvie, & Mumford, 2011).

Lastly, effectual and causal logics differ with regard to the interactions that entrepreneurs engage in with other actors (people or other organisations). Entrepreneurs deciding under a causal logic tend to regard knowledge and information

as a proprietary resource that needs to be protected from outsiders, thus contributing to their venture's *competitiveness*. As such, causation prescribes that stakeholders must be carefully selected and enrolled once a clear business plan and strategy have already been established for the venture. On the other hand, effectual entrepreneurs tend to prefer co-opting stakeholders early on, thus allowing other actors to shape the strategy of the new venture through *co-creation*. Such stakeholders can include customers, suppliers, and other strategic partners (Chandler et al., 2011; Sarasvathy & Dew, 2005).

Effectuation has become a widely adopted theoretical framework for studying entrepreneurial decision-making, and one of the most researched constructs in the entrepreneurship literature (Grégoire & Cherchem, 2020; McKelvie, Chandler, Detienne, & Johansson, 2020; Perry et al., 2012). It has been used to understand entrepreneurial decision-making both in the context of new venture creation (Berends, Jelinek, Reymen, & Stultiëns, 2014; Jiang & Tornikoski, 2019; Reymen et al., 2015; Smolka, Verheul, Burmeister-Lamp, & Heugens, 2018), as well as corporate entrepreneurship or new product development processes within existing organisations (Blauth, Mauer, & Brettel, 2014; Brettel et al., 2012; Werhahn, Mauer, Flatten, & Brettel, 2015). Whereas critics of effectuation theory have highlighted several weaknesses of the theory in relation to underspecified boundary conditions, limitations in the empirical testability of its propositions, and a lack of theorised mechanisms through which effectuation impacts on key entrepreneurial outcomes (Arend, Sarooghi, & Burkemper, 2015), a growing body of literature attests to the descriptive power of effectuation theory and its potential for advancing our understanding of how entrepreneurs actually think and behave (Alsos, Clausen, Mauer, Read, & Sarasvathy, 2020; Grégoire & Cherchem, 2020; Perry et al., 2012). Thus, this

thesis will use and build on effectuation theory as a framework for conceptualising how entrepreneurs decide and act in the new venture creation process.

Whereas effectual logics have been shown to be preferred by entrepreneurs, who decide and act in a context of uncertainty (Dew, Read, et al., 2009; Sarasvathy, 2001b), causal logics seem to be more applicable to managerial decision-making within larger, more established organisations where managers decide under risk (i.e., the possible outcomes and their probability distributions are known, Knight, 1921) (Alvarez & Barney, 2005; Alvarez & Busenitz, 2001) . However, from a theoretical standpoint, effectual and causal logics are not opposite approaches, and as such can be combined during decision-making (Sarasvathy, 2001a, 2008). Empirical evidence is also accumulating attesting to the prevalence and advantages of a hybrid approach to new venture creation that combines effectual and causal logics at different stages of development of the new venture (Reymen et al., 2015; Smolka et al., 2018). As such, the question of what drives entrepreneurs to use a specific logic at a given time arises, which is addressed in the following section.

1.1.5 Antecedents of effectual and causal logics

1.1.5.1 Individual-level antecedents

Effectuation research has started investigating factors associated with entrepreneurs' use of effectual and causal logics. Early effectuation research focused on expertise as a key individual-level variable associated with increased use of effectual logics (Dew, Sarasvathy, et al., 2009; S. Read, Dew, et al., 2009; Sarasvathy, 2001b). Nevertheless, more recent studies have shown that novice and student entrepreneurs also rely on effectuation, casting doubt on expertise being a necessary precondition for the usage of effectual logics (e.g., Politis, Winborg, & Dahlstrand,

2010). Subsequently, founder identity has been explored as a potential individual-level factor related to effectuation, with particular social identities being linked to increased use of effectual logics (Alsos, Clausen, Hytti, & Solvoll, 2016). Nevertheless, subsequent research has found diverging result patterns in relation to entrepreneurs' identities and their use of effectuation and causation (e.g., Sieger, Gruber, Fauchart, & Zellweger, 2016). It becomes apparent that research findings on individual-level antecedents of effectual logics are mixed, with a recent review of the effectuation literature concluding that "evidence about possible relationships between individual characteristics and one's mobilisation of / preference towards effectuation remains inconclusive" (Grégoire & Cherchem, 2020, p. 627).

1.1.5.2 Venture-level antecedents

More recently, research has started focusing on venture- rather than individual-level factors driving entrepreneurs' use of effectual and causal logics. In particular, given the theoretical underpinnings of effectuation theory, uncertainty has been proposed as a key antecedent of effectuation (Perry et al., 2012; Sarasvathy, 2001a; Wiltbank, Dew, Read, & Sarasvathy, 2006). Uncertainty tends to co-vary with the venture's stage of development, in that uncertainty is high in the early stages of creation of a venture and tends to reduce as the venture reaches a more mature stage of development (Sarasvathy, 2008). Berends and colleagues (2014) find that entrepreneurs in small firms tend to use effectual logics in the early stages of their product innovation efforts when uncertainty levels are high, and then gradually shift towards causation logics in later stages as uncertainty reduces. Resource constraints, although not a boundary condition for effectuation (see Fisher, 2012), are also related to entrepreneurs' use of effectual logics (Karami et al., 2020), as well as constraints

arising from changes in key personnel (Nummela et al., 2014) or regulations (Maine, Soh, & Dos Santos, 2015).

At the same time, a number of studies reveal heterogeneity in entrepreneurs' use of effectuation that we do not fully understand. For instance, recent studies show that entrepreneurs use causal rather than effectual logics at the very start of the venture creation process, when uncertainty is typically high (Jiang & Tornikoski, 2019). Furthermore, evidence from a longitudinal process study suggests that entrepreneurs use effectual logics also in the later stages of development of a venture, for instance in crisis situations when they respond by widening their venture's scope (Reymen et al., 2015). This is in line with increasing recognition that effectuation and causation tend to co-occur, and that entrepreneurs mix both approaches in their decision-making (Reymen et al., 2015; Smolka et al., 2018). However, specifically when and why entrepreneurs rely on effectual or causal logics to make decisions is still poorly understood (S. Read et al., 2016). Whereas the literature has focused on broad venture-level factors, with most attention devoted to uncertainty, it has rarely clarified what type of uncertainty researchers are referring to (Jiang & Tornikoski, 2019). Furthermore, the mechanisms through which uncertainty affects entrepreneurs' decision-making, and thus drive their use of effectual or causal logics, are often left unexplained (Grégoire & Cherchem, 2020). In sum, the antecedents of effectuation still remain vague, underspecified, and not as well understood as they should be. This is a key gap that I aim to address in this thesis. The proposed approach to addressing this gap is outlined in the section below.

1.2 Proposed approach and structure of this thesis

The previous sections outline past research on entrepreneurial decision-making and highlight significant gaps in our understanding of the antecedents of effectuation and causation. Filling this gap is the primary objective of this thesis. I argue that there are significant research and theoretical opportunities for clarifying some of the contradictory relationships that past research has found between key venture-level antecedents (e.g., uncertainty, stakeholders, resource constraints) and entrepreneurs' use of effectuation. In particular, I make the argument that venture-level antecedents previously investigated are too broad and lack specificity, thus resulting in mixed findings. Instead, I suggest a more in-depth, micro-level investigation of the role that the environment plays in driving entrepreneurs' use of effectuation and causation. In line with the ecological rationality approach within the cognitive sciences (Gigerenzer & Gaissmaier, 2011; Todd & Gigerenzer, 2012) and action theory in psychology (Hacker, 2003; Suchman, 1987), entrepreneurs should seek to adapt to the changing and evolving environments they encounter throughout the new venture creation process by using distinct decision-making logics and actions. Thus, in order to understand the antecedents of effectuation, we need a better understanding of the structure of the environment in which entrepreneurs operate, and specifically how entrepreneurs make sense of this environment through their perceptions. Previous research has shown that objective environmental properties show modest relationships with behaviour, and instead subjective perceptions of the environment are much more important drivers of entrepreneurs' cognitions and actions (McKelvie et al., 2011). As such, across a series of studies, we seek to better understand how entrepreneurs make sense of the environment in which they operate, and how the perceived environment

in turn drives their use of effectuation. I summarise the three empirical chapters of this thesis and the studies included in each of them below.

1.2.1 Chapter 2 – Entrepreneurs' ecological rationality: How the nature of decisions drives effectual and causal decision-making logics

Chapter 2 presents an empirical investigation of how the nature of the decisions that entrepreneurs encounter in the new venture creation process drives their use of effectual and causal decision-making logics. Rather than investigating broad individual- or venture-level factors, I focus attention on the decision itself, and ask the following questions: Could it be that some of the decisions entrepreneurs face lend themselves better to effectual logics, and others to causal logics, irrespective of individual differences and stage of a venture? And if so, what are the defining characteristics of these decisions that may help future research to predict when and why entrepreneurs use particular decision logics? By focusing on the micro-level of the decision, I seek to better understand how entrepreneurs make sense of and structure the environment in which they operate through their cognition, and in turn how this influences entrepreneurs' use of effectuation.

Thus, to develop our understanding of the antecedents of effectuation, this chapter introduces a new construct – that of *decision fit*. Focusing on the fit between decision-making logics and actual decisions allows us to unpack the micro-foundations (Shepherd, 2015), or the individual cognitions underpinning entrepreneurs' use of effectual and causal logics. To do so, I integrate insights from ecological rationality theory (Gigerenzer & Gaissmaier, 2011; Todd et al., 2012) with effectuation theory, to investigate when and why entrepreneurs use effectual or causal logics to make particular decisions. I propose that ecological rationality gives us a

framework for understanding the nature of the decisions entrepreneurs face, and to explore how entrepreneurs adapt the decision-making logics they use to fit with the content (i.e. what the decision is about, e.g., business development, cash flow, human resources) and structure (i.e. what information a decision-maker considers about a decision) of the decisions they face. I am interested in answering the following research question: *In what ways does decision content and structure drive entrepreneurs' use of effectual and causal logics?* I conduct a qualitative study with 41 entrepreneurs in the United Kingdom and analyse 290 decisions regarding decision content, structure, and the logics entrepreneurs use to make the decision. In line with the theory of ecological rationality, the findings suggest that the decision logic entrepreneurs adopt is a function of its fit with the decision they face (i.e., its content and structure). I highlight how the findings can help extend our understanding of when and why entrepreneurs use effectual and causal decision-making logics, and what the theoretical and practical implications of these findings are.

1.2.2 Chapter 3 – Effectual and causal decision-making logics: Development and validation of a scenario-based measure

Whereas chapter 2 explored qualitatively how the nature of the decisions entrepreneurs encounter drives their use of effectual and causal decision-making logics, in chapter 3 I aim to develop a quantitative measure highlighting the fit between decisions and entrepreneurs' use of effectuation. This addresses the previously highlighted need to better understand entrepreneurs' use of effectuation within the specific environment in which entrepreneurs operate (S. Read et al., 2016). As the effectuation literature reaches a more intermediate stage of development (Grégoire & Cherchem, 2020; Perry et al., 2012), the need for reliable and valid measurement of the effectuation construct becomes apparent. Despite a proliferation

of measures of effectuation developed (McKelvie et al., 2020), the measurement of effectuation remains controversial as existing measures suffer from important limitations hindering empirical research. Specifically, existing measures use multiple operationalisations of effectuation and its principles, they assess behaviours rather than decision-making logics, and aggregate at the team- and venture- level. These limitations hinder the accumulation of evidence within the effectuation literature, and testing propositions and hypotheses derived from theory, as they significantly diverge from Sarasvathy's (2001a, 2008) theoretical conceptualisation of the effectuation construct. Thus, in this chapter, I reconceptualise the effectuation construct based on theory and recent empirical evidence. Importantly, chapter 2 highlights the need for researchers to operationalise and measure the use of effectuation for specific decisions, rather than across the whole new venture development process, given the significant amount of heterogeneity that is found in how entrepreneurs make decisions in relation to their business. I suggest a new measurement approach – a scenario-based measure, also known as a situational judgment test in the psychology literature (Motowidlo, Dunnette, & Carter, 1990; Weekley, Hawkes, Guenole, & Ployhart, 2015), to effectuation whereby entrepreneurs' use of effectuation as a decision-making logic is assessed for a series of individual decisions that entrepreneurs typically encounter during the new venture creation process. Furthermore, I follow McKelvie et al.'s (2020) suggestion for researchers to explicitly state the assumptions underpinning their conceptualisation and measurement of effectuation.

Across several pilot studies and two main studies, I develop and validate a novel scenario-based measure of effectuation. The unit of analysis of the measure is the decision logic of the individual entrepreneur. In study 1, I develop the measure and explore its factor structure. In study 2, I refine the measure, confirm its structure,

and investigate its relationship with a behavioural effectuation measure (Chandler et al., 2011) and a maximising-satisficing scale assessing individuals' tendency to use comprehensive search strategies during decision-making (Schwartz et al., 2002). I also suggest several directions for future research using this measure, which offers opportunities for extending and building on effectuation theory.

1.2.3 Chapter 4 – How do entrepreneurs act when they don't know how to? The relationship between different types of uncertainty and entrepreneurs' use of effectuation and causation

A second implication of the findings in chapter 2 is that entrepreneurs' perceptions of the environment in which they operate are dynamic and change depending on the specific decisions the entrepreneur is encountering at a particular point in time. Thus, in chapter 4 I investigate longitudinally how entrepreneurs' perceptions of uncertainty – a key environmental characteristic that entrepreneurs encounter in their decision-making (Sarasvathy, 2001a; Shepherd et al., 2015) – change throughout the new venture creation process, and how entrepreneurs adapt to these changes by using distinct strategies and actions.

Whereas past theoretical work and some research has highlighted the importance of uncertainty as a key antecedent of effectuation (Jiang & Tornikoski, 2019; Sarasvathy, 2001a; C. Welter, Mauer, & Wuebker, 2016), key questions remain about the relationship between different types of uncertainty and entrepreneurs' use of effectuation. Specifically, I investigate entrepreneurs' perceptions of uncertainty related to the type of information missing, namely *state uncertainty* which relates to lack of information about how the environment might be changing in the future, *effect uncertainty* relating to lack of information about what the consequences of changes in

the environment might be for the venture, and *response uncertainty* relating to lack of information about how to respond to changes within the environment (Ashill & Jobber, 2010; Milliken, 1987). I propose that different types of perceived uncertainty (i.e., different types of missing information) are related to entrepreneurs' use of distinct effectual and causal action principles.

I take a longitudinal approach to studying this research question by collecting data on 176 entrepreneurs' perceptions of state, effect, and response uncertainty, and their use of effectual and causal actions, over a period of eight consecutive months across five different data collection waves. I then investigate the distinct relationships between their changing perceptions of uncertainty and their use of effectual and causal action principles. The findings suggest a more nuanced understanding of the relationship between uncertainty and effectuation, and have theoretical implications for our understanding of antecedents of effectuation which I discuss in this chapter.

A summary of the thesis and an overview of the studies included in each chapter can be found in Table 1-2.

Table 1-2: Structure of the thesis and breakdown of studies

Chapter number	***Title***	***Short summary of the studies included***
1	Introduction	Literature review, proposed approach, and outline of thesis structure
2	Entrepreneurs' ecological rationality: How the nature of decisions drives effectual and causal decision-making logics	Qualitative study of 290 decisions exploring the relationship between content, structure, and decision-making logics

3	Effectual and causal decision-making logics: Development and validation of a scenario-based measure	**Pilot studies**: development, content validity (q-sort study with effectuation researchers), pilot with entrepreneurs **Study 1**: Explore factorial structure and reliability **Study 2**: Refine measure, confirm factor structure, convergent and discriminant validity
4	How do entrepreneurs act when they don't know how to? The relationship between different types of uncertainty and entrepreneurs' use of effectuation and causation	Longitudinal study investigating the relationship between entrepreneurs' perceptions of state, effect, and response uncertainty, and their use of effectuation and causation
5	General discussion	General theoretical and practical contributions, suggestions for future research

Chapter 2 Entrepreneurs' ecological rationality: How the nature of decisions drives effectual and causal decision-making logics

2.1 Introduction

New venture creation requires entrepreneurs to make decisions in all areas of the firm, from recruiting co-founders and first employees, to funding their ventures (Shepherd et al., 2015). How entrepreneurs make these decisions has been explored using a variety of approaches and theoretical frameworks (Mitchell et al., 2007; Mitchell, Mcdougall, Morse, & Smith, 2004), as already detailed in chapter 1. One of the most widely used frameworks in research on entrepreneurial decision-making is effectuation theory (Perry et al., 2012; Sarasvathy, 2001a, 2008). Research on effectuation has started to investigate factors associated with entrepreneurs' use of effectual and causal decision-making logics (Grégoire & Cherchem, 2020). Studies connect the increased use of effectuation with individual-level factors, such as entrepreneurial expertise (e.g., Dew, Sarasvathy, Read, & Wiltbank, 2009) and founder identity (e.g., Alsos, Clausen, Hytti, & Solvoll, 2016). Other research finds effectuation relates to venture-level factors, such as high uncertainty (Jiang & Tornikoski, 2019; Wiltbank, Dew, Read, & Sarasvathy, 2006), resource constraints (Karami et al., 2020), as well as constraints arising from stakeholder pressure (Reymen et al., 2015) and changes in key personnel (Nummela et al., 2014). These venture-level factors tend to co-vary with the venture's stage of development (e.g., Berends, Jelinek, Reymen, & Stultiëns, 2014): for instance, uncertainty is typically high in the early stages of creation of a new venture and tends to reduce as the venture becomes more mature (Sarasvathy, 2008).

At the same time, a number of studies provide evidence for heterogeneity in the use of effectuation, both at the individual- and venture-levels. For instance, while

effectuation is often attributed to expert entrepreneurs, research shows that novice entrepreneurs also use effectual logics in their decision-making (Politis et al., 2010). Similarly, while effectuation is typically seen as associated with the early stage of venture development, studies also find that entrepreneurs use causation in the start-up phase (Jiang & Tornikoski, 2019), as well as use effectuation in later stages (Reymen et al., 2015). Aligned with such observations of heterogeneity is an increasing recognition that effectuation and causation may be 'mixed and matched' (S. Read et al., 2016; Reymen et al., 2015; Smolka et al., 2018); but when and why entrepreneurs rely on one or the other, or both logics, to make decisions is still poorly understood (Read et al., 2016, p. 531-532).

In this chapter, I aim to deepen our understanding of when and why effectuation and causation are used by entrepreneurs to make decisions. This study investigates whether the heterogeneity in the use of decision-making logics described above could be explained by heterogeneity in the actual decisions that entrepreneurs have to make, regardless of their individual characteristics and the characteristics (or stage) of their venture. That is, rather than investigating broad individual- or venture-level factors, I focus attention on the decision itself. I ask the question: Could it be that some of the decisions entrepreneurs face lend themselves better to effectual logics, and others to causal logics, irrespective of individual differences and stage of a venture? And if so, what are the defining characteristics of these decisions that may help future research to predict when and why entrepreneurs use particular decision logics? Thus, to develop our understanding of the antecedents of effectuation, this study introduces a new construct – that of decision fit. Focusing on the fit between decision-making logics and actual decisions allows us to unpack the micro-

foundations (Shepherd, 2015), or the individual cognitions and actions underpinning entrepreneurs' use of effectual and causal logics.

To conceptualise decision fit, I draw on a prominent theory from the cognitive sciences - ecological rationality theory (Todd et al., 2012). Ecological rationality is a theory concerned with understanding the nature of decisions and, in turn, how different decision-making strategies fit different types of decisions (Gigerenzer & Gaissmaier, 2011). It differs from logical rationality - the idea that decision-making strategies that are internally coherent and conform to probability theories are always optimal (Tversky & Kahneman, 1986). Instead, ecological rationality highlights how other decision-making strategies, such as fast-and-frugal heuristics (i.e. strategies that ignore part of the information available) are widely used (including by managers, see Luan & Reb, 2017), because they provide a better fit with particular types of decisions and outperform logically rational strategies for these decisions (Luan, Reb, & Gigerenzer, 2019; Todd et al., 2012).

In this study, I integrate insights from ecological rationality theory (Todd et al., 2012) with effectuation theory, to investigate when and why entrepreneurs use effectual or causal logics to make particular decisions. I propose that ecological rationality gives us a framework for understanding the nature of the decisions entrepreneurs face, and to explore how entrepreneurs adapt the decision-making logics they use to fit with the content (i.e. what the decision is about, e.g., business development, cash flow, human resources) and structure (i.e. what information a decision-maker considers about a decision) of the decisions they face. I aim to answer the following research question: *In what ways does decision content and structure drive entrepreneurs' use of effectual and causal logics?* I conduct a qualitative study

with 41 entrepreneurs in the United Kingdom and analyse 290 decisions regarding decision content, structure, and the logics entrepreneurs use to make the decision.

This study finds that decision content drives entrepreneurs' use of effectual and causal decision-making logics. Furthermore, the combination of two elements of decision structure — the number of perceived options, an indicator of decision complexity, and perceived costs— explains *why* entrepreneurs use distinct logics for decisions differing in content. Entrepreneurs predominantly use effectual logics for complex decisions when experimentation costs are low, and they use causal logics for less complex decisions when the costs of experimentation are high. Entrepreneurs use a hybrid logic combining effectual and causal principles for complex decisions with high experimentation costs.

The current study contributes to the entrepreneurship literature in two ways. Firstly, by integrating effectuation and ecological rationality theory (Gigerenzer & Gaissmaier, 2011; Todd et al., 2012), I draw attention to a new important concept – decision fit. By doing so, I offer new insights into the micro-foundations (Shepherd, 2015) of effectual and causal decision-making logics, enabling us to better predict and understand when and why entrepreneurs use effectual and causal logics in response to particular decisions (S. Read et al., 2016). By showing that decision content and structure drive the use of effectual and causal logics, I offer a perspective that complements research emphasising individual- and venture-level antecedents (Berends et al., 2014; Dew, Read, et al., 2009; Grégoire & Cherchem, 2020) and enables us to explain *why* even within the same level of expertise or venture development stage, entrepreneurs use differing logics. In line with the theory of ecological rationality, the decision logic entrepreneurs adopt is a function of its fit with the decision they face (i.e. its content and structure).

Secondly, by focusing on decision fit I also extend our understanding of 'hybrid' decision-making and in particular the joint use of effectual and causal logics not just at the same time, but for the same decision. Again, ecological rationality allows us to explain how/why certain characteristics of the decision are a particularly good fit with such hybrid decision-making (whereas other decisions are a good fit for causation or effectuation). This insight is important and extends past research which has pointed to the co-occurrence of effectuation and causation, for example during the same venture development phase (cf. Reymen et al., 2015), but which has not been able to uncover the reasons for this. In brief, understanding the nature of decisions extends our understanding of entrepreneurs' decision-making.

2.2 Theoretical background

As already reviewed in chapter 1 and in the introduction above, specifically when and why entrepreneurs rely on effectual or causal logics to make decisions is still poorly understood (S. Read et al., 2016). Thus, to address this gap, I propose a new construct – decision fit – to investigate the antecedents that drive entrepreneurs' usage of effectual and causal logics. Analysing effectuation through the lens of decision fit involves exploring the decision-making logics that entrepreneurs use when making particular decisions (e.g., hiring, creating a marketing strategy). It takes a micro-foundations approach (Shepherd, 2015) to effectuation by exploring individual cognitions and actions. Throughout new venture creation, entrepreneurs have to make many different decisions, from selecting co-founders or hiring first employees, to creating marketing strategies or seeking funding for their ventures. Despite the multiplicity of decision content areas in which entrepreneurs need to decide, and the varying nature of these decisions, we do not have a good understanding of the logics

entrepreneurs use to make these different decisions. Unpacking the new venture creation process and exploring the different decisions entrepreneurs face, may help us better understand the heterogeneity we see in entrepreneurs' use of effectual and causal logics even within the same venture development stage or for individuals with similar characteristics. By focusing on decision content (i.e. what the decision is about), we can start mapping specific decisions to dominant decision-making logics, and thus get a finer-grained understanding of *when* entrepreneurs use effectual and causal logics throughout the new venture creation process. In turn, this will enable us to make more precise predictions about entrepreneurs' use of effectuation and causation. Furthermore, focusing on decision fit enables us to uncover the mechanisms underpinning *why* entrepreneurs use different logics to make particular decisions. To this aim, I turn to the theory of ecological rationality.

2.2.1 Ecological rationality

Ecological rationality theory (Gigerenzer & Gaissmaier, 2011; Todd et al., 2012) proposes that in order to understand decision-making, we need to also understand the decision the individual is approaching. A decision requires an individual (or team) to make a choice between two or more alternative courses of action. The three main elements of a decision include the options to consider (i.e. the alternative courses of action), the potential consequences of these options, as well as the likelihood that these different consequences materialise. In decision-making, uncertainty describes the degree to which the alternative courses of action and their consequences are clearly defined, and knowledge about the likelihood of consequences materialising is available. More uncertainty implies less clarity about the options, their consequences, as well as the likelihoods of certain consequences

materialising. In turn, the *structure* of a decision describes what information about the decision and its elements is represented in the decision-maker's mind, and can thus be used to operationalise the level of uncertainty perceived by the decision-maker: what are the options I can choose between? How much and what kind of information do I have about these options, their potential consequences, and the likelihood that these different consequences materialise? What is the cost of acquiring more information? How can I acquire this information?

Ecological rationality (Gigerenzer & Gaissmaier, 2011; Todd et al., 2012) is a prominent theory in the cognitive sciences explaining how individuals adapt their use of decision-making strategies to the structure of the decisions they are faced with. Other theories and concepts in psychology also explain how individuals select strategies for thinking and decision-making, such as metacognition (Flavell, 1979, 1987). These frameworks have been successfully integrated with entrepreneurship theory (e.g., Haynie et al., 2012, 2010). However, whereas metacognition helps us better understand the cognitive process underpinning thinking about thinking (i.e. how decision-makers select strategies), ecological rationality provides an explanation for *why* decision-makers select one strategy over another one for particular decisions. Extending Simon's (1955, 1990) work on bounded rationality, ecological rationality theory highlights the importance of understanding both the decision-making strategies individuals use, and the decision in which these strategies are being used. It departs from decision-making research focusing on logical rationality, i.e. ensuring decision-making is internally coherent and conforms to probability theories (Tversky & Kahneman, 1986). By contrast, ecological rationality emphasises the fit between decision-making strategies and the structure of the decisions an individual faces (Gigerenzer & Gaissmaier, 2011). Rather than certain decision-making strategies

being intrinsically better or worse than others, certain strategies are better suited to decisions with some structures than others (Gigerenzer et al., 1999; Todd & Gigerenzer, 2012).

Ecological rationality theory thus acknowledges that individuals have evolved, through evolution and learning mechanisms, an adaptive toolbox containing a variety of different decision-making strategies, ranging from optimisation, whereby the decision-maker attempts to calculate the optimal course of action based on all available information, to so-called fast-and-frugal heuristics that ignore part of the information available to the decision-maker (Gigerenzer, 2008; Gigerenzer et al., 1999). Fast-and-frugal heuristics have been found to outperform optimisation strategies for certain decisions, such as those that present higher levels of uncertainty and where there is less available data to rely on (Gigerenzer & Gaissmaier, 2011). In line with ecological rationality theory, past research has also shown that individuals use decision-making strategies adaptively, by selecting strategies that show good fit with the structure of the decisions they are faced with (Luan & Reb, 2017; Payne, Bettman, & Johnson, 1993; Todd et al., 2012).

2.2.2 Integrating effectuation and ecological rationality theory

In this study, I integrate insight from ecological rationality theory with effectuation theory to deepen our understanding of when and why entrepreneurs rely on effectual and causal logics in their decision-making. Effectuation provides an account of the decision-making strategies entrepreneurs use during new venture creation (Sarasvathy, 2001a). On one hand, causal logics can be seen as examples of optimisation strategies that seek to use all the information available to the entrepreneur in order to try to predict the optimal course of action to achieve a long-term goal. On

the other hand, effectual logics can be conceived as domain-specific heuristics whereby entrepreneurs limit their search for information by focusing on simple principles and approximations of their environment. For instance, the affordable loss principle acts as a simple heuristic specifying the size of the investments that entrepreneurs make depending on what they can afford, and are willing, to lose in a worst case scenario (Martina, 2020). A causal logic would entail calculating the necessary investment for maximising the potential returns for the entrepreneur. Thus, effectual and causal logics, and the principles associated with each of them, constitute an array of strategies that entrepreneurs can leverage depending on the particular decisions they are encountering at different stages of creation of their new ventures.

In this study, I use ecological rationality as a framework for understanding and conceptualising the nature of the decisions entrepreneurs face. In addition to content, I unpack the decisions entrepreneurs face into their options, the potential consequences of these options, and the likelihood that these different consequences materialise. This approach enables unveiling the characteristics and properties that can be used to describe entrepreneurial decision structure. In turn, this understanding of decision structure can be used to clarify and operationalise entrepreneurs' uncertainty perceptions in relation to the decisions they face. This answers a call for more research unpacking entrepreneurs' perceptions of uncertainty in effectuation research (C. Welter et al., 2016).

Lastly, I mobilise ecological rationality theory to also help understand how entrepreneurs adapt their use of effectual and causal decision-making logics in response to particular decisions. In line with ecological rationality theory, I expect entrepreneurs to use decision-making logics that fit with the structure of the particular decisions they are faced with. I explore what information entrepreneurs have about

these components (i.e. decision structure), and whether decision structure influences entrepreneurs' use of effectual and causal logics. Thus, I build on ecological rationality theory to understand *why* entrepreneurs use either effectual or causal logics for particular decisions. I summarise the arguments in relation to how I bridge effectuation and ecological rationality theory in Figure 2-1.

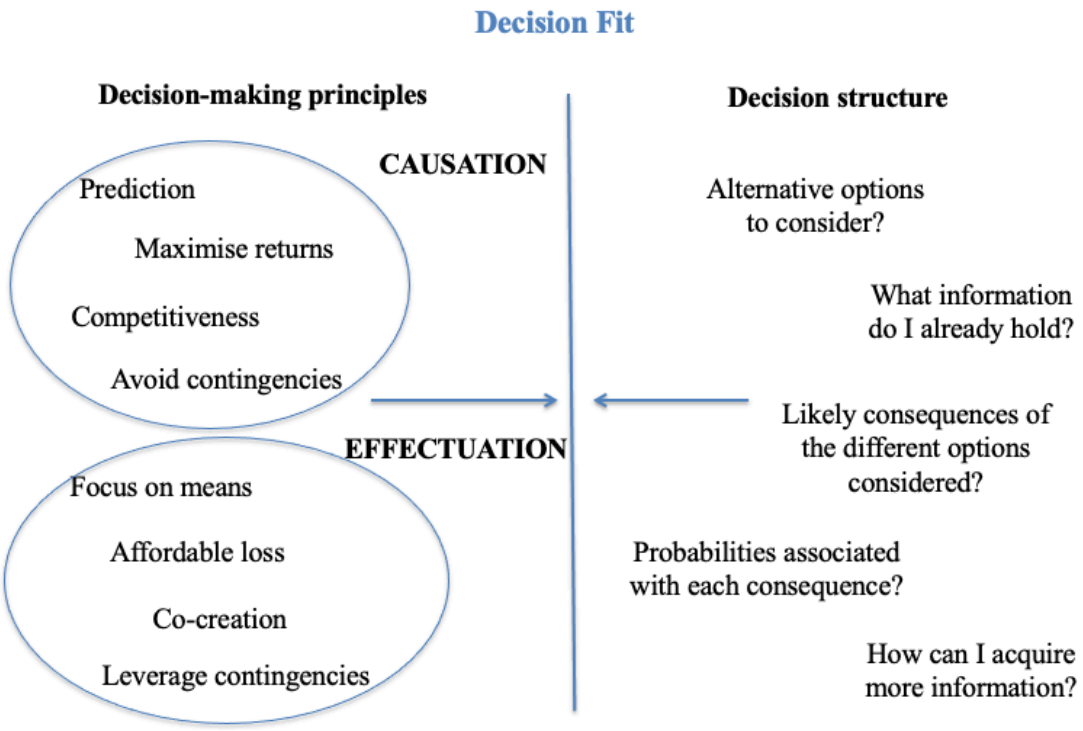


Figure 2-1: Ecological rationality applied to effectual and causal decision-making logics

2.3 Method

2.3.1 Sample

The primary sample consisted of 41 owner-managers of companies between two and seven years old, who had firsthand experience in making decisions related to new venture creation (Bird, Schjoedt, & Baum, 2012). I recruited entrepreneurs through a mix of personal contacts, cold calls, and the snowball technique (one

interviewee nominates others), as is common in qualitative research (e.g., Ashforth, Kreiner, Clark, & Fugate, 2007). As a sampling strategy, I used a combination of theoretical sampling (Eisenhardt & Graebner, 2007) and maximising variability in the data in order to enable theory development (Bluhm, Harman, Lee, & Mitchell, 2011). In line with previous research on the antecedents of effectual and causal logics, I sought high heterogeneity among participants with regards to previous entrepreneurial experience, firm size, firm age, and industry. Overall, 65% of participants were male, and had diverse educational levels (22% had no university degree, 37% held an undergraduate degree, and 41% held a postgraduate degree). 54% of participants co-founded their businesses and 61% were first-time business founders. Participants had on average 5 years of managerial experience (SD = 5.66, min = 0, max = 27). The ventures included in the sample were on average 3.51 years old (SD = 1.37, min = 2, max = 7), had a mean of 14 employees (SD = 23.11, min = 0, max = 110), and operated in 14 different industries, including Construction, Finance, Arts, and Technology. 19 ventures offered products (46%), 21 ventures offered services (51%), and one venture offered a combination of products and services (2%).

2.3.2 Data collection

I used a combination of different sources of data on entrepreneurial decision-making to triangulate the findings: interviews with entrepreneurs, social media data, and archival sources.

As the primary source of data, I conducted in-depth, semi-structured interviews which lasted an hour on average. The interview guides were developed from a review of previous effectuation literature and contained elements of the critical decision method, an adaptation of the critical incident technique used to study

decision-making processes during non-routine/significant events (Flanagan, 1954; Klein, Calderwood, & Macgregor, 1989). Interviewees first provided a brief description of their venture. Secondly, participants were asked to provide a timeline of the main events shaping the development of their venture since its creation (i.e. the moment when the entrepreneur started working on exploiting the idea for the venture) until the time of the interview using a visual prompt, and were asked to date these events, a technique intended to minimise recall biases (Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004). Thirdly, based on the timeline they provided, participants were asked to write down the most significant decisions they made over the course of venture development. I prompted the interviewees to provide examples of both successful and unsuccessful decisions, as well as provide decisions where no particular action was decided. On average, each interviewee talked about four to five decision events. Importantly, focusing on these critical decisions ensured that recall biases were minimised as past research has shown that individuals recall significant decision events accurately (Chell, 2004). Lastly, I probed each decision mentioned by the participant using a series of questions designed to elicit decision-making processes (e.g., "Walk me through the thought process you went through when you made this decision."; "Can you tell me more about the options you considered as part of your decision-making?"; "What were the factors that weighed in on this decision?"). Each interview was recorded and transcribed.

As previously described, several measures were implemented to minimise potential biases related to the use of a retrospective recall data collection methodology. In addition, in order to check the validity of the primary source of data and triangulate the findings, I collected data from social media forums for entrepreneurs, as a more concurrent and unobtrusive data collection method. The interviewees suggested that

social media forums are a resource they frequently employ when faced with an important decision and they wish to seek advice outside of their existing professional and social network. Indeed, data collected through social media has been employed in a variety of research fields, including entrepreneurship (e.g., Fischer & Reuber, 2011). Overall, I collected 343 posts and associated comments posted across 10 open groups for business founders and entrepreneurs, across two social media platforms (Facebook and LinkedIn). The data was anonymised and used to validate whether the types of decisions participants mentioned in their interviews matched the types of decisions entrepreneurs posted about on these groups. I found that there was a large degree of overlap in the content as well as structure of the decisions described by entrepreneurs in their social media posts and those mentioned by entrepreneurs during the interviews (89% agreement), which provided further evidence of the validity of the primary source of data, and helped triangulate the findings.

Lastly, I used archival sources and firm documents provided by participants to supplement and cross-check the data collected from the interviews.

2.3.3 Data coding and analysis

The coding of the data was performed in three main stages. Firstly, I coded each decision in terms of content, i.e. what the decision was about. I used Shepherd and colleagues' (2015) broad taxonomy of entrepreneurial decision-making content to guide coding in the first instance; however, I then proceeded to coding using a more granular set of content categories (see Table 2-1) to enable me to capture subtler differences in content between decisions, and to add new content categories that were present in the data.

To do this, each decision event was decomposed into individual decisions, and each decision was coded according to the content category it represented. For instance, one of the interviewees talked about an event where they made a decision related to selecting a product idea to turn into a prototype, how to implement the product, and how to market the product; this event would be decomposed into three individual decisions, each coded in terms of content. This step allowed me to later on analyse between-category heterogeneity in the logics that entrepreneurs reported. Table 2-1 provides the detailed code structure and exemplary quotes for each decision content category.

In stage two, I inductively coded the elements of decision structure mentioned in the entrepreneurs' accounts, i.e. any information about the decision and its elements and how it was represented in the decision-maker's mind. The decision structure elements that I identified in the data included what were the different options or alternatives entrepreneurs considered for each decision, the type and source of information the entrepreneurs gathered about the decision, their expected consequences, and the likelihood that these different consequences materialise, informational costs related to acquiring more information, and time pressure. The coding strategy for structure is further explained in the results section.

In stage three, I coded each of the individual decisions previously identified in terms of the decision-making principles and logics used by participants. I identified specific descriptors for each of the principles typically associated with effectual and causal decision-making logics, based on past effectuation research (e.g., Chandler et al., 2011; Dew, Read, et al., 2009; Reymen et al., 2015). Once all the principles used by entrepreneurs during their decision-making were coded, I also coded the overall logic that the entrepreneur used for each decision: effectual if they only used effectual

principles, causal if they only used causal principles, and hybrid if they used both effectual and causal principles for that decision. Table 2-2 provides the detailed code structure and exemplary quotes for each principle. Three coders independently coded principles and logics for each decision (290 decisions overall). Differences between coders were resolved through discussion.

As an additional check, given the significant proportion of entrepreneurs in the sample who were part of a team of founders where decisions were likely to also involve co-founders, I checked for any systematic differences between solo and co-founders' accounts of their decision-making. The distribution of usage of different logics across the different decision content categories was similar across the two groups.

The analysis strategy consisted of a mix of qualitative and quantitative research procedures (Van de Ven, 2007), and allowed me to first examine heterogeneity in the logics used by entrepreneurs for decisions different in content, and second analyse potential relationships between the elements of decision structure identified and the effectual and causal logics the entrepreneurs used for a particular decision.

Table 2-1: Coding structure and exemplary quotes of decision content categories from interviews (290 decisions from 41 participants)

Decision content category	Exemplary quote	Occur-rence
Human resources - Hiring	"I think everything comes down to having a good team involved, right? So I think it needs to be something, there's no way you can do this with an average team. If you have an average team, you get an average company. There's no way you get an average team and a super company, I think." [E1]	31
Human resources - Firing	"[...] the person who is not the right person for your company, it's a sort of poisonous injection in your daily work where all the interactions are somehow altered by the disposition of this person [...]. If you know already that it's not going to work, somehow it's more unfair to prolong this agony, even for the person who doesn't like at all the outcome of this process. And we had an incredible improvement on the quality of our work since this person left." [E6]	5
Human resources - Management	"Human management is always the most difficult thing in the world in terms of managing a company and businesses. It's not about your product, the product is important but the human is more important. If you get the right people to do the right thing, your business no matter what will still be fine." [E3]	16
Financial resources - Funding	"I think the first step is actually identifying how you're raising investment? So either raising funding with business angels, or with VC funds. [...] And then identifying the right partners, that's really important." [E22]	24
Financial resources - Investment	"Raising a bit of money can be a double-edged sword, because on the one hand you suddenly have the firepower to do more things and you want to spend it because you should spend it. But there's a very real risk that you... either you have contractors trying to take advantage of you or people see you have money and they try to... you just bring on the wrong people." [E26]	10
Product or service ideas	"I was looking at a lot of finance ideas, but I didn't really love anything that I sort of came up with, and then [...] I came up with this idea that intrigued me because it includes a few things, psychology, [...], software and gamification" [E1]	37
Implementation	"another critical decision was to actually build an app. So that is the technology decision, because in my last company we were used to building websites... so that didn't make the decision to build an actual app that easy." [E37]	19

Marketing	“The problem I have isn’t the idea, isn’t the concept, isn’t even really the website [...], it’s more the marketing. So definitely marketing is a big problem because, so I’ve restricted it largely to digital methods at the moment, [...] there aren’t that many channels for me to find that quality organic traffic” [E10]	24
Branding	“I suppose our brand strategy, how do we present that and we have a real problem actually, which is a lot of students in the UK, because they’ve never had a B2C supplier before, they say well I need to go to my university’s official supplier. So we have to kind of convey some authority and legitimacy, whilst at the same time, saying that we are fun, and interesting, and student-focused. [...] So we have a really difficult balance.” [E5]	15
Sales strategy	“that really specific early stage hustle that every entrepreneur goes through, which I think is really important for the journey because that’s when you literally get the cold face, every day, in a very simplistic sense. If you’ve got a product, call it what you like, but you’re out holding your product around hustling.” [E23]	23
Business development	“When we got going we started basically going out talking to clients, trying to bring clients on board. We started to think of how do we raise awareness for the product, how do we start to market?” [E21]	20
Business model	“Whether it’s consultancy where you charge a day rate for a certain number of days to go and advise and do some work for the company, or it’s a product where you are selling to multiple customers and they are consuming it... you need to understand what customers are willing to pay for those things... but also what it costs you to deliver it to them. [...] it’s just the fundamental of understanding if you’ve got a profitable business or not.” [E22]	11
Pricing	“I think it is really basic stuff like setting up rates for different types of work, which is quite important. So like covering overheads and how many hours of work... especially when I am doing my degree, I have to figure all of that out.” [E38]	8
Production	“What are we going to do, we need to do something, because otherwise I don’t feel comfortable going out there to someone, and then asking me for 30 pieces or whatever it is, and not having 100% certainty that I can deliver that.” [E7]	8
Cash flow management	“I think cash flow management is such a daily thing to be involved with and we definitely had to go down routes that were not ideal but it kind of forced us to make some decisions.” [E31]	7
Internationalisation	“So we are in the process of taking it out, very much the way it happens now is that we are still trading online the way we used to do initially in Brazil, because there’s still many things we need to adapt. There’s just too many things to reverse.” [E7]	13

Expanding offering / verticals	"We probably need to diversify and we need more revenue streams. We had a very serious meeting to decide what other revenue stream we could venture into." [E41]	19
		Total: 290

Table 2-2: Coding structure and exemplary quotes of decision-making logics

Logic	Principles	Exemplary quote
Causation	Basis for action: Prediction	"I estimated the size of the market to be around £90 million annually [...] so I thought this was worth giving it a go as a business" [E5]
	View of risk and resources: Maximise returns	"I did business plans and projections and I thought I need to... in order to play, you have to pay, right? So you need to invest in order to get growth." [E1]
	Attitude toward contingencies: Avoid	"I do not think this is the right time for us to take up management space, when we really should be focusing on doing our original product, making actual productions and going on tour" [E37]
	Attitude toward outsiders: Competitiveness	"We thought that to compete with the incumbent supplier who is so well established, we had to differentiate ourselves, and price alone was not a differentiator. And also for the long term of the business, it is not inconceivable that they will drop their prices […] and then as soon as they do that, we become less competitive." [E5]
Effectuation	Basis for action: Focus on means	"I speak French, I am a fluent speaker. So I thought, now that I've reached traction in the UK I could go to Paris. And the next step, I have a good set of connections in the Middle East. So my husband and I are thinking once we have taken control of the European market, we would go in the Middle East." [E39]
	View of risk and resources: Affordable loss	"we needed less of an investment to bring it here [UK] than to extend the range of what we do, so... I think it was the right step, both financially and in terms of developing the business" [E7]
	Attitude toward contingencies: Leverage	"I can tell you retrospectively what each quarter looked like for the past 3 years... but if I had sat back and started off here at 2016, it would look nothing like this. [...] That arrow you've got there, we've been all over the place. […] So it's not linear." [E30]

Attitude toward outsiders: Co-creation	"the first big thing for us would be to have a commitment to actually use whatever we produce, so to have someone to be the first user of the platform. What we want is a partnership in the sense of helping us improve it, getting feedback, getting more data" [E6]

Table 2-3: Prevalence of decision-making logics and principles for each decision content category (41 participants, 290 decisions)

Decision content	Decision logics									Decision structure	
(number of instances coded)	Effectuation				Causation				Hybrid	Number of options	Cost of experimentation
Human resources – Hiring (31)	**55%**				32%				13%	High	Low to Medium
	FoM	AL	LC	CC	P	MR	AC	Co			
	32%	6%	13%	48%	23%	35%	6%	13%			
Human resources – Firing (5)	0%				**100%**				0%	Low	High
	FoM	AL	LC	CC	P	MR	AC	Co			
	0%	0%	0%	0%	80%	80%	0%	0%			
Human resources – Management (16)	**63%**				25%				12%	Medium to High	Low to Medium
	FoM	AL	LC	CC	P	MR	AC	Co			
	25%	6%	38%	44%	25%	19%	0%	0%			
Financial resources – Funding (24)	29%				**50%**				21%	Low to medium	High
	FoM	AL	LC	CC	P	MR	AC	Co			
	17%	17%	4%	29%	25%	38%	4%	29%			
Financial resources – Investment (10)	40%				**60%**				0%	Low to Medium	Medium to High
	FoM	AL	LC	CC	P	MR	AC	Co			
	0%	40%	20%	20%	20%	50%	0%	10%			
Product or service ideas (37)	46%				19%				35%	High	Variable
	FoM	AL	LC	CC	P	MR	AC	Co			
	30%	8%	51%	22%	32%	19%	11%	11%			
Implementation (e.g., technology to leverage) (19)	21%				**53%**				26%	Low to Medium	Medium to High
	FoM	AL	LC	CC	P	MR	AC	Co			
	21%	11%	21%	16%	37%	32%	21%	16%			

Marketing (24)	38%				33%				29%	Medium to High	Medium to High
	FoM	AL	LC	CC	P	MR	AC	Co			
	38%	8%	21%	13%	33%	33%	13%	17%			
Branding (15)	33%				**47%**				20%	Low to Medium	Medium to High
	FoM	AL	LC	CC	P	MR	AC	Co			
	27%	7%	13%	33%	27%	20%	20%	33%			
Sales strategy (23)	30%				**48%**				22%	Medium to High	Medium to High
	FoM	AL	LC	CC	P	MR	AC	Co			
	9%	13%	30%	17%	26%	26%	39%	30%			
Business development (20)	40%				20%				40%	Medium to High	Medium to High
	FoM	AL	LC	CC	P	MR	AC	Co			
	45%	10%	15%	30%	15%	20%	35%	15%			
Business model (11)	**45%**				36%				19%	Medium to High	Low to Medium
	FoM	AL	LC	CC	P	MR	AC	Co			
	45%	9%	36%	36%	9%	18%	0%	18%			
Pricing (8)	25%				**75%**				0%	Medium	Medium to High
	FoM	AL	LC	CC	P	MR	AC	Co			
	25%	0%	13%	13%	63%	38%	38%	25%			
Production (8)	37%				**63%**				0%	Low	High
	FoM	AL	LC	CC	P	MR	AC	Co			
	25%	13%	0%	0%	38%	38%	13%	0%			
Cash flow management (7)	14%				**71%**				14%	Low	High
	FoM	AL	LC	CC	P	MR	AC	Co			
	0%	28%	0%	0%	85%	0%	0%	0%			
Internationalisation (13)	30%				40%				30%	High	Low to Medium
	FoM	AL	LC	CC	P	MR	AC	Co			
	31%	15%	23%	23%	23%	31%	23%	15%			
Expanding offering / verticals (19)	42%				32%				26%	High	Variable
	FoM	AL	LC	CC	P	MR	AC	Co			
	32%	21%	37%	11%	21%	26%	26%	11%			

Notes: FoM = Focus on Means; AL = Affordable Loss; LC = Leverage Contingencies; CC = Co-creation; P = Prediction; MR = Maximise returns; AC = Avoid Contingencies; Co = Competitiveness .

2.4 Findings

2.4.1 Decision content drives entrepreneurs' use of distinct logics and principles

In this section, I analyse entrepreneurs' reports in terms of the decision-making logics and principles they used for a variety of decisions. In particular, I was interested in whether entrepreneurs use different logics in response to decisions varying in content. Table 2-3 shows the prevalence of effectual, causal, and hybrid logics for each decision content category identified in the data.

Overall, entrepreneurs used different logics when making decisions varying in their content. Effectual logics dominated entrepreneurs' decision-making processes for decisions related to hiring, human resource management, selecting between potential product or service ideas to exploit, and choice of business model. Entrepreneurs predominantly employed causal logics for decisions related to firing employees, choosing a source of financing for their venture, investment of financial resources, implementation, branding, sales strategy, pricing, production, and cash flow management. Lastly, a higher proportion of participants reported using a hybrid logic, whereby they combined principles pertaining to both effectual and causal logics to reach a decision, in decisions related to marketing, business development, internationalisation, and expansion of the range of products or services offered.

In order to gain a deeper understanding of how decision content drives entrepreneurs' decision-making, I also analysed between-category heterogeneity in the effectual and causal *principles* that entrepreneurs reported using when making decisions differing in content. Table 2-3 also presents the prevalence of effectual and causal principles within each decision content category, respectively. The cross-

category heterogeneity pattern could also be observed in the principles used by entrepreneurs, with different principles being reported for different content categories. For instance, focus on means was predominantly used for hiring and business development decisions, affordable loss in investment and cash flow management decisions, leverage contingencies for selecting between product or service ideas, and co-creation for human resource management decisions. On the other hand, prediction was prevalent in decisions related to firing and cash flow management, maximise returns in investment, avoid contingencies in pricing and sales strategy choice, and competitiveness in branding.

This initial exploration of the data shows a clear pattern in terms of heterogeneity in the decision-making logics and principles used by entrepreneurs for decisions differing in content. This indicates that entrepreneurs adapt the decision-making logics they use to the specific decisions they face at a given time.

2.4.2 Decision structure – number of options and costs of experimentation

In order to further investigate potential mechanisms driving the heterogeneity observed in the logics used by entrepreneurs to make decisions in different content categories, I focused on identifying elements of decision structure that influenced the logics that the entrepreneurs used for making these decisions. In table 3, I specify the archetypical decision structure associated with each decision content category, based on the data.

The first element of decision structure that emerged from the data as an important determinant of the subsequent decision-making logic used was the number of options considered by the entrepreneur for a particular decision. In line with

previous research on decision-making (Dijksterhuis, Bos, Nordgren, & van Baaren, 2006), I use the number of options considered by the entrepreneur as an indicator of decision complexity. The median number of options that entrepreneurs mentioned in their reports was six, with a standard deviation of two. In order to aid with further data analysis and interpretation, I coded decisions where entrepreneurs considered less than four options as decisions low in complexity, between four and eight options as average, and decisions with more than eight options were coded as high in complexity. For instance, firing and production decisions were categories where entrepreneurs perceived low levels of complexity, whereas selecting between different product ideas or pricing decisions were high in complexity. A key phenomenon that I observed in the data was that decision complexity influenced the logics entrepreneurs used for that particular decision. For instance, a lower level of complexity allowed entrepreneurs to invest effort into logics that involved more comprehensive search strategies, as E2 reports: "these were the three alternatives I had to go through, and I understood that it's a lot of groundwork […] but it was totally realistic, and I had to do it". On the other hand, for decisions that involved higher levels of complexity, the entrepreneurs tended to use decision-making logics that relied on fewer and more subjective criteria for selection rather than comprehensive search: "I had a lot of ideas […] it's not always systematic this process, it depends on your background, I think. For example, my background is in finance, so I was looking at a lot of finance ideas" [E1].

The second element of decision structure that influenced participants' use of decision-making logics was the perceived cost of trying out, or experimenting with, different options. Costs were defined loosely in terms of expenditure of resources, and this included financial and non-financial costs (e.g., time, as per Lévesque & Stephan (2020)). As I was interested in elements of decision structure as perceived by the

entrepreneurs, I qualified costs of experimentation based on participants' subjective perceptions. Decisions where entrepreneurs used qualifiers such as "reasonable", "cheap", or "quick and easy to do" to describe these costs were coded as low, qualifiers such as "it wasn't easy, but it could be done" were coded as average, and qualifiers such as "it was quite a significant investment" were coded as high. Decisions such as devising a marketing strategy or choosing a financing source were perceived as having high experimentation costs, whereas decisions such as hiring employees or expanding their target markets to other cities were perceived as incurring lesser costs of experimentation. In addition to complexity, costs of experimentation was the second element of decision structure that drove entrepreneurs' usage of distinct decision-making logics. Whereas low experimentation costs allowed entrepreneurs to use logics whereby they tried out various options to gather information ("it's quite quick and it's free, so we can do one tender per month and see what happens" [E28]), high costs made entrepreneurs more likely to use logics that employ alternative methods for gathering data: "we could potentially lose a lot of money, so we had to do a lot of due diligence and research" [E5].

The combination of these two elements of decision structure – decision complexity, and the costs of experimenting with different options — were the two main elements of decision structure influencing entrepreneurs' use of decision-making logics based on the data. In the subsequent sections, I discuss in more depth how effectual, causal, and hybrid logics were used by entrepreneurs to adapt to decisions combining the two decision structure elements identified.

2.4.3 Dominant decision-making logics

2.4.3.1 Testing-the-waters decisions: high complexity, low to medium costs

The first type of decision structure that the entrepreneurs reported involved high levels of complexity, and low perceived costs to experiment with different options. Most entrepreneurs adopted effectual logics when making this type of decisions (see Table 2-3). The entrepreneurs were first concerned with reducing the complexity incurred by the high number of options by focusing on a more limited set of options, and then collecting domain-specific data through experimentation, permitted through the relatively low costs of trying out alternatives. The focus on means and co-creation principles helped entrepreneurs reduce complexity, and the leverage contingencies principle guided entrepreneurs in their cycles of experimentation. In the following paragraphs, I illustrate the ecological rationalities of these three principles.

Due to the high complexity associated with type 1 decisions, entrepreneurs attempted to control and reduce the number of options they were considering at a given time. The focus on means principle was employed at this stage to help entrepreneurs choose between the many possible options, and can be seen as a satisficing strategy (Gigerenzer & Gaissmaier, 2011; H. A. Simon, 1955), or a way to ignore part of the information in order to reduce decision complexity. For instance, E39 makes an inventory of her means, by referring to her identity, knowledge, and social capital to help her decide which countries to expand her venture to next: “So many places I would like to expand to, but I speak French, I am a fluent speaker. So, I am thinking, once I have more traction in the UK to go to Paris. Because […] I speak the language and I know the culture quite well, so the next step would be to go to

Paris. And then the next step, I have a good set of connections in the Middle East as well. So, my husband and I are thinking once we have taken quite a control of European market, we would go into the Middle East.".

Alongside focusing on existing means, co-creation was another principle through which entrepreneurs attempted to reduce the complexity of the decisions they were faced with (see Table 2-3). Entrepreneurs used the feedback obtained through interacting with self-selected stakeholders as validation, or endorsement for particular options available to them, rather than conducting a systematic search. As E6 noted when recounting how they made a series of key decisions related to their product idea: "I would say the first big thing for us was to have a commitment [from customers] to actually use whatever we produce, so to have someone, not only us, to be the first users of the platform. […] What we wanted was a partnership in the sense of helping us, improving, getting feedback. We needed their involvement, otherwise it would have been a wild shot in the dark."

Once the number of options had been narrowed down, and given the low costs of experimentation, the principle of leveraging contingencies allowed entrepreneurs to implement potential options in a cost-effective way and to engage in cycles of experimentation to gather more data on the (subset of) option(s) they were considering. Experimentation was used rather than more indirect ways of gathering feedback on the suitability of different options (e.g., market research). This is an excerpt from E10's account of settling on a business model for her start-up offering expert advice on career changes: "The other thing that I'm testing now is B2B, because what I'm finding through doing all of this is that actually it [the B2C model] is quite labour-intensive, trying to reassure and speak to each individual person who this

expert is, and how it would help them whereas actually if I can go to a larger corporate, they may just be making 100 people redundant, then I can actually offer a more interesting proposition potentially. So I have two meetings this week where I can pitch, and trying doesn't cost anything".

In some cases, however, entrepreneurs struggled to interpret the results of these experiments, as it was not always clear from the data gathered whether the experiment had been a success or not. At this stage, some entrepreneurs were tempted to start experimenting again with a new option, given the low costs of doing so, in the hope that a more successful option would be identified. As such, the search and experimentation process would continue, sometimes for long periods of time, leading to what previous research has termed effectual churn (Fischer & Reuber, 2011). E12's account of the process they went through when trying to discern which business development opportunities were worth investing in is a good example of entrepreneurs' efforts to limit these cycles of effectual churn, and thus control costs: "And what I found was, coming back to this thing of initially meeting lots of people and lots of possibilities to work together, there's only so much time you've got, therefore which relationships are you going to invest into […]? There's lots of 'who are you' conversations going on, 'really nice to meet you', but am I going to willingly invest to build that relationship? So I've invested a lot of time in [1], [2], and [3] because I like the people, I like the work, we've done stuff together, and I want to be part of those organisations."

2.4.3.2 Commitment decisions: low complexity, high costs

The second type of decision structure that the entrepreneurs reported involved low levels of complexity, and high perceived costs of experimentation. Most

entrepreneurs adopted a causal logic for making these decisions (see Table 2-3). Given the lower number of options available, entrepreneurs invested more time and effort defining each option more clearly; however, due to the high costs associated with trying out different options, entrepreneurs sought alternative ways of gathering information on each of them. In particular, prediction and the maximise returns principles allowed them to gather information about the available options without performing costly experiments, whereas affordable loss, avoid contingencies, and the competitiveness principles allowed them to further minimise the costs related to implementing the chosen option. In the following paragraphs, I illustrate how these five principles are well fitted to the structure of commitment decisions.

Given the low level of complexity incurred by the few options considered, the entrepreneurs spent time defining each option more clearly, and seeking as much information as possible by conducting systematic research. Furthermore, perceptions of high costs of experimentation motivated entrepreneurs to avoid testing out different options, and instead adopt more indirect methods for gathering information. Specifically, prediction and the maximise returns principles were used to gather information on the different options without resorting to experimentation. Prediction enabled entrepreneurs to use and adapt the information entrepreneurs had gathered on the different options available to them and turn it into information they could use as part of their decision-making process. The maximise returns principle was often coupled with prediction (see Table 2-4) in order to use the data collected through predictive strategies to quantify expected outcomes. E15 describes the process they went through for selecting a vertical to focus their marketing strategy on; earlier in the interview, the participant mentioned that three different verticals had been considered

as options: “We did work around, what is the size of the market, what does the market look like in the UK and what it looks like globally […] We looked at the different verticals where we thought the product could basically fit, and we did market research […] We always knew whatever it was that we were doing, to start off we really need to be very focused, we couldn’t afford to lose too much time and money. [...] You want clients that can afford the service, and so we have gone after UK financial services to start off with.”

A minority of entrepreneurs, on the other hand, employed the affordable loss principle to limit their resource commitments to levels that were uncritical to them, in order to avoid loss of resources that would endanger the survival of the venture. Interestingly, affordable loss was the least prevalent principle in entrepreneurs’ accounts of their decision-making; however, it was mostly used for commitment decisions, where the downsides of a project were relatively easy to estimate. Some entrepreneurs preferred affordable loss as an alternative to predictive strategies when encountering decisions low in complexity but high in experimentation costs. For instance, E14 describes his early investment strategy as minimising potential losses in case things went wrong, by focusing on low-cost facilities and small-scale projects: “So when we started this venture, we invested a very small amount [of money]. We had a facility that was not as good as other companies’, we thought this would be our starting point. We had a lot of customers, but again very local and very low price.”

The high experimentation costs led entrepreneurs to use the avoid contingencies principle and stick to their chosen course of action. Feelings of confidence were often mentioned by entrepreneurs as accompanying their predictions

and were used as a reason for remaining inflexible in the face of information that went against their predictions, once a particular option had been selected. For instance, E22 discusses their decision to stick to their initial marketing strategy consisting of targeting customers in a specific industry, despite indications disconfirming that their selected course of action was the right one: "I think once you made a decision, and you're confident in your analyses, you got to move on. In bigger businesses, you sit there and you might go right let's cut our losses and try this, but we haven't got the resources available to start from scratch again in a different vertical, so there's no point even looking at it at this stage. We've made a decision; we're going to commit to it and we are going to go and keep focused on that."

As a complement to the avoid contingencies principle, the competitiveness principle also enabled entrepreneurs to be selective about the involvement of external stakeholders and allowed them to stay on track with their selected course of action. Its use was more content-dependent than the other causal principles, the domains where competitiveness was most often used being branding, choice of sales strategy, and financing (see Table 2-3). In these contexts, saying no to potential partnerships or customers enabled entrepreneurs to focus their limited resources on the actions that were most likely to be successful, whilst deterring potential distractions. As E39 notes: "I think saying no is something that I have perfected over the years, as I found myself wasting a lot of my time and money. Saying no to clients, saying no to partners that I don't think have value to what I am doing. And saying no to clients who […] ask me to do a lot of random things but without an end goal in mind."

2.4.3.3 Direction-setting decisions: high complexity, high costs

The third type of decision structure that the entrepreneurs reported involved high levels of complexity, and high costs to experiment with these options. For these decisions, a larger proportion of entrepreneurs used a hybrid logic that combined both effectual and causal principles as part of the same process. In the following paragraphs, I show how entrepreneurs mix principles pertaining to different logics to solve the cognitive demands posed by direction-setting decisions.

To gain a deeper understanding of these hybrid logics, I first examined co-occurrences of principles pertaining to contrasting logics for individual decisions. Table 2-4 shows the number of occurrences of each pair of principles within the data. I also tested for differences in frequencies of co-occurrence for different pairs of principles, as an exploratory analysis; the only pair that was significantly more likely to co-occur than other hybrid pairs was the prediction-leverage contingencies pair, $\chi^2 = 8.25$, $df = 1$, $p = .004$. Furthermore, out of all eight principles, only the maximise returns ($\chi^2 = 3.53$, $df = 1$, $p = .06$) and avoid contingencies ($\chi^2 = 4.05$, $df = 1$, $p = .04$) principles were more, and less likely, respectively, to occur within a hybrid logic than within a purely effectual or causal one. Nevertheless, between 17% (competitiveness and co-creation) and 32% (affordable loss and leverage contingencies) of all principle occurrences were as part of a hybrid logic.

Table 2-4: Frequency of co-occurrence of principles (41 participants, 290 decisions)

	2	**3**	**4**	**5**	**6**	**7**	**8**
1. E: Focus on means	3	13	18	5	5	3	3
2. E: Affordable loss	-	**10***	2	3	4	2	2
3. E: Leverage contingencies	-	-	12	**11****	8	2	1
4. E: Co-creation	-	-	-	2	5	3	2
5. C: Prediction	-	-	-	-	17	14	7
6. C: Maximise returns	-	-	-	-	-	5	4
7. C: Avoid contingencies	-	-	-	-	-	-	14
8. C: Competitiveness	-	-	-	-	-	-	-

Note. E = Effectuation; C = Causation. I performed Chi-square tests to test whether certain pairs of principles were more likely to co-occur than the other pairs. Significant differences are marked as: *$p < .05$; **$p < .01$.

Similarly to their approach to testing-the-waters decisions, entrepreneurs employed effectual principles to try to reduce the complexity associated with the many options they were considering. For instance, the focus on means principle allowed entrepreneurs to prioritise certain options over others. However, instead of experimenting with these options, entrepreneurs used causal principles, such as prediction and maximise returns, to gather data on these options. For instance, E13 talks about selecting a marketing strategy for their services, and mentions three potential target customer personas and for each, about two to three different ways of marketing to these customers (seven options overall). Finally, he decides to create a book they could distribute to CEOs of large corporates, based on a strategy combining the focus on means and maximise returns principles: "So I've originally thought about going into advertising, which I did and then I sold with two other people later on […] So I've always kind of believed that appearances are very important, so that's why I made that book, and obviously it's relatively expensive, right? And it's 20 pages of very carefully written stuff and it took months to do, […] with the whole purpose of knowing you could give that to the CEO of [1]."

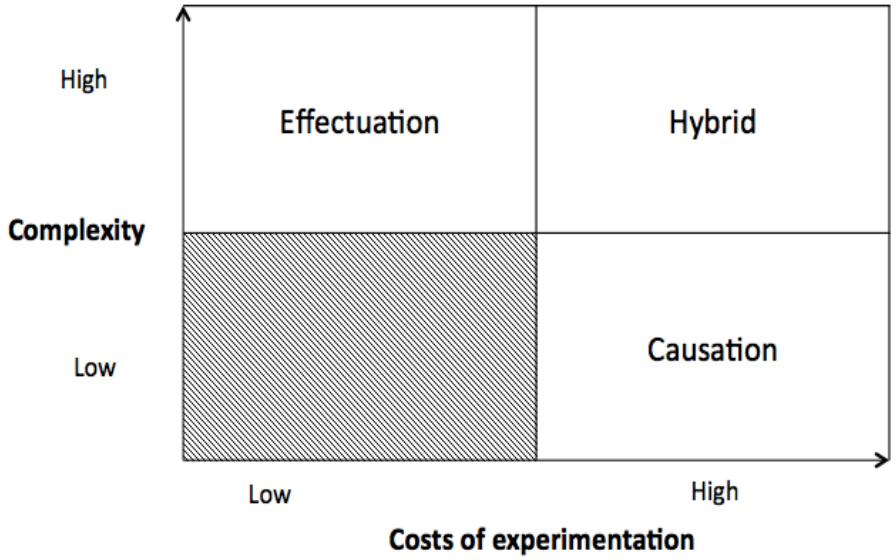
Interestingly, unlike their approach for commitment decisions and despite the high perceived costs of trying out different options, entrepreneurs remained flexible once a particular option had been selected and implemented. As such, entrepreneurs combined prediction principles, exemplified through market research and competitive landscape analysis, with the leverage contingencies principle that allowed them to change course of action as they went along. E30 noted, as part of their decision on a product that would expand their existing range: "We were also doing user testing and we were surveying the market and we realised that it wasn't the right time to penetrate the market with the investment app. At the same time, there were lot of investment apps out there and we were just looking at our idea that we were working on for two-three months and we realised we are not better than any of them. […] We had already spent a lot of money, but we decided to pivot something that was a little bit like a lower hanging fruit. So that is why we moved to education."

2.4.4 Ecological rationality of entrepreneurial decision-making logics

I synthesise the pattern of results found on the relationship between decision structure elements — namely complexity and costs of experimentation with options — and entrepreneurs' use of decision-making logics in

Figure 2-2.

Figure 2-2: Relationship between decision complexity, costs of experimentation, and decision-making logic



In sum, for decisions high in complexity but low in experimentation costs, entrepreneurs predominantly used an effectual logic allowing them to reduce complexity and experiment with different options before settling on one. Entrepreneurs adapted their strategy for decisions low in complexity and high in costs of experimentation by employing causal logics; the lower level of complexity associated with these decisions allowed them to collect more information, whereas the high costs motivated them to avoid contingencies. Lastly, entrepreneurs dealt with the demands of decisions high in both complexity and experimentation costs by mixing effectual and causal principles within their decision-making logics, mostly by using prediction to collect information and adopting a more flexible approach to implementation.

2.5 Discussion

The current study investigated how the nature of the decisions that entrepreneurs face during new venture creation influences the decision-making logics entrepreneurs adopt. I integrate insight from ecological rationality theory in cognitive science (Gigerenzer & Gaissmaier, 2011; Todd & Gigerenzer, 2012) with effectuation theory to explain when and why entrepreneurs use effectual and causal logics to make particular decisions. Thus, I advance new insight into the micro-foundations of effectual decision-making by drawing attention to the decision level. I collected qualitative data on 290 decisions from 41 entrepreneurs and analysed these decisions in terms of their content, structure, and logics used by the entrepreneurs. I first clarify that decision content (e.g., hiring, marketing, cash flow) drives the use of effectual and causal decision-making logics. Second, I use decision structure to explain why entrepreneurs use distinct logics for decisions differing in content. In particular, two elements of decision structure — the number of perceived options, an indicator of decision complexity, and the costs of experimenting with these different options— drives entrepreneurs' use of effectual, causal, and hybrid effectual-causal decision-making logics. I now elaborate the contributions that this study makes.

2.5.1 Extending effectuation by considering entrepreneurs' ecological rationality

By integrating effectuation and ecological rationality theory (Gigerenzer & Gaissmaier, 2011; Todd et al., 2012), I draw attention to a new construct – decision fit – and introduce this to research on effectual and causal decision-making logics. This study illustrates that the very nature of the decisions that entrepreneurs are faced with influences whether entrepreneurs use effectual, causal, or hybrid decision-making logics. In doing so, I complement past research that identifies individual and

venture-level antecedents driving the use of effectual or causal logics (e.g., Jiang & Tornikoski, 2019; Reymen et al., 2015). By unpacking how the micro-level of decisions (decision content and structure) 'triggers' different decision-making logics, our study offers new insights into the micro-foundations (Shepherd, 2015) of effectual and causal decision-making. This addresses a key critique of effectuation theory: not being able to predict and fully understand when and why entrepreneurs use effectual and causal logics to make specific decisions (Arend et al., 2015; S. Read et al., 2016).

I first draw attention to decision content to advance our understanding of *when* entrepreneurs use effectual or causal logics, and then turn to structure to explain *why* entrepreneurs use these logics for particular decisions. Decision content helps to understand why even within the same venture development stage, entrepreneurs use distinct logics. For instance, I find that selecting a new product idea, choosing a mode of implementation, and devising a marketing strategy were all associated with different decision logics even though these decisions typically co-occur within the same venture development stage. Whereas past research often emphasises that effectuation is used predominantly in early venture development stages (e.g., Berends et al., 2014), the findings of this study highlight that it is decision content rather than development stages per se that drives the use of effectual decision-making logics. This provides a deeper understanding of why we may see effectuation used not just in the initial venture development phase but also in later phases (cf. Reymen et al., 2015), and to predict with much more precision *when* entrepreneurs will use effectual logics for particular decisions. However, decision content is still a descriptive label; in the effort to unearth 'why' and 'when' entrepreneurs use different decision logics I introduce the concept of decision structure. I turn to this next.

Secondly, introducing decision structure – i.e. entrepreneurs' consideration of their options (i.e. the alternative courses of action), the potential consequences of these options, and the likelihood that these different consequences materialise – allows us to understand *why* entrepreneurs use an effectual or causal logic for decisions differing in their content. These findings suggest that decision complexity and costs of experimentation are the two key elements of decision structure that trigger effectual, causal, or hybrid decision-making. Past research on the antecedents of effectuation has either tended to use venture development stage as a proxy for high uncertainty, which is seen to drive increased use of effectual over causal logics (e.g., Berends et al., 2014; Nummela et al., 2014) or has more explicitly related uncertainty to decision-making logics (Jiang & Tornikoski, 2019; Wiltbank et al., 2006). However, even though uncertainty is often invoked, it is rarely clear what exactly is uncertain. Focusing on decision structure gives future research a theoretical framework to assess and operationalise uncertainty in terms of decision options, their consequences, and the likelihood of these consequences materialising. Specifically, the findings of this study suggest that entrepreneurs' perceptions of uncertainty can be broken down into the dimensions of decision complexity and costs of experimentation. This answers a call for more research unpacking entrepreneurs' perceptions of uncertainty in effectuation research (C. Welter et al., 2016). It also helps clarify the role that resources play in entrepreneurs' use of effectual decision-making logics (Dew, Sarasvathy, et al., 2009). Entrepreneurs use and assess their resource availability (e.g., time, money, people) for gathering more information on the options being considered, their consequences, and the likelihood that these consequences materialise, and this in turn drives their usage of effectuation or causation. In sum, introducing decision

structure to effectuation research allows us to get a better understanding of why entrepreneurs use effectual or causal logics for particular decisions.

Thus, decision structure helps us understand why past research finds decision logics systematically related to venture development stage. Early stage decisions typically involve a high number of options (Reymen et al., 2015), and the costs of experimenting with different options is typically low as the entrepreneurs are unencumbered by existing organisational structures (Sarasvathy, 2001a; Wiltbank et al., 2006). This can explain why entrepreneurs tend to use effectual logics in the early stages of development of a venture. In the later stages, entrepreneurs tend to converge on a narrower set of options due to strategic choices and resource commitments that they made at an earlier development stage, and the costs of experimenting become higher as the entrepreneurs have already started committing to larger investments in particular directions. Thus, as the structure of the decisions entrepreneurs face in the later stages of development of a venture changes, entrepreneurs tend to use causal decision-making logics to match this structure. Considering decision structure can also help understand why entrepreneurs may switch back to effectuation, even in the later stages of development of their venture, for instance, in times of crisis (Reymen et al., 2015). In crisis situations, entrepreneurs tend to resume their search for new options in order to unearth new opportunities, thus increasing the complexity of the decisions they face. Furthermore, experimentation costs reduce as the alternative option – staying on the same course – becomes more costly. Thus, the structure of the decisions entrepreneurs encounter in crisis situations is a better fit to effectual rather than causal logics. In sum, turning our attention to decision structure as an antecedent to effectual and causal logics enables us to better understand why entrepreneurs use certain logics

over others at different stages of development of the venture, and to explain switches between logics with much more precision.

Thirdly, these findings have implications for the measurement of effectual and causal decision-making logics in future research. The findings suggest that much explanatory power might be gained if we measure effectuation and causation in relation to the decision level, rather than in relation to the entire venture (Chandler et al., 2011; Werhahn et al., 2015) or at the project-level in corporate settings (e.g., R&D project, Brettel et al., 2012). This study suggests that when effectuation is assessed at the venture level, it risks masking important heterogeneity in entrepreneurs' use of logics across different decisions. In line with recent calls for paying more attention to the level of analysis in the measurement of effectuation and causation (McKelvie et al., 2020), I encourage researchers to assess their usage at the micro-level of the decision. Moreover, given the relatively high proportion of decision content categories in which entrepreneurs employed a hybrid decision-making logic where they combined effectual and causal principles, effectuation and causation should be measured independently and allowed to correlate. This is in line with studies finding significant correlations between scales measuring the usage of effectuation and causation (Chandler et al., 2011).

Lastly, building on ecological rationality as a novel lens to effectuation theory has implications for research investigating the outcomes associated with the use of effectual and causal decision-making logics. Previous research on the outcomes of effectuation has tried to unveil direct relationships between effectuation and new venture performance (e.g., Read, Song, & Smit, 2009; Smolka et al., 2018). However, from an ecological rationality perspective, the effectiveness of a decision-making strategy depends on its fit to decision structure (Todd et al., 2012). Such a perspective

suggests that there is no single best decision-making logic to use throughout the process of new venture creation, but rather that entrepreneurs should adapt their use of effectual and causal logics to the different decisions they face. Thus, I urge future research to investigate for what types of decision structure effectual and causal decision-making logics perform better, and why. This will help address a key criticism of effectuation theory in relation to underspecified boundary conditions and mechanisms underpinning the effectiveness of effectual and causal logics (Arend et al., 2015).

2.5.2 Hybrid decision-making logics – combining effectual and causal principles at the decision level

By focusing on the decision level, I also develop our understanding of 'hybrid' decision-making. Previous studies have shown that entrepreneurs can switch between effectual and causal logics at different stages of the venture development process, resulting in a hybrid approach to new venture creation (cf. Reymen et al., 2015). Yet, past research has traditionally viewed effectuation and causation as standalone logics that can be leveraged at different times. In other words, a hybrid approach meant using effectuation and causation sequentially, rather than simultaneously. These findings depart from this conception and instead suggest that entrepreneurs can also *simultaneously* combine effectual and causal principles as part of a single, hybrid decision-making logic. In this study, entrepreneurs used effectual and causal principles simultaneously as part of a hybrid rather than purely causal or effectual logic a significant proportion of the time (between 17% and 32% of all occurrences in the data). Thus, these findings contribute to and refine our conceptual understanding of the relationship and synergies between effectual and causal principles.

The findings of this exploratory analysis of hybrid logics suggest that in particular, entrepreneurs using hybrid logics in their decision-making sought to validate their predictions by testing them out and leveraging data collected in the process. This illustrates the "planning effectuator" approach (Smolka et al., 2018, p. 21) at the decision level, and helps us better understand how entrepreneurs mix effectual and causal principles to deal with highly complex and costly decisions. Furthermore, the results of my exploratory analysis draw attention to the fact that not all effectual and causal principles are equally suited for use within a hybrid logic. For instance, the avoid contingencies principle was less likely to be used by entrepreneurs within a hybrid logic than other principles, suggesting that this principle is more representative of a purely causal logic. This highlights the need for further research on hybrid decision-making to investigate how entrepreneurs simultaneously leverage and combine different effectuation and causation principles.

2.5.3 Practical implications

This research has important practical implications for entrepreneurs. Entrepreneurs need to make decisions in all areas of the new venture – such as hiring first employees, devising marketing strategies, and financing (Shepherd et al., 2015). The results suggest that the nature of these decisions differs, and in turn, the cognitive demands that they pose to entrepreneurs as decision-makers. Thus, different decision-making strategies will be optimal for different decisions. Rather than relying on a particular decision-making strategy throughout new venture creation, or in particular stages of the venture, entrepreneurs can benefit from using decision-making strategies that fit the content and structure of the specific decision they are faced with. The model of decision-making presented in this chapter, based on ecological rationality, can be

used to encourage entrepreneurs to reflect about the structure of the decisions they approach, in particular the complexity and costs of experimentation they incur, and subsequently enable them to choose decision-making logics that fit this structure.

Furthermore, the findings suggest that entrepreneurship education should train the whole range of effectual and causal principles for decision-making to enable entrepreneurs to make use of their adaptive toolbox. Given entrepreneurs use hybrid logics when dealing with highly complex decisions that incur high costs of experimentation, entrepreneurship education should also make entrepreneurs aware of the importance of combining effectual and causal principles to deal with the cognitive demands of these types of decisions.

2.5.4 Limitations and future research

This study suffers from certain limitations and thus opens opportunities for future research. While this study focuses on identifying the decision-making logics entrepreneurs use across decisions differing in content and structure, I do not investigate the relative effectiveness of these logics. Therefore, I am unable to conclude whether the decision-making logics predominantly used by entrepreneurs for particular decisions are also effective. Previous studies attempting to disentangle the relationship between the use of effectual and causal decision-making logics and performance outcomes (e.g., Parida, George, Lahti, & Wincent, 2016; Read, Song, et al., 2009; Smolka et al., 2018) have not studied the effectiveness of different approaches for different types of decisions. Future research can test these findings in large samples and subsequently develop guidance for entrepreneurs in relation to which types of decisions they should use effectuation or causation. I contend that methodologies typically used in ecological rationality research, such as comparative

model testing using simulation (e.g., Luan, Reb, & Gigerenzer, 2019) may be particularly useful for further testing some of the propositions we make in this paper.

Secondly, in this study I identified two elements of decision structure – decision complexity and costs of experimentation – that drive entrepreneurs' use certain logics. These decision structure elements were derived inductively, and as such could be related to the nature of the data we collected. In particular, there may be other potential decision structure properties that are not as easy to verbalise as complexity and costs, and that could influence entrepreneurs' use of effectual and causal decision-making logics. For instance, redundancy between decision-related cues (Gigerenzer & Gaissmaier, 2011) and a skewed distribution of the importance of the cues (Luan et al., 2019) have been found to influence the logics that decision-makers adopt for different decisions. I encourage future research on the ecological rationality of effectual and causal logics to investigate these potential factors using experimental approaches, where these more implicit influences on entrepreneurs' decision-making logics can be more readily observed than methods relying on introspection. This would enable us to further theorise on the nature of entrepreneurial decision-making structure. Lastly, in the current study I observed that entrepreneurs are able to adapt their use decision-making logics to the content and structure of decision they are approaching. However, it is unclear what the effect of entrepreneurial learning on preferred logics are, especially these decisions are re-conducted; I suggest this as an interesting avenue for future research.

It must be noted that I cannot comment on the logics that entrepreneurs adopt for decisions that are low in both complexity and experimentation costs, as this type of decision structure was not represented among the decision events sampled in the

entrepreneurs' accounts. It is possible that this is an artefact of the methodology used to elicit data in this study, in particular the fact that I focused on decisions that were considered as significant by the decision-maker. Given that high complexity levels and/or high experimentation costs posed additional challenges to the decision-maker, this may mean that these decisions were more salient, and thus more readily available for recall to interviewees as well as to entrepreneurs seeking advice on social media.

2.5.5 Conclusion

In this chapter, I set to show how the nature of the decisions entrepreneurs encounter in the new venture creation process drives their use of distinct decision-making logics. The results suggest that entrepreneurs use effectual and causal decision-making logics and principles for distinct decision content categories and that two elements of decision structure – complexity and costs of experimentation – explain this heterogeneity. By integrating effectuation and ecological rationality theory, I complement past research on individual- and venture-level antecedents of effectuation and introduce a new construct – that of decision fit – to illustrate how entrepreneurs adapt their use of decision-making logics for different decisions.

Chapter 3 Effectual and causal decision-making logics: Development and validation of a scenario-based measure

3.1 Introduction

Early research has shown that effectuation has the ability to capture accurately how entrepreneurs go about making decisions in the process of new venture creation (Dew, Read, et al., 2009; Sarasvathy, 2001b), whereas more recently effectual logics have been linked to important new venture outcomes (Chen, Liu, & Chen, 2021; Smolka et al., 2018). In order for the effectuation field to progress further, we need valid and reliable measurement tools (Arend et al., 2015; Perry et al., 2012). However, the measurement of effectuation remains controversial, with a recent review calling for researchers to more clearly and explicitly delineate the nature of the constructs and levels of analysis measured (McKelvie et al., 2020).

Whereas process studies have relied on qualitative coding of effectual logics (e.g., Dew et al., 2009; Reymen et al., 2015), several standardised, questionnaire-based measures of effectuation have also emerged. The most widely used measures in the literature, however, suffer from several limitations. Firstly, these measures assess behaviours as proxies of the decision-making logics adopted by entrepreneurs, and they assess the use of effectuation across the whole start-up or innovation process rather than investigating individual decisions (Brettel et al., 2012; Chandler et al., 2011). As such, these measures are not able to assess whether entrepreneurs use different decision-making logics depending on the type of environment and decision they are facing at different stages in the new venture creation process (cf. Berends et al., 2014; Jiang and Tornikoski, 2019; Reymen et al., 2015). Secondly, existing measures ask respondents to reflect on the behaviours carried out by the whole team

rather than the individual entrepreneur. This aggregation at the team level is inadequate for studies aiming to investigate effectuation at the individual-level, and especially research that seeks to identify the individual-level antecedents (e.g., personality, ability), manifestations, and outcomes (e.g., wellbeing) associated with effectuation. Thirdly, some of the measures available in the literature deviate from Sarasvathy's (2001a, p.245) conceptualisation of effectuation processes which "take a set of means as given and focus on selecting between possible effects that can be created with that set of means". In particular, Chandler et al.'s (2011) measure, the most widely used measure in research on new venture creation (McKelvie et al., 2020), does not contain a scale assessing this key principle underpinning effectuation. This poses an issue as empirical evidence on effectuation collected using this measure risks employing a theoretically distinct operationalisation of effectuation, thus hindering the accumulation of evidence in the effectuation literature.

To address these limitations, the aim of the current study is to develop and validate a scenario-based measure of effectual and causal decision-making logics, that is consistent with theoretical descriptions of the effectuation construct (Sarasvathy, 2001a), and incorporates some of the more recent empirical evidence regarding how entrepreneurs use effectuation in the new venture creation process (e.g., Jiang and Tornikoski, 2019; Reymen et al., 2015). The unit of analysis of the measure is the decision logic of the individual entrepreneur. In study 1, I develop the measure and explore its factor structure. In study 2, I refine the measure, confirm its structure, and investigate its relationship with a behavioural effectuation measure (Chandler et al., 2011) and a maximising-satisficing scale assessing individuals' tendency to use comprehensive search strategies during decision-making (Schwartz et al., 2002).

The theoretical contributions of this work are twofold. Firstly, I contribute a new measure of effectual and causal decision-making logics that addresses some of the most important limitations of existing measures, and thus helps effectuation research progress towards a more advanced stage of development (cf. Grégoire and Cherchem, 2020; Perry et al., 2012). In particular, the novel scenario-based measure operationalises effectuation as a decision-making logic, assessed at the individual entrepreneur level across a series of decisions representative of the new venture creation process. In turn, this will allow effectuation researchers to test propositions directly derived from effectuation theory, rather than have to rely on behavioural proxies or aggregate measures. I believe this newly developed measure of effectuation enables the effectuation literature to expand in several directions, notably towards better understanding the antecedents and outcomes of specific effectual principles (e.g., focus on means), researching effectuation from a cognitive lens (Mitchell et al., 2007; Shepherd et al., 2015), and advancing research on effectuation both at the individual- (M. Frese & Gielnik, 2014) and at the team-level (Kerr & Coviello, 2020; Tryba & Fletcher, 2020). Secondly, I contribute to clarifying the ontological nature of the effectuation construct and expand its nomological net. The results of this chapter show that causation is a unidimensional construct, whereas effectuation consists of four distinct principles. This suggests that causation could be a more general logic underpinning entrepreneurial decision-making, whereas the effectual principles represent more specialised strategies enabling entrepreneurs to make decisions in different domains of the emerging venture. This diverges from Sarasvathy's (2001a) theoretical conceptualisation specifying four contrasting principles underpinning the effectuation and causation constructs. I believe that this re-conceptualisation of the effectuation and causation constructs can help further advance the effectuation field

by providing a more thorough, empirically supported conceptualisation of these constructs. Furthermore, I expand the nomological net of the effectuation construct by exploring the distinctive relationships between effectual decision-making logics, effectual behaviours, and maximising-satisficing. This enables us to more fully ground the effectuation construct into the related decision-making literature (Schwartz et al., 2002; H. A. Simon, 1959). Furthermore, it also helps explain some of the overlap that previous research has documented of particular principles (i.e., co-creation) between effectual and causal logics.

3.2 Literature review

Since Sarasvathy's (2001a) foundational paper, empirical papers exploring the effectuation process, its antecedents and outcomes have used a variety of measures to operationalise the effectuation construct. Process-based research into effectuation has typically relied on qualitative coding of effectual and causal logics of data collected predominantly through think-aloud protocols and interviews with entrepreneurs (e.g., Dew et al., 2009; Jiang and Ruling, 2019; Reymen et al., 2015). Nevertheless, as the field of effectuation is heading towards a more mature stage of development (Grégoire & Cherchem, 2020; Perry et al., 2012), there has been an increase in the use of standardised, quantitative measures in effectuation research. In the sections below I will summarise some of the most commonly used measures of effectuation.

A first quantitative adaptation of the think aloud protocol methodology used in early effectuation studies was developed by Wiltbank et al. (2009). They developed a scenario-based measure assessing entrepreneurs' preference for the use of predictive or non-predictive (i.e. control) strategies in their decision-making. However, they did

not operationalise the various principles associated with effectual or causal logics. More recent measures have developed scales that assess the different principles of effectuation separately. For instance, a measure of effectual and causal behaviours focused on the corporate context developed by Brettel et al. (2012) assesses four contrasting principles associated with effectual and causal logics: preference for means versus goals, affordable loss versus expected returns, partnerships versus competitive market analysis, and acknowledge versus overcome the unexpected. The forced-choice format of this measure treats effectuation and causation as competing strategies, and thus assumes that entrepreneurs rely on either one or the other. In light of empirical evidence emerging showing that entrepreneurs tend to combine effectuation and causation in the new venture creation process (cf. Reymen et al., 2015), this measure has been adapted to assess causal and effectual principles independently (Appelhoff, Mauer, Collewaert, & Brettel, 2016; Blauth et al., 2014). An alternative measure assessing entrepreneurs' effectual and causal behaviours are the scales developed by Chandler et al. (2011), which is the most widely used measure when researching effectuation in the context of new venture creation (McKelvie et al., 2020). Nevertheless, this measure departs from the four contrasting principles proposed by Sarasvathy (2001b) notably by failing to include a scale assessing entrepreneurs' focus on given means, a key principle underpinning effectuation.

Thus, a number of measures have emerged in the effectuation literature, however these measures employ a number of different conceptualisations of the effectuation construct. Firstly, these measures differ in the number of, as well as the nature of the principles they assess. Wiltbank et al. (2009) only capture overall predictive and control-based logics, whereas Brettel et al. (2012) include scales for all four

contrasting principles specified in Sarasvathy's (2001b) original conceptualisation, and Chandler et al. (2011) assess causal logics as a unified construct and four separate principles associated with effectual logics. Secondly, whereas conceptually effectuation is typically described as a decision-making logic (Dew, Read, et al., 2009; S. Read, Dew, et al., 2009; Sarasvathy, 2001a), measures of effectuation have predominantly operationalised the construct as behaviours (Brettel et al., 2012; Chandler et al., 2011). For instance, entrepreneurs are asked to report on whether "[they] used pre-commitments from customers and suppliers" or whether "[they] experimented with different products and/or business models" (Chandler et al., 2011). Behavioural measures can be regarded as proxies of the underlying decision-making logics the entrepreneurs are adopting, which however can mask important differences between how entrepreneurs think and how they act (McKelvie et al., 2020). Thirdly, most existing measures assess the use of effectuation at the team- rather than individual entrepreneur-level (Brettel et al., 2012; Chandler et al., 2011; Werhahn et al., 2015), and at the overall venture- rather than decision-level (Chandler et al., 2011; Werhahn et al., 2015). In other words, these measures ask respondents to report on the actions that the team performed across the new venture creation process that may be indicative of an effectual or causal logic. This approach poses several empirical issues, in particular related to understanding any potential heterogeneity in team members' use of logics (it could be that in a new venture team, one founder is using a causal logic whereas their co-founder is using an effectual one), as well as entrepreneurs' heterogeneous use of different logics for different decisions (cf. Reymen et al., 2015, different decisions may be made using different logics, also see results of Chapter 2).

3.2.1 Reconceptualising the effectuation construct based on recent evidence

As noted by recent reviews of the effectuation literature (Grégoire & Cherchem, 2020; McKelvie et al., 2020; Perry et al., 2012), since Sarasvathy's (2001a) foundational paper there has been diversification and expansion in both the theoretical conceptualisation of the effectuation construct, as well as how it is operationalised in empirical research. I contend with McKelvie et al.'s (2020) recommendation that effectuation researchers should more explicitly state the assumptions they make in their conceptualisation and measurement of effectuation. Furthermore, I believe that in order to address criticisms leveraged at effectuation theory in relation to a lack of systematic testing of its propositions and a much needed expansion of theory and research clarifying its predictive validity (Arend et al., 2015), we need to develop measures of effectuation that (a) operationalise effectuation in line with existing theory (Sarasvathy, 2001a, 2008; Sarasvathy & Dew, 2013), and (b) integrate recent empirical evidence clarifying how entrepreneurs use effectuation in the new venture creation process (e.g., Jiang and Ruling, 2019; Jiang and Tornikoski, 2019; Reymen et al., 2015) as well as the nature of the effectuation construct (Chandler et al., 2011; Smolka et al., 2018). In the following paragraphs, I describe the main assumptions underpinning this newly proposed measure of effectuation, as well as the rationale for selecting these assumptions.

3.2.1.1 The principles underpinning the effectuation and causation constructs

As already noted in the previous section, different measures have operationalised effectual and causal logics differently. Whereas some measures have amalgamated the different principles associated with either effectuation or causation into one overall scale (Wiltbank et al., 2009), others have operationalised four

principles associated with both effectuation and causation (Brettel et al., 2012), and others have found that whereas the four principles associated with causal logics could not be measured as distinct principles, effectual principles were independent from one another and suggested a formative rather than a reflective effectuation construct (Chandler et al., 2011). Nevertheless, only a limited number of studies have thoroughly investigated the dimensionality of the effectuation construct, and research on dimensionality is heavily influenced by the operationalisation chosen by the measure developers (McKelvie et al., 2020). As such, given there is no consensus on the factorial make-up of the effectuation construct, I suggest that researchers should develop scales in line with theoretical conceptualisations of the effectuation construct (Sarasvathy, 2001a). This involves four principles each for effectuation – focus on means, affordable loss, leverage contingencies, and co-creation – and causation – prediction, maximise returns, avoid contingencies, and competitiveness.

3.2.1.2 Effectuation as a decision-making logic

Whereas conceptually effectuation has been defined as a decision-making logic (Dew, Read, et al., 2009; S. Read, Dew, et al., 2009; Sarasvathy, 2001a), most effectuation measures have operationalised it as behaviours. This can create issues related to testing and building on existing theory, as there is a discrepancy between how entrepreneurs use effectuation in their decision-making, and how entrepreneurs behave in ways consistent to an effectual approach (McKelvie et al., 2020). For instance, it may be that entrepreneurs use prediction, conduct market research, and produce business plans (behaviour). However, this does not necessarily mean that they will use these business plans to support their decisions when it comes to selecting a target market, or choosing a strategy for marketing their product to their target

customers (decision). Whereas behaviours may be a proxy for entrepreneurs' reliance on effectual logics, there may be important differences between behaviours and decision-making logics that a behavioural measure would not be able to capture. Thus, given there is currently no measure of effectuation and its underlying principles operationalising this construct as a decision-making logic, I develop a complementary measure to existing measures of effectuation behaviours.

3.2.1.3 Assessing effectuation at the decision- rather than the venture-level

Emerging findings from process studies have indicated that entrepreneurs do not rely on one decision-making logic throughout the new venture creation process, but rather switch between logics depending on the stage of development of their venture (Berends et al., 2014), levels of uncertainty (Jiang & Tornikoski, 2019), resource availability, and stakeholder pressure (Reymen et al., 2015). Furthermore, research on entrepreneurial decision-making also suggests that entrepreneurs may rely on different strategies for solving the many organisational decisions they encounter in the new venture creation process (Shepherd et al., 2015). Consequently, the measurement of effectuation should be able to capture any potential decision heterogeneity by sampling a wider array of decisions, rather than asking entrepreneurs to reflect on the venture creation process as a whole.

3.2.1.4 Assessing effectuation at the individual- rather than the team-level

Effectuation theory describes how individual entrepreneurs approach decisions in the context of new venture creation (Sarasvathy, 2001a, 2001b, 2008). Nevertheless, most existing measures assess the whole entrepreneurial team's use of effectuation, rather than measuring it at the individual-level of the entrepreneur. Whereas this has not been an issue for studies focusing on the venture-level, for

research that investigates the individual-level antecedents (e.g., personal characteristics, resources, or psychological mechanisms) and outcomes (e.g., wellbeing), there is a need for complementary measures that assess individuals' use of effectuation. This also answers calls for more consistency and clarity in the levels of analysis investigated in effectuation research (McKelvie et al., 2020).

In summary, this measure operationalises effectuation and causation as decision-making logics of the individual entrepreneur, each consisting of four independent principles.

3.2.2 Expanding the nomological net of the effectuation construct

One of the main criticisms leveraged at effectuation theory concerns its lack of grounding into existing decision-making theory (Arend et al., 2015). I agree that better understanding how effectuation relates to, and is different from, other constructs representing how individuals approach decision-making would help elucidate the nature of the effectuation construct and help advance theory.

In this study, in order to establish the convergent and discriminant validity of the newly developed instrument of effectual decision-making logics, I investigate the relationship between effectual decision-making and effectual behaviours (Chandler et al., 2011). Whereas I expect matched principles from both the decision-making and behavioural measures to be positively related (convergent validity), I only expect moderate-sized relationships given the conceptual differences between these two measures (discriminant validity). Furthermore, I also explore the relationship between effectual decision-making and an individual's tendency to satisfice or maximise in their decision-making (Cheek & Schwartz, 2016). Satisficing represents a decision-

making logic whereby decision-makers continue their search for information and options only until a certain acceptability threshold has been met (Schwartz et al., 2002; H. A. Simon, 1959). Satisficing is most often contrasted with maximising, whereby decision-makers seek to optimise their decisions by searching for the option with the highest expected returns (Gigerenzer & Brighton, 2009; von Neumann & Morgenstern, 1944). Differences in individuals' tendencies to maximise and satisfice have been linked to a series of important psychological outcomes, such as regret, decision-making difficulty, happiness, and life satisfaction (Cheek & Schwartz, 2016; Schwartz et al., 2002). Sarasvathy (2001a, p.246) has acknowledged in her conceptualisation of effectuation that entrepreneurs who make decisions using an effectual logic are likely to also use satisficing strategies in their decision-making. As an effectual logic emphasises flexibility and adapting to changing circumstances and unexpected events, entrepreneurs are unlikely to comprehensively search for information enabling them to pick the option with the highest expected return. Instead, entrepreneurs are likely to favour decisions where an acceptable option is found quickly, given decisions are subject to change and adaptation in light of new events and feedback from the environment. However, to the best of my knowledge, the relationship between effectuation and maximising-satisficing has never been tested empirically. I explore this relationship in our study to help extend the nomological net of the effectuation construct.

3.3 Overview of studies

Building on the methodology used by past studies to develop and validate measures for entrepreneurship research (Cardon, Gregoire, Stevens, & Patel, 2013; Chandler et al., 2011; Haynie & Shepherd, 2009), I followed a three-step procedure

to develop the measure and to assess the newly developed instrument in terms of multiple dimensions of validity. Firstly, I develop the scales and conduct several pilot studies to assess content validity and adjust wording for improving respondents' comprehension of the items. In study 1, I explore the factor structure of the measure. In study 2, I refine the measure, confirm its factor structure, and explore its convergent and discriminant validity.

3.4 Scale development and pilot studies

3.4.1 Measurement approach

Given I make an argument that effectuation should be measured at the decision- rather than the whole venture- or venture stage-level, I sought a measurement approach that enabled the assessment of entrepreneurs' use of effectual and causal decision-making logics for specific decisions in the new venture creation process. Thus, the measurement format I opted for in this study was that of a scenario-based measure (Baum, Bird, & Singh, 2011; Wiltbank et al., 2009), also referred to as a situational judgment test in the psychology literature (Motowidlo et al., 1990; Weekley et al., 2015). This methodology has been suggested as an alternative to self-report measures due to its ability to capture situated (i.e., context-specific) decisions and behaviours. Rather than asking respondents to reflect and report on self-perceptions aggregated across many different instances and situations (McClelland, 1987), this type of measure consists of fictitious scenarios describing a situation in detail and a series of response options presenting alternative logics for making a decision or behaving in that specific situation. Based on the behavioural consistency principle, it is expected that respondents' answers to the scenario-based assessments

mirror their decision-making and behaviours in real-life situations (Wernimont & Campbell, 1968).

Overall, the literature on scenario-based measures shows that they are valid measures, show convergent validity with self-report measures of the same or theoretically related measures (Arthur et al., 2014; Arthur & Villado, 2008; Olaru et al., 2019), and also predict various performance outcomes (e.g., Bledow & Frese, 2009; David Chan & Schmitt, 2002; Christian, Edwards, & Bradley, 2010). Furthermore, there is recent evidence suggesting that as the specificity of the situations presented within scenario-based assessments increases, so does their predictive validity (Rockstuhl & Lievens, 2021). Scenario-based measures counter some of the main limitations of self-report measures asking respondents to reflect back on their behaviours over an extended period of time, such as issues related to recall bias (March & Sutton, 1997) or anchoring effects (Paulhus, 1991).

Scenario-based measures differ in whether they are designed to assess broader performance in a particular work context (i.e., work samples or low-fidelity simulations; e.g., David Chan & Schmitt, 2002; Motowidlo et al., 1990; Motowidlo & Tippins, 1993) or specific constructs (e.g., Bledow & Frese, 2009; Guenole, Chernyshenko, & Weekly, 2017; Olaru et al., 2019; Wiltbank et al., 2009). For construct-specific scenario-based measures, researchers typically use theory to develop the scenarios and response options (Guenole et al., 2017). Given I aimed to develop a scenario-based measure of the effectuation construct, I was guided by Sarasvathy's (2001a) theoretical conceptualisation of effectuation when writing the scenarios and the response options. A scenario-based measure of effectuation and

causation would ask respondents to report on their use of effectual and causal decision-making logics across a series of decisions that entrepreneurs typically encounter in the new venture creation process. Thus, an entrepreneur's overall preference for a logic, or principle more specifically, is a function of an entrepreneur's situated preferences for that logic across different decisions.

3.4.2 Development of scenario and response items

The data from the 41 semi-structured interviews described in Chapter 2 was used in this study to collect critical incidents of the typical decisions entrepreneurs encounter and deal with during the new venture creation process. As already described in section 2.3.3, I coded instances where the decision-making logics the entrepreneurs described were consistent with effectual or causal principles. This theory-led, abductive process ensured that when designing the measurement items, I was led by Sarasvathy's (2001a) conceptualisation of effectuation and causation, whilst using examples of real-life decisions that entrepreneurs typically encounter during new venture creation.

Similarly to Wiltbank, Read, Dew, & Sarasvathy (2009), I devised a scenario briefly describing a venture developing products using virtual reality technology. The scenario also contained information about the fictional entrepreneur (Allison) creating the venture and the resources available for the venture. Based on the critical incidents collected, I then developed 21 questions targeting different decisions the entrepreneur developing this venture would face, such as choosing a product idea to turn into a prototype, forming a team, or marketing the venture's offering. Lastly, for each of these decisions I developed between three and seven response items reflecting

effectual and causal decision-making principles. Best practices on developing construct-specific scenario-based measures recommend that each response option should be unidimensional (Guenole et al., 2017). Thus, each response option should only assess one construct, however each scenario may contain response options assessing multiple constructs. When developing the response options, I used the coded excerpts from the interviews representing exemplars of effectual and causal decision-making principles in order to stay close to the language employed by the entrepreneurs (cf. Chandler et al., 2011). The full scenario, questions, and response items can be found in the Appendix. Below is an example of a decision and the corresponding response items:

> *Allison needs to start making decisions around how to market her product. What would you do?*
>
> a) *Rely on marketing methods that you, your team, or wider network are familiar with*
> b) *Devise a detailed marketing plan based on systematic customer segmentation and market research*
> c) *Experiment with different marketing methods*
> d) *Limit spending on marketing to sums of money that would not put the venture in real trouble financially if they were lost*

In total, across all decisions, I developed 101 items reflecting the following seven effectual and causal principles: Focus on Means, Affordable Loss, Co-Creation, Leverage Contingencies, Prediction, Maximise Returns, Competitiveness. I depart slightly from Sarasvathy's (2001a) conceptualisation of eight principles (four for effectuation, four for causation) by merging the Avoid and Leverage Contingencies principles into one scale. I opted for this approach because devising items that were likely to be distinct enough to belong to separate principles proved challenging. Instead, I developed one Leverage Contingencies scale representing this principle,

where lower scores reflect entrepreneurs' principle of avoiding contingencies, whereas higher scores reflect entrepreneurs' principle of leveraging contingencies.

3.4.3 Pilot studies

Having developed an initial set of items, I investigated the content validity of these items using a modified q-sort approach (Nag, Corley, & Gioia, 2007; Stephenson, 1953). I engaged six active, PhD holding researchers in the effectuation field. As a first step, respondents categorised each item into an effectual or causal logic. As a second step, the respondents categorised all the items into one of the seven principles outlined above. Respondents could choose not to categorise the items in either of the two logics, or in any of the principles. They completed the q-sort task and also provided qualitative feedback on the items. I used the results of this study and their comments to modify and reword a number of items. I also conducted a pilot study with 10 entrepreneurs to assess whether target respondents encountered any difficulties in comprehending and answering the scenario and the response items. I made some minor edits to the items based on the pilot.

3.5 Study 1

3.5.1 Participants and procedure

I surveyed 205 owner-managers of businesses in the United Kingdom, thus meeting the definition of "everyday entrepreneurs" (F. Welter, Baker, Audretsch, & Gartner, 2017). A panel of pre-screened entrepreneurs was used. Participants were offered financial incentives for completing the questionnaire.

The sample was 52% female (106 females), had a mean age of 39.65 years (SD = 12.09), 59.5% had university-level education, on average had 17.51 years (SD

= 11.82) of work experience, had founded 1.60 ventures (SD = 1.09, min = 1, max = 10), and had 7.89 years (SD = 7.47, min = 0, max = 38) of entrepreneurial experience. Participants' businesses were between 0 and 40 years old, had annual business revenues of between 0 and £3,000,000, and employed on average 3.12 employees (SD = 7.94).

3.5.2 Measures

Participants read the scenario and were asked to put themselves in the shoes of the entrepreneur as they are making a series of decisions about the fictitious venture. Each of the response options represented either a causal or effectual principle based on Sarasvathy's (2001a) conceptualisation. Response formats for scenario-based measures vary in either asking respondents to choose the response options they most (and least) likely to perform, rating each response option using Likert-type scales, or ranking each of the options from most to least likely. Different response formats have been used for assessing different types of constructs (McDaniel & Nguyen, 2001), however Likert-type rating scales seem to show better measurement properties, including improved reliability compared to other response formats used in the literature on scenario-based measures (Arthur et al., 2014; Catano, Brochu, & Lamerson, 2012; Weekley et al., 2015). Thus, I opted for a 5-point Likert rating scale (1 = Strongly Disagree to 5 = Strongly Agree). This format also enabled me to assess the effectual and causal principles independently, rather than as opposites.

3.5.3 Data analysis

Exploratory factor analysis was used to investigate the underlying dimensionality of the initial set of 101 items. I used parallel analysis (Hayton, Allen, & Scarpello, 2004) to decide on the number of factors to be retained, as it has been

advocated as one of the most accurate methods for making factor retention decisions (Zwick & Velicer, 1986).

The factorability of the data was assessed using communality cut-off values (should be above .50, Hair Jr. et al., 2006), Bartlett's test of sphericity (should be significant, Bartlett, 1950), and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (should be greater than .50, Kaiser, 1970). Each of the individual variables exceeded the communality cut-off value of .50. I found a KMO value of .75 and a significant Bartlett's test ($\chi^2 = 10682.73$, $p < .001$), indicating that factor analysis is appropriate. I used both orthogonal and oblique rotations to aid in the interpretation of the factors obtained, and the results were similar using both rotation approaches. I report the factor loadings obtained using orthogonal rotation in the subsequent results section.

3.5.4 Results

The results of the parallel analysis suggested that seven factors should be retained. However, when investigating the factors resulting from the exploratory analysis extracting seven factors, I discovered that only five factors corresponded to effectual and causal principles, whereas the remaining two factors were not interpretable with reference to effectuation or causation constructs. I removed the items that loaded on the two uninterpretable factors and reran the parallel analysis, which indicated that five factors should be retained. I further removed items that loaded significantly (> .40, Hair Jr. et al., 2006) on more than one factor, and was left with 51 items across 15 decisions.

Similarly to the factor structure reported by Chandler et al. (2011), the items reflecting causal principles loaded together on one Causation factor (22 items, α = .91), whereas items reflecting the four effectuation principles loaded on separate factors, namely Focus on Means (6 items, α = .68), Affordable Loss (7 items, α = .58), Co-Creation (10 items, α = .77), and Leverage Contingencies (6 items, α = .76). The items all had factor loadings above .40, indicating appropriate fit and power (Hair Jr. et al., 2006).

3.6 Study 2

In study 2, I aimed to improve the reliability of the Affordable Loss and Focus on Means scale, confirm the structure of the revised instrument in a new sample, and investigate convergent and discriminant validity.

3.6.1 Participants and procedure

I used the same sampling procedure as for study 1 and collected data from an additional sample of 216 owner-managers of businesses in the UK.

The sample was 65% female (140 females), had a mean age of 37.85 years (SD = 11.43), 62.5% had university-level education, on average had 15.59 years (SD = 10.54) of work experience, had founded 1.58 ventures (SD = 1.13, min = 1, max = 10), and had 7.47 years (SD = 6.88, min = 0, max = 40) of entrepreneurial experience. Participants' businesses were between 0 and 29 years old, had annual business revenues of between 0 and £7,000,000, and employed on average 2.06 employees (SD = 7.97).

3.6.2 Measures

3.6.2.1 Scenario-based measure of effectual and causal decision-making logics

In the second iteration of the scenario-based measure of effectual and causal decision-making, I retained the items from the initial measure that displayed good psychometric properties and developed additional items for the Focus on Means and Affordable Loss scales. The final version of the instrument contained 14 decisions, 18 response items assessing Causation, 4 items assessing Focus on Means, 6 items assessing Affordable Loss, 7 items assessing Co-creation, and 5 items assessing Leverage Contingencies.

3.6.2.2 Self-report measure of effectual and causal behaviours

In order to assess the convergent validity of the newly developed measure, I include one of the most widely used measures of effectuation in the literature (Chandler et al., 2011; McKelvie et al., 2020). This measure assesses an entrepreneurial team's overall use of effectual and causal behaviours across five dimensions. Participants were asked to indicate their level of agreement with each of the items using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree).

Causation is a 7-tem scale ($\alpha = .83$). Example items include "We designed and planned business strategies" and "We developed a strategy to best take advantage of resources and capabilities".

Affordable loss is a 3-item scale ($\alpha = .86$). An example item is "We were careful not to commit more resources than we could afford to lose".

Pre-commitments is a 2-item scale (α = .62) assessing entrepreneurs' use of strategic alliances through pre-commitments with stakeholders (Sarasvathy, 2001a). An example item is "We used pre-commitments from customers and suppliers as often as possible". In previous research, pre-commitments has been suggested as a shared principle between effectual and causal logics.

Chandler and colleagues (2011) slightly depart from Sarasvathy's (2001a) conceptualisation of effectual principles and include two scales assessing separate components of the leverage contingencies principle. The experimentation scale contains 4 items (α = .61) and illustrates entrepreneurs' tendency to trial different approaches before selecting a final one. This principle is in line with research on innovation in established organisations (Brown & Eisenhardt, 1997) and more recent research on pivoting in entrepreneurial firms (Kirtley & O'Mahony, 2020). An example item is "We experimented with different products and/or business models". The flexibility scale contains 4 items (α = .46) and is closer to the leverage contingencies principle as described by Sarasvathy (2001), which implies that entrepreneurs using this principle tend to capitalise on and exploit unexpected contingencies that occur over time. An example item is "We allowed the business to evolve as opportunities emerged".

Whereas reliabilities above .60 have been argued to be reasonable for moderately broad firm-level measures (Waldman, Ramirez, House, & Puranam, 2001), it must be recognised that the reliability of the flexibility scale is low. I still include this scale in the analyses for completeness.

3.6.2.3 Maximising-satisficing scale

In this study, I aimed to expand the nomological net of the effectuation construct by investigating the relationship between entrepreneurs' use of effectual decision-making logics, behaviours, and their tendency to maximise-satisfice.

Schwartz and colleagues' (2002) maximising-satisficing measure is a 13-item scale ($\alpha = .68$) assessing an individual's tendency to maximise. Higher scores indicate a preference for maximising. Participants were asked to indicate their level of agreement with each item on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). An example item includes: "Whenever I'm faced with a choice, I try to imagine what all the other possibilities are, even ones that aren't present at the moment".

3.6.2.4 Marker variable – blue attitude

Given all the measures I used in the study are self-reported, I also assessed the potential presence of common method bias, as well as its impact on our results (Williams, Hartman, & Cavazotte, 2010). As such, I included blue attitude as a marker variable (Simmering, Fuller, Richardson, Ocal, & Atinc, 2015). This is a 4-item measure that assesses individuals' attitudes towards the colour blue. An example item is "I like the colour blue". The measure was developed specifically for use as a marker variable as it is not theoretically related to constructs typically of interest in organisational research (Simmering et al., 2015). Furthermore, the items capture both affective and evaluative components of respondents' attitudes, which have been argued to be especially susceptible to biases associated with common method variance (D Chan, 2009; Williams et al., 2010).

3.6.3 Data analysis

Descriptive statistics and correlations for the variables included in Study 2 are presented in Table 3-1. Each of the individual variables exceeded the communality cut-off value of .50. I found a KMO value of .78 and a significant Bartlett's test (χ^2 = 4848.75, p < .001), indicating that factor analysis is appropriate. I use the same exploratory factor analysis procedures as in Study 1. I used both orthogonal and oblique rotations to aid in the interpretation of the factors obtained, and the results were similar using both rotation approaches. I report the factor loadings obtained using orthogonal rotation in the subsequent results section.

I further validate the factor structure of the instrument using confirmatory factor analysis (CFA). In line with recommendations by Edwards (2001), I used several fit indices to evaluate the different models tested. I used the comparative fit index (CFI), incremental fit index (IFI), and the Tucker-Lewis Index (TLI) as indicators that are more stable for smaller sample sizes (Fan, Thompson, & Wang, 1999). Values greater than .90 are considered to represent acceptable model fit, whereas values above .95 indicate good fit (Bentler, 1992). I also examined the root mean square error of approximation (RMSEA), with values below .05 representing a good fit (Byrne, 2001). In addition to good overall fit, it is also important to inspect the individual parameter estimates to ensure that the model does not suffer from any misspecifications at the individual item level (Bollen, 1989). I inspected the value, sign, and statistical significance of the parameter estimates for each of the items, as well as the squared multiple correlations as a measure of effect size. Finally, I used CFA to assess the presence of common method bias (Williams et al., 2010). I

conducted our CFA analyses using AMOS 27, and Maximum Likelihood Estimation (MLE) procedures. I used SPSS 27 for all other analyses.

3.6.4 Results

3.6.4.1 Exploratory factor analysis, final items retained, and reliabilities

The results of the parallel analysis for the revised set of items suggested that five factors should be retained. I removed 18 items that had factor loadings below .40. The resulting scales derived from the exploratory factor analysis were: Causation (18 items, $\alpha = .89$), Focus on Means (4 items, $\alpha = .72$), Affordable Loss (6 items, $\alpha = .80$), Co-creation (7 items, $\alpha = .75$), and Leverage Contingencies (5 items, $\alpha = .76$). Thus, the revised scales show good reliability. The factor loadings for all items in the final version of the measure are presented in Table 3-2.

3.6.4.2 Confirmatory factor analysis

To further investigate the factor structure of the instrument, I used confirmatory factor analysis (CFA) and following suggestions by Byrne (2001) I evaluated the fit of alternative measurement models. I analysed several first-order models, whereby I compared the fit for a single factor (Entrepreneurial Decision-Making), two factors (Effectuation and Causation), and five factors (Causation, Focus on Means, Affordable Loss, Co-Creation, Leverage Contingencies). I do this to help determine whether the principles of effectuation are empirically distinct from causation (i.e. evidence of discriminant validity).

Reviewing the model fit statistics reveals that all three models showed good absolute fit with the data (see Table 3-3). The chi-squared difference tests indicated that the difference in fit between the first-order one-factor and two-factor models was

statistically significant ($\Delta\chi^2 = 27.82$, $p < .001$). Furthermore, the difference in fit between the first-order one-factor and five-factor model was also statistically significant ($\Delta\chi^2 = 61.38$, $p < .001$). Thus, in terms of relative fit, the first-order two-factor model ($\chi^2 = 749.56$, CFI = .95, TLI = .94, IFI = .95, RMSEA = .03) showed the best fit to the data.

However, when inspecting the individual parameter estimates of the models, a number of items within the one- and two-factor models did not have statistically significant loadings on their hypothesised factors. In particular, in the two-factor model 11 out of 22 items did not load significantly on the Effectuation factor and in the one-factor model 21 out of 40 items did not load significantly on the Decision-Making factor. Inspection of the squared multiple correlations for each of the items also revealed values close to 0 for many items in the one- and two-factor models. By contrast, in the five-factor model all items on the final measure loaded significantly ($p < .001$) and positively on their hypothesised factors. The squared multiple correlations for items within the five-factor model were moderate to high.

In sum, despite the two-factor model presenting the best relative fit amongst the models I compared in this study, the individual item loadings did not provide satisfactory support for the validity of this model. Instead, the five-factor model provided good overall model fit, as well as significant loadings for all items included in the final scales. Overall, this suggests that the five-factor model is the most accurate model for the data I present.

Table 3-1: Descriptive statistics, internal consistencies, and correlations between variables in Study 2

	1	2	3	4	5	6	7	8	9	10	11	Mean	SD
1. Causation DM	(.89)	-	-	-	-	-	-	-	-	-		4.03	0.49
2. Affordable loss DM	.22**	(.80)	-	-	-	-	-	-	-	-		3.88	0.69
3. Leverage contingencies DM	.20**	.15*	(.76)	-	-	-	-	-	-	-		3.71	0.65
4. Focus on means DM	.06	.23**	.23**	(.72)	-	-	-	-	-	-		3.55	0.68
5. Co-creation DM	.38**	-.01	.24**	.10	(.75)	-	-	-	-	-		3.62	0.60
6. Causation behaviours	**.41****	.12	.08	.13	.10	(.83)	-	-	-	-		3.81	0.66
7. Affordable loss behaviours	.15*	**.58****	0	25**	-.01	.07	(.86)	-	-	-		4.15	0.83
8. Experimentation behaviours	.13	.05	.34**	.08	.05	.19**	.04	(.61)	-	-		4.30	0.53
9. Flexibility behaviours	.34**	.05	**.49****	.02	.18**	.20**	-.01	.21**	(.46)	-		3.53	0.87
10. Pre-commitments behaviours	.24**	.04	.03	.12	**.24****	.47**	.06	.07	.22**	(.62)		3.19	0.96
11. Maximising	.12	.08	.09	.08	.11	**.20***	.08	.17*	.03	.17*	(.67)	3.16	0.52

Note. Cronbach's alpha internal consistency estimates are placed on the diagonal in parentheses; n = 216; DM = Decision-Making. Correlations between matched principles are in bold (evidence of convergent validity).

*$p < .01$

**$p < .001$

Decision	Item	C	AL	CC	LC	FM
1.Allison knows she can't build and grow this company alone, so she needs to assemble a team to help her get started with the new venture.	Seek co-founders who commit time and resources to shape the future vision of the company			.46		
2. Allison is working on the specifications for her first product prototype.	Base prototype specifications on in-depth competitor analysis and positioning	.46				
	Be careful not to risk more money than you are willing to lose with your initial idea		.62			
3. Allison is starting to think about the resources necessary for building an initial product prototype.	Build a detailed business plan and estimate the resources and costs associated with building the prototype	.66				
4. Allison is trying to figure out how to manage and allocate the funds she has available to invest in her start-up.	Build a financial plan projecting budgets for the main functional areas of the business requiring investment	.56				
	Only spend what is absolutely necessary at this stage, save the remainder for a rainy day		.49			
5. Now that Allison has developed specifications for her prototype, she needs to decide which set of technologies to engage in the development of her prototype's software.	Look for technology partners that can help you design and build the technology infrastructure			.59		
6. Allison's team is starting development work for the prototype, so she has to organise and manage the team's workload.	Carefully plan the team's activities for the upcoming period	.59				
	Experiment with and trial different ways of organising the workload among the team				.54	
7. Allison is identifying and deciding between potential sources of revenue for her business, in particular whether to target enterprises or individual customers.	Evaluate expected returns from different sources of revenue	.47				

	Conduct detailed market analyses and use this data to decide which target customers you should focus on	.63				
	Base your decision on your and your team's previous experience and network					.74
8. Allison is deciding which production modality to use so she can start fulfilling customer orders.	Research alternatives and project the expected efficiencies for each production mode	.50				
	Base your decision on a consideration of your past experience and network					.65
	Search for a key stakeholder who is willing to share the risks			.56		
9. Allison is working on developing her company's branding.	Establish partnerships with reputable organisations and individuals to benefit off their brand			.66		
	Focus on highlighting key differentiators from your competition's offering through your branding	.42				
	Devise a clear, well-defined branding strategy based on data about your target customer and their preferences	.62				
	Be careful not to commit more resources in branding than you can afford to lose		.75			
10. Allison needs to start making decisions around how to market her product.	Rely on marketing methods that you, your team, or wider network are familiar with					.80
	Devise a detailed marketing plan based on systematic customer segmentation and market research	.71				
	Experiment with different marketing methods				.78	

	Limit spending on marketing to sums of money that would not put the venture in real trouble financially if they were lost		.77			
11. Allison is working on getting her company's sales efforts off the ground.	Experiment with different sales methods				.76	
	Evaluate different sales strategies based on calculations of expected returns	.51				
	Devise a detailed strategy outlining sales targets and plans on how to achieve these targets	.71				
	Research your competitors' sales strategies and look for a strategy that will allow you to build competitive advantage over them	.55				
	Choose sales methods and channels that you or your team have previous experience with					.65
12. Allison starts thinking about identifying and creating new business opportunities for her company.	Develop a detailed plan for business development activities and set clear performance targets	.73				
	Calculate and evaluate expected returns from various opportunities to decide which ones to focus on	.47				
	Partner up with organisations targeting similar customers and create business opportunities together			.74		
	Limit your investment of resources into business development to what you can afford to lose in a worst case scenario		.74			
13. Allison is designing processes intended to facilitate entry into new geographical markets.	Co-opt local partners who can help you figure out local conditions and share the risks of expansion			.70		

	Experiment with various approaches in the local market				.70
	Conduct in-depth research of local market conditions and plan a clear strategy	.66			
	Only spend as many resources as you could afford to lose if things didn't work out		.82		
14. Allison needs to come up with some product ideas that would enable her to diversify her venture's offering.	Study expert predictions of where the market is heading to get ideas for expansion	.58			
	Establish partnerships that enable you to develop new products or services			.67	
	Experiment with different product ideas before deciding on a direction to pursue				.67
	Produce calculations of potential returns for different ideas for products and services	.63			

Table 3-2: Item loadings (Study 2)

Note. C = Causation, AL = Affordable Loss, CC = Co-creation, LC = Leverage Contingencies, FM = Focus on Means.

Table 3-3: Fit statistics for CFA models tested in Study 2

Model	Chi-square	CFI	TLI	IFI	RMSEA
One-factor	777.38	.94	.93	.94	.03
Two-factor	749.56	.95	.94	.95	.03
Five-factor	838.76	.94	.93	.94	.03

3.6.4.3 Convergent and discriminant validity

Inspection of the correlation matrix (Table 3-1) presented good evidence of both convergent and divergent validity for all five scenario-based scales with the behavioural effectuation measure. The correlations between matched principles on the two measures range between .24 and .58, and are larger in size than the correlations with non-matched principles.

In terms of relationships with maximising-satisficing logics, none of the scales assessing effectual and causal decision-making logics showed significant correlations. On the other hand, behavioural Causation (r = .20), Experimentation (r = .17), and Pre-commitments (r = .17) were significantly and positively related to maximising. The two positive correlations between maximising and behavioural Experimentation and Pre-Commitments respectively are unexpected given effectuation has typically been associated with satisficing, rather than maximising (Sarasvathy, 2001a).

3.6.4.4 Common method biases

Lastly, I evaluated the presence of common method bias using the CFA procedure suggested by Williams et al. (2010). This procedure involves comparing a series of models that include a marker variable thought to be unrelated to effectual and causal decision-making logics. I first tested a constrained model whereby the effect of method biases was assumed to be uniform across all items. A comparison between the baseline and constrained model indicated that the effects of method bias were unlikely to be uniform across all items of the newly developed measured ($\Delta\chi^2_1$ = .002, p = .489). I tested an un-constrained model where the effect of method bias on each of the items was estimated freely and was allowed to differ between items. The results from this

model revealed that on average, the methods factor accounted for less than 1% of item variance and 0.62% of construct reliability. The decomposition of reliability into substantive construct reliability and method-related reliability for each of the five scales can be found in Table 3-4. Lastly, the comparison between the un-constrained model and a restricted model indicate that the presence of small method biases does not affect the pattern of correlations between the different effectual and causal decision-making logics ($\Delta\chi^2_{10} = .012$, $p = .488$). In sum, this analysis suggests that common-method biases are unlikely to affect the validity of the newly proposed measure of effectual and causal decision-making logics.

Table 3-4: Reliability decomposition into substantive and method-related variance

	Reliability Baseline Model	Decomposed Reliability Unconstrained Model		
Latent variable	Total Reliability	Substantive Reliability	Method Reliability	% Reliability Marker Variable
Affordable Loss	0.81	0.81	0.000	0.04
Co-Creation	0.77	0.76	0.014	1.81
Experimentation	0.80	0.80	0.004	0.80
Focus on Means	0.77	0.76	0.003	0.34
Causation	0.92	0.92	0.004	0.40
Marker Variable	0.80	-	-	-

3.7 Discussion

This study develops and validates a new scenario-based measure of effectual and causal decision-making logics. Across several empirical studies, I examine the content validity of the newly developed measure, I explore and then confirm the dimensionality of the measure, and provide evidence of convergent and discriminant validity. This novel, scenario-based measure of effectual and causal decision-making

logics shows evidence of strong reliability and validity. I believe this work provides several contributions.

Firstly, I make a methodological contribution by developing and validating a new measure of effectuation for research, which addresses some of the most important limitations of existing measures. In this measure, I operationalise effectuation as a decision-making logic, assessed at the individual entrepreneur level across a series of decisions representative of the new venture creation process. This enables an independent measurement of effectual and causal logics, and allows for variability in entrepreneurs' use of effectual and causal logics across different decisions (Berends et al., 2014; Reymen et al., 2015). Furthermore, as a scenario-based measure, it counters recall bias issues (March & Sutton, 1997) associated with self-report measures asking respondents to reflect back on their behaviours over an extended period of time. I believe this newly developed measure of effectuation enables the effectuation literature to expand in several directions, which I elaborate in the following section.

Secondly, this chapter builds a theoretical conceptualisation of the effectuation construct grounded in theoretical work on effectuation (Dew, Sarasvathy, et al., 2009; Sarasvathy, 2001a, 2008; Wiltbank et al., 2006), and integrating insights gleaned from more recent research on both the nature of the effectuation construct (Chandler et al., 2011; Smolka et al., 2018) and on how entrepreneurs use effectuation in the new venture creation process (Jiang & Ruling, 2019; Jiang & Tornikoski, 2019; Reymen et al., 2015). I contribute to clarifying the ontological nature of the effectuation construct, by showing that causation is a unidimensional construct, whereas

effectuation consists of four distinct principles. This supports Chandler et al.'s (2011) empirical findings, but departs from Sarasvathy's (2001) conceptualisation showing effectuation and causation consisting of four contrasting principles each. Gigerenzer and Brighton (2009) conceptualise optimising strategies as general-purpose strategies, whereas heuristics (and other satisficing strategies) as more specialised strategies enabling decision-makers to adapt to different environments and decisions. Similarly, the different effectual principles could represent specialised strategies enabling entrepreneurs to make decisions in different domains of the venture: the focus on means principle may help entrepreneurs make decisions in relation to the evaluation and use of resources, the affordable loss principle applies to resource investment decisions, leverage contingencies helps entrepreneurs make decisions when unexpected events happen, and co-creation helps entrepreneurs navigate relationships with potential stakeholders. On the other hand, causal logics may apply to a wider variety of decisions that entrepreneurs encounter throughout the process of new venture creation, thus constituting a wider logic underpinning entrepreneurial decision-making. I believe that this re-conceptualisation of the effectuation and causation constructs can help further advance the effectuation field by providing a more thorough, empirically supported conceptualisation of these constructs. It also addresses calls for more integration of relevant theories and perspectives from cognitive science and psychology into effectuation theory (Arend et al., 2015).

Thirdly, at an empirical level, I provide evidence on the nomological net of the effectuation construct. In particular, I show that effectual decision-making logics and behaviours are distinct constructs and thus researchers should clearly define and delineate whether they are operationalising effectuation as a decision-making logic or

as a behaviour. Furthermore, I unveil a potential explanation for why particular principles may belong to both effectuation and causation, that is due to their shared relationship with maximising-satisficing tendencies. This helps provide evidence of the convergent and discriminant validity of our measure, as well as show how effectuation is related to more domain-general decision-making logics.

3.7.1 Implications for future research

A primary implication of this work is to facilitate future research on the role that effectuation plays in the new venture creation process (Alsos et al., 2020; Grégoire & Cherchem, 2020). In particular, I believe that this newly developed measure can help progress research investigating the antecedents and outcomes of effectuation, and in particular effectual principles that have been investigated less often in past quantitative research – such as focus on means. For instance, investigating the role of other resources beyond entrepreneurial expertise (Dew, Read, et al., 2009; Sarasvathy, 2001b), including the role of human and social capital, in entrepreneurs' mobilisation of the focus on means principle, as well as potential mechanisms underpinning this mobilisation could be fruitful areas of research. Passion, entrepreneurial self-efficacy, and risk perceptions have also been suggested as individual-level antecedents of effectual logics (Stroe, Parida, & Wincent, 2018), however we can expect these antecedents to be differentially linked to the four principles underpinning effectuation (T. Frese, Geiger, & Dost, 2020). Furthermore, entrepreneurs' reliance on the focus on means principle could also impact new venture processes and outcomes beyond those already investigated in existing research (e.g., Deligianni et al., 2017; Smolka et al., 2018). Does the focus on means principle enable entrepreneurs to test their ideas more quickly (Camuffo, Cordova, Gambardella, & Spina, 2020) as they make use of

existing resources rather than looking to acquire additional resources for implementing their ideas? Do entrepreneurs using this principle, in turn, manage to achieve a first sale more quickly than entrepreneurs not relying on this principle? Alternatively, does focusing on given means, rather than pre-selecting an idea based on predictive strategies, result in more creative new venture ideas (Sarasvathy, 2001a)? I also see a lot of potential in better understanding the micro-foundations of the new venture creation process by exploring whether entrepreneurs' use of effectuation impacts on entrepreneurial action (McMullen & Shepherd, 2006), and subsequently, whether effectual decision-making logics play a role in helping entrepreneurs maintain motivation and persist in the face of challenges and obstacles (Holland & Shepherd, 2013), beyond other individual-level factors such as self-efficacy and passion (Cardon & Kirk, 2015). Recently, there has also been a call for investigating psychological outcomes in addition to the growth and performance outcomes typically emphasised in the entrepreneurship literature (Wiklund, Nikolaev, Shir, Foo, & Bradley, 2019). Effectuation, by making entrepreneurs feel more in control (Sarasvathy, 2001a; Wiltbank et al., 2006), may lead to increases in entrepreneurs' psychological wellbeing (Ryff, 1989, 2019). It would also be interesting to clarify whether particular principles are differentially related to entrepreneurs' wellbeing. For instance, could the focus on means and leverage contingencies principles be associated to increases in wellbeing, whereas the affordable loss principle, through its focus on losses as opposed to potential gains (Dew, Sarasvathy, et al., 2009; Martina, 2020), be negatively related to wellbeing?

A second potential direction for future research that emerges from the conceptualisation of effectuation as a decision-making logic is the opportunity to

study effectuation from a cognitive lens (Mitchell et al., 2007; Shepherd et al., 2015). In particular, ecological rationality theory (Gigerenzer & Gaissmaier, 2011; Todd & Gigerenzer, 2012) could help explain firstly, how entrepreneurs adapt their use of effectual and causal logics to the different decisions and environments they encounter in the new venture creation process, and secondly how effectual and causal logics perform under different task environments. In turn, this could help establish the effectiveness of effectual and causal logics for achieving particular outcomes in the new venture creation process (Luan et al., 2019).

A third potential direction for future research employing this new measure is to investigate more thoroughly the role of effectuation beyond the individual entrepreneur, at the new venture team level. Recently, several conceptual and qualitative papers have started exploring how effectuation theory could be used to better understand new venture team processes (Kerr & Coviello, 2020; Tryba & Fletcher, 2020). As such, I believe that the measure I develop in this paper could help contribute to this research stream by assessing and isolating the use of effectuation of individual entrepreneurs, and thus enabling researchers to study the role of diversity or heterogeneity in decision-making logics (Harrison & Klein, 2007; West, 2007). In particular, I believe this would contribute to our understanding of the dynamics underpinning team cognition, and its role in shaping new venture processes and outcomes (Klotz, Hmieleski, Bradley, & Busenitz, 2014). Interesting research questions emerging from this stream could include, how does diversity in the logics used by entrepreneurs within new venture teams affect processes and outcomes? On one hand, it could be hypothesised that diversity in perspectives may result in better decision-making outcomes (cf. Smolka et al., 2018), however at the same time this

could result in conflicts and clashes between founders with preferences for different logics and approaches (Tryba & Fletcher, 2020). Consequently, what kinds of diversity (Harrison & Klein, 2007) in logics are beneficial as opposed to a hindrance to team functioning? Is there an ideal team composition in terms of effectual and causal decision-making?

3.7.2 Limitations and avenues for expansion

Notwithstanding the contributions of this work, the studies I conducted suffer from a number of limitations. Firstly, similarly to the measure developed by Chandler et al. (2011), the scenario-based measure does not differentiate between the three causal principles (Prediction, Maximise Returns, and Competitiveness), and so departs from Sarasvathy's (2001a) theoretical conceptualisation of causation. Furthermore, researchers employing this measure will not be able to ascertain the antecedents and outcomes associated with each of the causal principles. I believe more empirical research is needed to replicate the dimensional structure of this measure. Furthermore, more empirical research using other types of measures of effectuation (e.g., behavioural, McKelvie et al., 2020) needs to investigate whether indeed causation is a unidimensional construct, whereas effectuation is a multidimensional construct consisting of distinct principles.

Empirically, some of the measures I used to investigate this new measure's convergent and discriminant validity, as well as for exploring its nomological net, showed relatively low reliabilities. Thus, these relationships should be replicated in future research. Furthermore, I did not investigate the predictive validity of the scenario-based measure. Lastly, despite the analysis showing that common method

bias did not significantly impact on the measure and results, the reliance on self-report measures is a limitation of this study. In future research, the scenario-based measure should be validated using other sources of data, such as observational data regarding entrepreneurs' behaviours, or objective performance outcomes.

3.7.3 Conclusion

Effectuation theory helps us better understand how entrepreneurs make decisions in the new venture creation process. Nevertheless, existing measures of effectuation suffer from important limitations hindering the progress of effectuation research. By developing and validating a scenario-based measure of effectuation assessing the decision logic of the individual entrepreneur, I hope to help advance effectuation research on less researched effectual principles such as focus on means, enable effectuation research through a cognitive lens, and expand effectuation research at both the individual- and the new venture team-level.

Chapter 4 How do entrepreneurs act when they don't know how to? The relationship between different types of uncertainty and entrepreneurs' use of effectuation and causation

4.1 Introduction

Uncertainty is a ubiquitous construct in organisational research, and has been recognised as a defining characteristic of entrepreneurial decision-making (Shepherd et al., 2015) and action (Alvarez & Barney, 2005; McMullen & Shepherd, 2006). Furthermore, effectuation theory has emerged as one of the most prominent frameworks attempting to explain how entrepreneurs make decisions and act under conditions of uncertainty (Sarasvathy, 2001a, 2008). As such, understanding how uncertainty influences entrepreneurs' use of effectuation and causation in the process of new venture creation is a key research question in the effectuation literature.

Despite the theoretical significance of the uncertainty construct in the entrepreneurship literature, the definition and nature of the uncertainty construct are still debated (McKelvie et al., 2011; Townsend, Hunt, McMullen, & Sarasvathy, 2018). Most research and theories define uncertainty broadly, following the Knightian definition of objective uncertainty which states uncertainty occurs when future events are unpredictable and their occurrence cannot be associated with a probability distribution (Knight, 1921; Wiltbank et al., 2009). However, emerging evidence suggests that firstly, entrepreneurs' subjective perceptions of uncertainty (i.e. how entrepreneurs perceive uncertainty in their environment, rather than true levels of uncertainty within the environment) are important predictors of entrepreneurial decision-making and action (McKelvie et al., 2011). Secondly, Milliken (1987) argues that there are different types of perceived uncertainty, depending on the information that the entrepreneur lacks at a given time. Entrepreneurs perceive *state uncertainty*

when they do not understand how components of the environment might be changing. Entrepreneurs perceive *effect uncertainty* when they are unsure about what the consequence of changes within the environment might be for their venture. Entrepreneurs perceive *response uncertainty* when they are unsure about how to react and respond to changes within the environment. Milliken (1987) also suggests that these different types of uncertainty, due to their differing nature, have distinct influences on entrepreneurs' decision-making and actions.

Existing theoretical accounts (Sarasvathy, 2001a) and empirical studies (e.g., Berends, Jelinek, Reymen, & Stultiëns, 2014; Reymen et al., 2015) on effectuation have mostly focused on broad definitions of uncertainty. Furthermore, most of the existing literature discusses effectuation as a normative approach to dealing with objective, Knightian uncertainty (Packard & Clark, 2020; Townsend et al., 2018). Nevertheless, there is very little research (for a notable exception see Jiang & Tornikoski, 2019) investigating *how and why entrepreneurs act in the face of perceived uncertainty* during the new venture creation process. Thus, in this study I move my focus away from effectuation as a decision-making logic to its conceptualisation as action, and specifically how entrepreneurs use effectual and causal action principles during the new venture creation process (Wood, Bakker, & Fisher, 2021). Furthermore, what is also unclear is how the differing nature of uncertainty drives distinct strategies and actions. Given the significance of the uncertainty construct within the entrepreneurship literature and specifically within the effectuation field, there have been multiple calls for more precision in the definitions and conceptualisation of uncertainty (Mauer, Wuebker, Schlüter, & Brettel, 2018; Packard & Clark, 2020; Townsend et al., 2018; C. Welter et al., 2016). As such, I aim

to fill this gap within the literature and investigate the role of different types of uncertainty (i.e., state, effect, and response uncertainty; Ashill & Jobber, 2010; Milliken, 1987) in driving entrepreneurs' use of effectuation and causation. To do this, I integrate effectuation theory and action theory (Hacker, 2003; Suchman, 1987) to show how entrepreneurs seek to use behaviours that are congruent with their perceptions of the environment. Specifically, I argue that different effectual principles will enable entrepreneurs to navigate different types of perceived uncertainty, due to the nature of the information that entrepreneurs lack being different for different types of uncertainty.

I take a longitudinal approach to studying this research question by collecting data on entrepreneurs' perceptions of state, effect, and response uncertainty, and their use of effectual and causal actions, over a period of eight consecutive months across five different data collection waves. Using this dataset, I investigate the distinct relationships between their changing perceptions of uncertainty and their use of effectual and causal action principles. This study find that whereas entrepreneurs' use of affordable loss is not empirically related to entrepreneurs' uncertainty perceptions, their use of focus on means, flexibility, and co-creation action principles, as well as causation, is driven by different types of uncertainty. Specifically, entrepreneurs use co-creation actions in response to perceived state uncertainty, whereas entrepreneurs use causation, focus on means, and flexibility actions in response to perceived response uncertainty.

I hope to contribute to the effectuation literature by clarifying the role that perceived uncertainty plays in driving entrepreneurs' use of effectual and causal action

principles in the new venture creation process. In this study, I operationalise uncertainty as missing knowledge (Milliken, 1987), and theorise about the kinds of action principles that entrepreneurs use to cope with this lack of knowledge. Specifically, this study shows that entrepreneurs seek to use actions that fit with the type of uncertainty they are experiencing at a given time. Thus, by integrating effectuation and action theory (Hacker, 2003; Suchman, 1987), I advance our understanding of the antecedents of effectuation, and explain how effectual and causal action principles help entrepreneurs make progress on their ventures despite perceived lack of information about the environment in which they operate. I complement past research that investigates the role of effectuation in mitigating objective, or true uncertainty (Mauer et al., 2018; C. Welter & Kim, 2018) and process studies documenting how entrepreneurs react to overall perceptions of environmental uncertainty (Berends et al., 2014; Reymen et al., 2015). These findings enable us to predict with much more precision how entrepreneurs use causation and effectual action principles to respond to changes in uncertainty (C. Welter et al., 2016). This study thus answer calls for more research investigating the individual principles of effectuation and their differing roles within the new venture creation process, rather than broad investigations of effectual logics (Smolka et al., 2018). Lastly, I contribute to our understanding of the relationship between the effectuation and causation constructs by showing how entrepreneurs mix causation and particular effectual principles when they act in the face of perceived response uncertainty.

4.2 Theoretical background

Due to uncertainty being a defining characteristic of entrepreneurship (Knight, 1921), theories of entrepreneurial decision-making and action emphasise strategies

and behaviours that enable entrepreneurs to cope with uncertainty in the new venture creation process (McMullen & Shepherd, 2006; Sarasvathy, 2001a). However, despite the centrality of the uncertainty construct in entrepreneurship theories, there are very few empirical studies investigating the relationship between uncertainty and entrepreneurial action. There is evidence suggesting that uncertainty influences entrepreneurs' willingness to engage in entrepreneurial action (McKelvie et al., 2011), however how entrepreneurs cope and adapt to uncertainty once they decide to take the plunge and found a venture, throughout the creation and early stages of growth of new ventures, is unknown.

One key theoretical perspective describing the strategies that entrepreneurs use when making decisions and acting under uncertainty throughout the new venture creation process is effectuation theory (Perry et al., 2012; Sarasvathy, 2001a). Effectual principles describe entrepreneurs' basis for action, view of risk and resources, attitude towards the unexpected, and their attitude towards stakeholders when deciding and acting under uncertainty. The assumption is that prediction-based strategies cannot be implemented when predictive information is missing, in other words when there is uncertainty in the environment. Instead, control-based principles enable entrepreneurs to still make decisions and act in the face of uncertainty by focusing on the knowns of a situation (who I am, what do I know, and who do I know; Read & Sarasvathy, 2005; Wiltbank, Dew, Read, & Sarasvathy, 2006) rather than the unknowns.

Nevertheless, recent research on the antecedents of effectuation suggests that the relationship between uncertainty and effectuation is more nuanced than initially

thought. For instance, entrepreneurs do not always use effectuation when uncertainty levels are high, and instead rely on causation (Jiang & Tornikoski, 2019; Reymen et al., 2015). This evidence suggests that entrepreneurs seek to employ causation even when predictive information may not be readily available. A simulation-based study provides support for this conjecture by showing that effectuation can provide advantages to entrepreneurs using this approach not only under conditions of uncertainty, but also in risky situations when correct predictions are difficult to make (C. Welter & Kim, 2018). Furthermore, another simulation-based study using a more nuanced operationalisation of uncertainty found that extreme levels of uncertainty may not be the boundary condition for effectuation, but rather different conditions affecting environmental uncertainty (environmental isotropy, goal ambiguity) may affect the dominance of effectual approaches (Mauer et al., 2018).

Thus, the emerging body of empirical evidence on the relationship between uncertainty and effectuation seems to suggest that a more nuanced understanding of how uncertainty influences effectual action is needed. Furthermore, whereas existing studies on effectuation mostly focus on objective uncertainty within the environment (Mauer et al., 2018; C. Welter & Kim, 2018), I argue that by focusing on entrepreneurs' subjective perceptions of the environment I can offer a complementary perspective and thus further clarify our understanding of uncertainty as an antecedent of effectuation.

To better understand how entrepreneurs' subjective perceptions of environmental uncertainty drive their use of effectuation and causation, I leverage action theory (Hacker, 2003; Suchman, 1987). Action theory specifies how

individuals' perceptions of the environment trigger an evaluative process whereby individuals choose actions that fit the perceived environment. In this process of regulating action, explicit knowledge about the environment is thus leveraged to inform the selection of a suitable course of action (Hacker, 2003). Central to action theory is the fit between individuals' perceptions of their environment and the actions that they choose in response to these environments (Mischel, 2004; Suchman, 1987). Thus, I use action theory to explain how entrepreneurs select between different action principles – namely causation, co-creation, affordable loss, flexibility, and focus on means – depending on their perceptions of the environment.

4.2.1 Operationalising uncertainty

Recently, several conceptualisations of uncertainty have emerged in the organisational research literature, and in the entrepreneurship literature more specifically. These different conceptualisations propose more nuanced definitions and typologies of uncertainty, and differ in their focus on whether probabilities can be estimated (Packard, Clark, & Kleinc, 2017, in line with Knight, 1921), the nature of the knowledge problems that agents encounter in their decision-making and actions (Townsend et al., 2018), and the mitigability of the uncertainty that agents encounter (Packard & Clark, 2020). Given action theory's focus on perceptions of and explicit knowledge about the environment as antecedents to action (Hacker, 1994, 2003), I chose an operationalisation of uncertainty that captures how individuals translate and interpret information about the environment into knowledge (i.e. subjective or perceived uncertainty). Milliken (1987) provides a conceptualisation of perceived uncertainty that delineates the nature of the uncertainty being experienced in terms of the type of information that the individual perceives they are lacking.

Firstly, state uncertainty refers to uncertainty as lack of information about how the environment (or its components) might be changing in the future. This is the most common conceptualisation of perceived uncertainty within the literature, and follows Knight's (1921) definition of uncertainty. When entrepreneurs experience state uncertainty, they perceive the environment as being unpredictable.

Secondly, effect uncertainty refers to not knowing what the likely impact of changes in the environment will be on the venture. This type of uncertainty involves a lack of understanding of cause-effect relationships, and is distinct from state uncertainty in that one can be certain about a particular event occurring, however, they may be uncertain about how it will affect their venture.

Thirdly, response uncertainty refers to lack of knowledge about how to respond to a particular change within the environment, or what the likely consequences of a particular response are. This type of uncertainty is likely to be particularly salient in situations when there is a perceived need to act. Response uncertainty seems likely to involve a lack of knowledge about what action best fits the environment in which the individual operates.

Milliken (1987) conjectures that these three different types of uncertainty will elicit different types of coping responses. I contend with this suggestion and propose that different types of uncertainty drive entrepreneurs' use of distinct effectual principles. This is in line with predictions made by action theory, which suggests individuals engage in an evaluative process which seeks to select action principles that fit with the knowledge the individual has about the environment in which they operate (Hacker, 1994, 2003). I detail these arguments below. A key notion that I leverage in

this study, by integrating literature on uncertainty types, effectuation, and action theory, is that entrepreneurs are not passive recipients of the environment, but rather are active actors who can act and modify environmental uncertainty through their actions (Mauer et al., 2018; Townsend et al., 2018).

4.3 Hypotheses development

4.3.1 Uncertainty and causation

Most theoretical accounts of effectuation and causation discuss these as representing alternative action principles that entrepreneurs use under uncertainty and risk, respectively (S. Read, Dew, et al., 2009; Sarasvathy, 2001a; Wiltbank et al., 2006). As such, the assumption is that entrepreneurs will seek to use effectuation when uncertainty is high, and causation when uncertainty is low (i.e., in risky situations when future outcomes can be predicted).

Some early empirical evidence from qualitative studies investigating the antecedents of effectuation and causation seem to confirm this pattern. For instance, entrepreneurs use effectuation in the early stages of creation of a new venture, when uncertainty is high, and gradually shift to causation in the later stages of development, when uncertainty reduces (Berends et al., 2014). Similarly, entrepreneurs do not only seem to use causation in the later stages of development of a venture, but also whenever they perceive lower levels of environmental uncertainty (Reymen et al., 2015). However, these studies only investigate overall perceptions of environmental uncertainty, and do not differentiate between different types of uncertainty.

I hypothesise that entrepreneurs' use of causation will be related to decreased perceptions of state uncertainty. Whenever entrepreneurs perceive information about

potential future changes within the environment as available and certain, entrepreneurs are able to predict future conditions and thus use this information to plan accordingly. Similarly, I also expect that decreased perceptions of effect uncertainty will drive entrepreneurs' use of causation, since entrepreneurs believe they will be able to predict the likely impact of these changes on their ventures, and thus they are able to use this information to inform their planning. Lastly, I expect that decreased perceptions of response uncertainty will relate to entrepreneurs' use of causation as knowledge about how to respond to changes within the environment is perceived as available and thus entrepreneurs can plan their actions and predict the likely impact of these actions. This will require less flexibility in their actions since entrepreneurs can plan in advance and trust their predictions. Overall, because lower levels of state, effect, and response uncertainty mean that more information is available to the entrepreneur and that they are more certain about this information, I expect entrepreneurs to leverage this information to plan their actions, calculate and select actions that maximise the potential impact and returns for their venture, and to stick to their initially made plans. Thus, I hypothesise:

> *H1*: Decreased perceptions of state, effect, and response uncertainty will be related to entrepreneurs' use of causation.

4.3.2 Uncertainty and flexibility

The flexibility principle enables entrepreneurs to adapt to changing conditions and tailor their actions in response to unexpected changes or contingencies (Chandler et al., 2011; Sarasvathy, 2001a). Entrepreneurs using this principle do not have to rigidly stick to a plan and can adapt their strategy as they start gathering more

information from the environment by acting. Thus, entrepreneurs can use this principle whenever they perceive a lack of information about the appropriate response to changes within the environment – i.e. response uncertainty. As such, I expect that increased perceptions of response uncertainty will be associated with entrepreneurs' use of flexibility action principles, as entrepreneurs may struggle to plan ahead and will instead prefer a more iterative approach. As the flexibility principle is targeted towards adapting *responses* to changing conditions, I do not expect state or effect uncertainty to be related to entrepreneurs' use of the flexibility action principle. Thus, I hypothesise:

> *H2*: Increased perceptions of response uncertainty will be related to entrepreneurs' use of flexibility.

4.3.3 Uncertainty and co-creation

Effectuation theory posits that rather than trying to predict how the environment is likely to change (which is difficult under high uncertainty), entrepreneurs can attempt to control the future (Wiltbank et al., 2006). The co-creation principle allows entrepreneurs to control the future by partnering with self-selected stakeholders early on, allowing partnerships to shape the strategy of the new venture rather than carefully pre-selecting and enrolling partners only once a clear vision and strategy for the new firm has been decided on (Sarasvathy, 2004). Whereas competitive landscape analysis can enable entrepreneurs within established industries to better understand and predict future changes within the environment in which they operate (Kotler, 2000), when entrepreneurs perceive a lack of information about the current state of the environment and how it is likely to change in the future, it can be

difficult to perform such detailed analyses. This can happen especially when entrepreneurs operate within new or emerging industries (Dew, 2003; Sarasvathy, 2008), or when ventures are so early in their development that entrepreneurs do not yet know which industry they will be operating in (Sarasvathy, 2004). I argue that co-creation is likely to be used by entrepreneurs when they perceive state uncertainty, because using this action principle allows them to shape the environment by co-creating future states with self-selected partners. Thus, co-creation enables entrepreneurs to mitigate the ill effects of state uncertainty by taking control of their environment. Thus, I hypothesise:

> *H3*: Increased perceptions of state uncertainty will be related to entrepreneurs' use of co-creation.

4.3.4 Uncertainty and affordable loss

When entrepreneurs lack information about what the likely consequences of changes in the environment are likely to be for their ventures, they will perform actions that enable them to still make progress on their ventures despite this lack of information. Affordable loss can enable entrepreneurs to still continue making progress whilst mitigating the potential risks associated with a bad move. Specifically, affordable loss specifies that the size of the investments that the entrepreneur makes in relation to the venture should not exceed what the entrepreneur is willing and can afford to lose in a worst case scenario (Dew, Sarasvathy, et al., 2009; Martina, 2020). Thus, entrepreneurs can use the affordable loss action principle to mitigate the potential losses they could incur by assuming a worst case scenario, i.e. the effects of changes within the environment prove deleterious to the venture. Thus, affordable loss

enables entrepreneurs to keep making progress in creating and growing the new venture by reducing the size of their investments and thus the potential risk, despite uncertainty about the impact of changes within the environment on the venture. Thus, I hypothesise:

> *H4*: Increased perceptions of effect uncertainty will be related to entrepreneurs' use of affordable loss.

4.3.5 Uncertainty and focus on means

Entrepreneurs may struggle with knowledge about how to react and respond to changes within the environment (Milliken, 1987). As such, this lack of knowledge can result in paralysing the entrepreneur and thus preventing them from making further progress on their venture. In these situations, entrepreneurs need a set of behaviours that will enable them to still act and make progress on their venture, even when they may be at a loss as to what the appropriate course of action, or what the likely consequences of alternative actions, may be. Focus on means entails entrepreneurs seeking to question the set of means at their disposal (who are they, what and whom do they know?), and combining these means in creative ways to achieve new effects (Sarasvathy, 2001a; Sarasvathy & Dew, 2005). The emphasis is on leveraging and building on what is already available and known, rather than trying to predict what new means and new knowledge may help the entrepreneur make progress. Thus, I expect that entrepreneurs who perceive a lack of knowledge when it comes to the appropriate response to environmental changes will employ focus on means as a way of generating response options they can implement. Thus, I hypothesise:

H5: Increased perceptions of response uncertainty will be related to entrepreneurs' use of focus on means.

4.4 Method

4.4.1 Data collection

I conducted a longitudinal study over eight consecutive months, with five different data collection points repeated every two months. I opted for an intensive, short-lag and high frequency design by following recommendations made by Dormann & Griffin (2015). Specifically, based on past process studies documenting frequent switches between effectuation and causation in the new venture creation process (Jiang & Tornikoski, 2019; Maine et al., 2015; Reymen et al., 2015), I decided to opt for a 2-month lag between data collection waves. This duration was deemed a suitable lag as it should give entrepreneurs sufficient opportunities to act and make progress in the creation of their new ventures, however at the same time I should be able to capture any changes that would happen over time in entrepreneurs' usage of different action principles. Furthermore, given the COVID-19 context in which the data was collected, I expected frequent changes in entrepreneurs' perceptions of environmental uncertainty since the global crisis was characterised by frequent changes in restrictions inhibiting business activities as well as in the targeted support made available to entrepreneurs by the government and other entrepreneurial support organisations.

Upon enrolment in the study, participants were asked to complete a demographics questionnaire to assess whether they met the inclusion criteria for the study (detailed in the section below). The entrepreneurs who were eligible were invited to complete the baseline survey, and were sent invites via email to the follow-

up questionnaires every two months. Participants completed all the measures at each wave (i.e., a longitudinal rather than panel design; Ployhart & Vandenberg, 2010). At each data collection wave, I sent up to 3 reminders to complete the survey to participating entrepreneurs. In order to incentivise participation and continued engagement in the study, I offered feedback on psychological well-being and the study's results. Data collection took place during the COVID-19 pandemic, with the first data collection wave starting in May 2020. All questionnaires were completed online.

4.4.2 Sample

The sample consisted of owner-managers of businesses less than 5 years old at the start of the study (i.e., ventures founded after May 2015), as new ventures are typically defined (Bird et al., 2012). All entrepreneurs included in the study resided and ran their businesses primarily in the United Kingdom, to account for any cross-country differences in how the businesses were impacted by the pandemic and the support available to them. I recruited entrepreneurs through personal contacts at various organisations supporting entrepreneurs within the UK (e.g., accelerators, incubators, venture capital firms, etc.), online databases of entrepreneurs, and through various newsletters targeted at entrepreneurs within the UK. Initially, 291 entrepreneurs expressed interest in participating, out of which 176 entrepreneurs completed the baseline survey at wave 1 (61% response rate). Subsequently, 143 participants completed the questionnaire at wave 2 (81% retention), 127 completed wave 3 (72%), 119 completed wave 4 (68%), and 101 completed wave 5 (57%).

Participants were between 19 and 64 years old (mean = 36.20, SD = 10.27), 58% were female, 74% had a higher education degree. Entrepreneurs had between 0 and 22 years of entrepreneurial experience (mean = 4.65, SD = 4.28) and between 0 and 40 years of full-time work experience (mean = 13.92, SD = 9.72). Their current businesses were between 20 days and 5 years old, most were founded by an individual entrepreneur (68%, the remainder had between 1 and 5 co-founders), 54% did not hire any employees at the start of the study (baseline mean = 1.97, SD = 4.71, max = 40), 71% of entrepreneurs owned between 90% and 100% equity in the business, and 23% had received external financial investment for their business. The ventures operated in 18 different industries, with 15% of ventures in Arts, Entertainment, and Recreation, 11% in Professional, Scientific, and Technical Activities, 10% in Information and Communication, and 9% in Human Health and Social Work activities.

4.4.3 Measures

4.4.3.1 Dependent variables: effectual and causal actions

I assessed entrepreneurs' use of effectual and causal action principles using a modified version of Chandler and colleagues' (2011) measure. This is one of the most widely used measures of effectuation within the literature (McKelvie et al., 2020), and assesses entrepreneurial teams' overall use of effectual and causal actions. At each data collection wave, I asked entrepreneurs to report on the actions they performed in the 2 months preceding the survey, on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree).

Causation is a 7-tem scale ($\alpha = .80$). Example items include "We designed and planned business strategies" and "We developed a strategy to best take advantage of resources and capabilities".

In Chandler et al.'s (2011) original scales, the flexibility measure included 4 items. This scale assesses the leverage contingencies principle as described by Sarasvathy (2001), whereby entrepreneurs using this principle tend to capitalise on and exploit unexpected contingencies that occur over time. Based on the results of a factor analysis I conducted on the scales, I removed two items that did not significantly load on the factor and was thus left with two items ($\alpha = .70$). An example item is "We allowed the business to evolve as opportunities emerged". I note that the experimentation scale was not included in the study, as the flexibility scale is much closer conceptually to the leverage contingencies principle as described in theoretical accounts of effectuation (Sarasvathy, 2001a, 2008; Wiltbank et al., 2006).

Affordable loss is a 3-item scale ($\alpha = .77$). An example item is "We were careful not to commit more resources than we could afford to lose".

In previous studies, the co-creation (or pre-commitments) scale has been found to belong to both causation and effectuation factors (Chandler et al., 2011), which departs from Sarasvathy's (2001) theoretical conceptualisation of this principle. Furthermore, Chandler and colleagues (2011) recommended that this scale is revisited and improved in future iterations. As such, in addition to the two items from the original measure, I developed two new items that were more in line with the theoretical description of this principle in the effectuation literature (Sarasvathy, 2001a; Wiltbank et al., 2006). When developing these items, I reviewed other prevalent measures of effectuation that were not targeted at founders of new ventures, but typically used to study effectuation in corporate contexts (Brettel et al., 2012; Werhahn et al., 2015). Whereas the two original items forming the pre-commitments

scale cross-loaded on multiple factors, the two newly developed items loaded on a separate factor and formed a reliable scale (α = .84). As such, I used these two items to assess co-creation in this sample. An example item is: "We allowed partnerships with other organisations to shape our venture's activities and initiatives".

In addition to the 4 scales developed by Chandler and colleagues (2011), I also developed a fifth scale to assess Focus on Means behaviours, a key principle underpinning effectuation's basis for action (Perry et al., 2012; Sarasvathy, 2001a). I developed 4 new items (α = .80), an example item is: "We actively used our previous experience, existing skills and networks when deciding how to move forward". Factor analyses indicated that these 4 items formed a unidimensional scale (all factor loadings were significant, above .40, and there were no items that showed significant cross-loadings).

I explored the correlations between the effectual and causal actions reported by participants at different data collection waves to assess the stability of this construct over time. Given that the measures I used target actions and that previous research has documented substantial changes and heterogeneity in the type of actions used by entrepreneurs across the new venture creation process (e.g., Berends et al., 2014; Jiang & Tornikoski, 2019; Reymen et al., 2015), I expected significant variability in scores. Causation scores at different data collection waves correlated with one another .56-.77, flexibility correlated .33-.57, affordable loss correlated .30-.41, co-creation correlated .50-.69, and focus on means correlated .25-.58. Thus, the size of these correlations implies relatively high levels of variability in scores across the different data collection waves, and provides support for the chosen methodology.

4.4.3.2 Independent variables: state, effect, and response uncertainty

I assessed state, effect, and response uncertainty using Ashill and Jobber's (2010) self-report scale. The scale was originally developed for assessing uncertainty perceptions among SME marketing executives. I adapted the scale to the entrepreneurship context by asking the participants to reflect about the most important factors they take into consideration when making decisions about their venture. I also asked participants to focus on decisions made in the 2 months preceding the survey at each wave to fit the repeated measurement requirement of the study design. The scale consisted of 3 items for each of the three types of uncertainty measured. Participants were asked to report on their perceptions using a 5-point Likert scale (1 = Never to 5 = Always). The reliabilities of the scales were .83 for state uncertainty, .71 for effect uncertainty, and .79 for response uncertainty. Example items are: "In the past 2 months, how often have you felt you had the information you needed in order to understand how these factors will change in the future?", "In the past 2 months, how often did you feel you fully understood the effect of these factors on your decision-making?", and "In the past 2 months, how often did you feel you knew how to respond to changes in the external environment?" respectively. The scores were reversed so that higher scores reflected higher uncertainty perceived to aid with the interpretability of the coefficients in subsequent analyses. Again, I investigated the amount of variability in entrepreneurs' perceptions of uncertainty across the new venture creation process. For state uncertainty, scores from the different data collection waves correlated with one another between .42-.68, for effect uncertainty .32-.61, and for response uncertainty .41-.67. This also indicated substantial variability over time in scores.

4.4.3.3 Control variables

I controlled for individual differences in age and gender, as well as entrepreneurial experience operationalised as the number of years the entrepreneur had experienced owning and managing a business, as this variable has been found to influence entrepreneurs' use of effectuation in past research (Dew, Read, et al., 2009; Sarasvathy, 2001b). Furthermore, I also controlled for a series of firm-level variables that have been found to impact on entrepreneurs' use of effectuation in past research (Berends et al., 2014; Reymen et al., 2015). I controlled for the venture's age (operationalised as the number of days between the founding date reported by the entrepreneurs and the date at which they completed each of the surveys), the number of employees of the venture as a proxy for venture size, and the number of co-founders in order to differentiate between any potential individual- and group-level influences on entrepreneurs' use of different action principles. Lastly, I used a subjective measure of the impact that COVID had on the entrepreneurs' businesses on a 10-point Likert scale, whereby 1 = Had a very significant NEGATIVE impact on my business; 5 = My business has not been impacted at all by the pandemic, and 10 = Had a very significant POSITIVE impact on my business. I assessed the perceived impact of COVID at each data collection wave, to account for changes in restrictions and support available to entrepreneurs that we witnessed throughout the data collection period, as well as to account for the potential effect of these changes on entrepreneurs' perceptions of environmental uncertainty.

4.5 Results

Table 4-1 shows the means, standard deviations, and intercorrelations of the study variables. Before testing the hypotheses, I examined the within-person variance

among the dependent variables. The percentage scores of within-person variance are as follows: 59% for causation, 38% for affordable loss, 40% for flexibility, 53% for co-creation, and 48% for focus on means. These values suggest significant within-person variance and justify the use of multilevel models. Multilevel models are appropriate for data with multiple measurements over time and account for the nested structure of the data (Ployhart & Vandenberg, 2010). The lme4 package in R was used to run the multilevel models. The state, effect, and response uncertainty variables were person-mean centred. For each participant, I computed their mean levels of perceived uncertainty across the five measurement points and then subtracted these mean values from their reported scores at each wave. This procedure enabled me to remove between-person effects due to individual differences between participants when estimating within-person parameters. The dependent and control variables remained uncentered.

I first calculated the null model with the intercept as the only predictor, followed by model 1 in which I included the control variables (age, gender, entrepreneurial experience, number of co-founders, number of employees, venture age, impact of COVID). Model 2 includes the independent variables (state, effect, and response uncertainty) and the control variables. For the hypotheses tests, I included all three uncertainty types in the same model to control for any shared effects between these variables, and thus test for the independent effects of each uncertainty type on entrepreneurs' use of causal and effectual actions. For these models, I calculated variance inflation factors to check for potential multicollinearity between our predictors. The variance inflation factors for variables in all models ranged between 1.04 and 1.62, indicating no issues with multicollinearity. I also tested the three types

of uncertainty in separate models (including the control variables, but only containing one type of uncertainty at a time) as a robustness check.

4.5.1 Hypotheses tests

The regression model results predicting entrepreneurs' use of causation are reported in Table 4-2. H1 predicted that decreased perceptions of state, effect, and response uncertainty will be related to entrepreneurs' use of causation. In Model 2, state (β = .06, p = .28) and effect uncertainty (β = .01, p = .85) did not significantly predict entrepreneurs' use of causation. Response uncertainty had a significant, positive effect (β = .11, p = .04) on entrepreneurs' use of causation. I also tested for the effects of state, effect, and response uncertainty in three separate models, thus not controlling for any shared effects. In these models, I replicate the positive effect of response uncertainty (β = .13, p = .004), but also find significant, positive effects of state (β = .11, p = .01) and effect (β = .10, p = .02) uncertainty. Thus, H1 was not supported.

The regression model results predicting entrepreneurs' use of flexibility are reported in Table 4-3. H2 predicted that increased perceptions of response uncertainty will be related to entrepreneurs' use of flexibility. In Model 2, response uncertainty had a significant, positive effect (β = .16, p = .02) on entrepreneurs' use of flexibility, thus supporting H2. At the same time, state (β = -.04, p = .54) and effect (β = -.02, p = .71) uncertainty were not significantly related to entrepreneurs' use of flexibility. The same pattern of results was replicated when testing the three types of uncertainty in separate models.

Table 4-1: Descriptive statistics

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.Age	36.20	10.25	-													
2.Gender	.58	.49	-.01	-												
3.Entrepreneurial experience	4.65	4.27	.38**	.04	-											
4.Number of co-founders	.48	.90	-.09**	-.15**	.00	-										
5.Number of employees	2.12	4.54	-.12**	-.12**	.05	.52**	-									
6.Venture age (days)	1019.33	536.40	.14**	-.10**	.15**	.01	.09*	-								
7.Impact of COVID	4.17	2.26	-.04	-.05	.11**	.08*	.09*	-.10*	-							
8.State uncertainty	.00	.44	.00	.00	.00	.00	.00	.00	.08*	-						
9.Effect uncertainty	.00	.43	.00	.00	.00	.00	.00	.01	.09**	.47**	-					
10.Response uncertainty	.00	.43	.00	.00	.00	.00	.00	.01	.11**	.54**	.55**	-				
11.Causation	3.54	.66	-.05	-.10*	.10*	.20**	.21**	.01	.09*	.14**	.07	.09*	-			
12.Flexibility	4.22	.62	.05	-.04	.14**	.05	.06	-.06	.22**	.04	.05	.19*	.38**	-		
13.Affordable loss	4.04	.65	.08*	.07	.10*	.03	.01	.14**	-.05	.02	.05	.03	.21**	.13**	-	
14.Co-creation	2.96	1.11	.01	-.14**	.01	.22**	.26**	-.06	.14**	.09*	.03	.01	.37**	.26**	.03	-
15.Focus on means	4.10	.54	.21**	-.09*	.13**	.02	.01	-.02	.07	.06	.06	.08**	.34**	.50**	.30**	.17**

Notes: Gender: 0 = male; 1 = female. Variables 5-15 are aggregated across the five measurement waves (N = 176).

Table 4-2: Results of regression models predicting entrepreneurs' use of causation

Outcome variable: Causation									
	Model 0			**Model 1**			**Model 2**		
	Est	**SE**	***p***	**Est**	**SE**	***p***	**Est**	**SE**	***p***
Fixed effects									
Intercept	3.56	.04	.001	3.47	.18	.001	3.51	.18	.001
Age				-.00	.00	.31	-.01	.00	.27
Gender				-.09	.08	.26	-.08	.08	.31
Entrepreneurial experience (years)				.02	.01	.13	.02	.01	.09
Number of employees				.02	.01	.04	.01	.01	.05
Venture age (days)				.00	.00	.55	.00	.00	.55
Number of cofounders				.08	.05	.10	.09	.05	.07
COVID Impact				.02	.01	.03	.01	.01	.21
State uncertainty							.06	.05	.28
Effect uncertainty							.01	.05	.85
Response uncertainty							**.11**	**.05**	**.04**
Variance components									
Intercept	.25	.50		.21	.46		.006	.08	
State uncertainty							.04	.21	
Effect uncertainty							.02	.14	
Response uncertainty							.02	.13	
ICC	.59								
Pseudo R^2				.08			.18		
-2 log likelihood (FIML)	1042.6			943.2			918.8		
df	669			593			580		

Table 4-3: Results of regression models predicting entrepreneurs' use of flexibility

Outcome variable: Flexibility									
		Model 0			**Model 1**			**Model 2**	
	Est	**SE**	***p***	**Est**	**SE**	***p***	**Est**	**SE**	***p***
Fixed effects									
Intercept	4.05	.04	.001	3.72	.17	.001	3.78	.17	.001
Age				.00	.00	.49	.00	.00	.54
Gender				-.03	.08	.71	-.03	.07	.66
Entrepreneurial experience (years)				.02	.01	.04	.02	.01	.03
Number of employees				-.00	.01	.83	-.00	.01	.88
Venture age (days)				-.00	.00	.31	.00	.00	.28
Number of cofounders				.04	.04	.41	.03	.04	.45
COVID Impact				.05	.01	.001	.04	.01	.002
State uncertainty							-.04	.06	.54
Effect uncertainty							-.02	.06	.71
Response uncertainty							**.16**	**.07**	**.02**
Variance components									
Intercept	.17	.41		.14	.38		.00	.00	
State uncertainty							.00	.01	
Effect uncertainty							.02	.13	
Response uncertainty							.06	.23	
ICC	.40								
Pseudo R^2				.06			.09		
-2 log likelihood (FIML)	1185.4			1071.3			918.8		
df	669			593			580		

Table 4-4: Results of regression models predicting entrepreneurs' use of co-creation

Outcome variable: Co-creation									
	Model 0			**Model 1**			**Model 2**		
	Est	**SE**	***p***	**Est**	**SE**	***p***	**Est**	**SE**	***p***
Fixed effects									
Intercept	2.96	.07	.001	2.55	.29	.001	2.58	.29	.001
Age				.01	.01	.42	.00	.01	.54
Gender				-.25	.13	.06	-.24	.13	.07
Entrepreneurial experience (years)				.00	.02	.91	.00	.02	.83
Number of employees				.03	.01	.01	.03	.01	.02
Venture age (days)				-.00	.00	.72	.00	.00	.71
Number of cofounders				.17	.08	.03	.17	.08	.03
COVID Impact				.05	.02	.006	.05	.02	.005
State uncertainty							**.19**	**.09**	**.04**
Effect uncertainty							.01	.09	.94
Response uncertainty							-.15	.09	.10
Variance components									
Intercept	.65	.81		.50	.71		.00	.00	
State uncertainty							.05	.23	
Effect uncertainty							.01	.09	
Response uncertainty							.00	.00	
ICC	.53								
Pseudo R^2				.10			.18		
-2 log likelihood (FIML)	1813.7			1614.3			1603.3		
df	669			593			580		

Table 4-5: Results of regression models predicting entrepreneurs' use of affordable loss

Outcome variable: Affordable Loss									
	Model 0			**Model 1**			**Model 2**		
	Est	**SE**	***p***	**Est**	**SE**	***p***	**Est**	**SE**	***p***
Fixed effects									
Intercept	4.20	.04	.001	3.82	.16	.001	3.83	.16	.001
Age				.00	.00	.51	.00	.00	.49
Gender				.12	.07	.12	.11	.07	.13
Entrepreneurial experience (years)				.01	.01	.39	.01	.01	.42
Number of employees				-.00	.01	.99	.00	.01	.99
Venture age (days)				.00	.00	.006	.00	.00	.006
Number of cofounders				.03	.04	.56	.03	.04	.57
COVID Impact				-.01	.01	.59	-.01	.01	.45
State uncertainty							-.04	.06	.45
Effect uncertainty							.06	.06	.28
Response uncertainty							.05	.07	.44
Variance components									
Intercept	.15	.39		.13	.37		.00	.01	
State uncertainty							.00	.03	
Effect uncertainty							.00	.00	
Response uncertainty							.06	.24	
ICC	.38								
Pseudo R^2				.04			.07		
-2 log likelihood (FIML)	1162.3			1045.9			1036.9		
df	669			593			580		

Table 4-6: Results of regression models predicting entrepreneurs' use of focus on means

Outcome variable: Focus on Means									
	Model 0			**Model 1**			**Model 2**		
	Est	**SE**	***p***	**Est**	**SE**	***p***	**Est**	**SE**	***p***
Fixed effects									
Intercept	4.08	.03	.001	3.72	.14	.001	3.76	.14	.001
Age				.01	.00	.002	.01	.00	.002
Gender				-.09	.06	.18	-.09	.06	.19
Entrepreneurial experience (years)				.01	.01	.21	.01	.01	.20
Number of employees				-.00	.01	.76	-.00	.01	.77
Venture age (days)				-.00	.00	.24	-.00	.00	.15
Number of cofounders				.02	.04	.64	.02	.04	.55
COVID Impact				.01	.01	.38	.00	.01	.89
State uncertainty							-.04	.05	.39
Effect uncertainty							.00	.05	.99
Response uncertainty							**.15**	**.05**	**.006**
Variance components									
Intercept	.14	.37		.12	.34		.00	.00	
State uncertainty							.00	.06	
Effect uncertainty							.00	.04	
Response uncertainty							.03	.19	
ICC	.48								
Pseudo R^2				.07			.14		
-2 log likelihood (FIML)	905.1			809.8			792.7		
df	669			593			580		

The regression model results predicting entrepreneurs' use of co-creation are reported in Table 4-4. H3 predicted that increased perceptions of state uncertainty will be related to entrepreneurs' use of co-creation. In Model 2, state uncertainty had a significant, positive effect (β = .19, p = .04) on entrepreneurs' use of co-creation, thus supporting H3. Effect (β = .01, p = .94) and response (β = -.15, p = .10) uncertainty were not significantly related to entrepreneurs' use of co-creation. The same pattern of results was replicated when testing the three types of uncertainty in separate models.

The regression model results predicting entrepreneurs' use of affordable loss are reported in Table 4-5. H4 predicted that increased perceptions of effect uncertainty will be related to entrepreneurs' use of affordable loss. In Model 2, effect uncertainty (β = .06, p = .28) did not significantly predict entrepreneurs' use of affordable loss. State (β = -.04, p = .45) and response (β = .05, p = .44) uncertainty were not significantly related to entrepreneurs' use of affordable loss either. The same pattern of results was replicated when testing the three types of uncertainty in separate models. Thus, H4 is rejected.

The regression model results predicting entrepreneurs' use of focus on means are reported in Table 4-6. H5 predicted that increased perceptions of response uncertainty will be related to entrepreneurs' use of focus on means. In Model 2, response uncertainty (β = .15, p = .006) was significantly, positively related to entrepreneurs' use of focus on means behaviours, thus supporting H5. State (β = -.04, p = .39) and effect (β = .00, p = .99) uncertainty were not significantly related to entrepreneurs' use of focus on means. The same pattern of results was replicated when testing the three types of uncertainty in separate models.

The results related to the support for hypotheses are summarised in Table 4-7.

Table 4-7: Summary of hypotheses results

Hypothesis	**Result**
H1: Decreased perceptions of state, effect, and response uncertainty will be related to entrepreneurs' use of causation.	Rejected
H2: Increased perceptions of response uncertainty will be related to entrepreneurs' use of flexibility.	Supported
H3: Increased perceptions of state uncertainty will be related to entrepreneurs' use of co-creation.	Supported
H4: Increased perceptions of effect uncertainty will be related to entrepreneurs' use of affordable loss.	Rejected
H5: Increased perceptions of response uncertainty will be related to entrepreneurs' use of focus on means.	Supported

4.6 Discussion

By integrating effectuation and action theory (Hacker, 2003; Suchman, 1987), I help advance our understanding of how and why entrepreneurs navigate different perceived environmental conditions, thus contributing to the study of the antecedents of effectuation. This study illustrates how entrepreneurs use effectual and causal action principles to respond to perceptions of missing information about the environment and its future states. Specifically, I show that entrepreneurs use the co-creation principle to act when they perceive lack of information about how the environment is likely to change in the future, and they use the flexibility and focus on means principles to act when they perceive lacking information about how to respond to future changes in the environment in which they act. Surprisingly, I find that entrepreneurs also use causation to respond to perceptions of response uncertainty.

Thus, I complement past research that investigates the role of effectuation in mitigating objective, or true uncertainty (Mauer et al., 2018; C. Welter & Kim, 2018) and process studies documenting how entrepreneurs react to overall perceptions of environmental uncertainty (Berends et al., 2014; Reymen et al., 2015). By investigating the distinctive relationships between different types of perceived uncertainty, causation and specific effectual principles, I further clarify and provide nuance to the relationship between effectuation, causation, and uncertainty. I show that effectuation entails a series of action principles that can help entrepreneurs act and make progress on their ventures despite missing information typically being seen as an impediment to entrepreneurial action (McKelvie et al., 2011). Specifically, effectuation enables entrepreneurs to shape future changes in the environment by partnering with self-selected stakeholders, initiate action by focusing on available means and combining these to create new artifacts, and sustain action by flexibly adapting to dynamic feedback and unexpected contingencies that may occur in the new venture creation process. When perceiving uncertainty in relation to the best course of action for addressing environmental changes, entrepreneurs tend to use a combination of effectual principles and causation to mitigate this type of uncertainty. I expand on the implications of the main findings of this study below.

4.6.1 Different types of uncertainty drive different actions in the new venture creation process

In this study, I investigated how the nature of the uncertainty perceived by entrepreneurs, in terms of the type of information they perceive as lacking, drives their use of effectual and causal action principles. By investigating the effects of different types of perceived uncertainty, I answer calls for both entrepreneurship (McKelvie et al., 2011; McMullen & Shepherd, 2006; Packard & Clark, 2020; Townsend et al.,

2018) and effectuation research (Jiang & Tornikoski, 2019; Mauer et al., 2018; C. Welter et al., 2016) to further unpack the uncertainty construct and its role in driving entrepreneurial decision-making and action. Thus, I provide further nuance to the relationship between uncertainty, effectuation, and causation. Furthermore, I provide evidence that entrepreneurs use different effectual principles in different ways, to respond to distinct perceptions of environmental conditions.

4.6.1.1 State uncertainty

Theoretical conceptualisations of the effectuation construct emphasise the role of control-based strategies in situations when the future cannot be predicted, thus enabling the entrepreneur to circumvent this type of uncertainty (S. Read, Dew, et al., 2009; Sarasvathy, 2001a; Wiltbank et al., 2006). In this study, I provide more nuance to this assumption by showing that the co-creation principle is the main action principle that entrepreneurs use when they perceive the future as unpredictable. These findings suggest that the co-creation principle may enable entrepreneurs to gain control of their environment, and thus navigate situations when they are unable to predict future changes. Through enrolling self-selected stakeholders, entrepreneurs can influence and shape the environment in which their venture operates, thus removing the need to predict future changes and plan accordingly. Invested actors, such as early customers, co-founders, investors, or strategic partners provide much needed input to entrepreneurs who perceive a lack of information about the state of the environment in which they operate. Thus, entrepreneurs are able to still act and make progress in the development of their ventures. For instance, entrepreneurs can influence and shape the competitive landscape in which they operate by making a decision to partner with rather than go against one of their prospective competitors.

Alternatively, entrepreneurs can seek to avoid uncertainty related to future regulatory changes by getting involved and playing an active role in organisations and bodies regulating their environment (e.g., industry regulating bodies, advisory boards).

Interestingly, state uncertainty was found to be the least impactful impediment to action in past research (McKelvie et al., 2011), and this could be explained by entrepreneurs' ubiquitous and prevalent use of partnerships and co-creation actions in the new venture creation process. Furthermore, state uncertainty is closest in definition to broader notions of perceived environmental uncertainty which have been most often investigated in past research (Milliken, 1987). Thus, this finding suggests that a key mechanism in navigating perceived environmental uncertainty entails the co-creation and shaping of collective goals, that move beyond individual goals for the venture. This in turn suggests that ventures who want to control the future when they are unable to predict it need to think beyond the goals and interests of their own venture, and instead seek to influence and shape also the environment in which their prospective venture will operate, thus allowing entrepreneurs to successfully navigate an unpredictable environment.

4.6.1.2 Effect uncertainty

I had hypothesised that entrepreneurs would use the affordable loss principle in response to situations when they cannot predict the effect of changes within the environment on their venture, in order to minimise potential adverse effects on their ventures in a worst case scenario. Interestingly, I do not find support for a relationship between perceptions of effect uncertainty and affordable loss. Moreover, effect uncertainty was not an antecedent for any of the effectual principles I investigated. It

could be argued that out of the three types of uncertainty, effect uncertainty is perhaps the type of uncertainty that most entrepreneurs, once they have taken the decision to take the plunge and found a venture, are prepared to tolerate. Given the newness of their ventures, entrepreneurs do not have much to lose in terms of potentially negative effects of changes within their environment. Thus, arguably entrepreneurs will not worry about lacking information on how future changes will affect them (since the entity is so new and investments are very low in the early stages of a new venture), but rather they will struggle with lack of information about the nature of these changes (state uncertainty) and how to respond to these changes (response uncertainty). Our findings also suggest that affordable loss may have a distinct antecedent other than lack of information. Indeed, in past research affordable loss has been discussed as a principle with potentially different underpinnings, including personal characteristics such as an individual's loss aversion, level of ability to invest resources, and level of willingness to invest resources (Martina, 2020), as well as other effectual principles (e.g., focus on means) acting as antecedents to entrepreneurs' use of the affordable loss principle (Werhahn et al., 2015). Thus, future research should further investigate the antecedents of the affordable loss principle.

4.6.1.3 Response uncertainty

This study's findings suggest that out of the three types of perceived uncertainty, response uncertainty is perhaps the most complex and impactful influence on entrepreneurial action. This provides more nuance to previous research suggesting that perceived response uncertainty is a powerful impediment to entrepreneurial action (McKelvie et al., 2011), by showing that entrepreneurs use specific behaviours and actions to navigate this type of uncertainty and keep making progress on their venture.

Specifically, my findings show that entrepreneurs use a combination of causation and effectual principles in situations when they perceive a lack of information about how to respond to changes within the environment. This suggests that perceptions of response uncertainty trigger hybrid actions, that first attempt to mitigate perceived uncertainty through using prediction and planning, and second try to adapt to perceived uncertainty by focusing on the knowns of a situation (i.e., given means) and keeping a flexible approach that promotes iteration and incrementality. I propose that it is this unique behavioural signature that enables entrepreneurs to still act when they perceive missing information about the best way to proceed.

The results relating increased perceptions of uncertainty and entrepreneurs' use of causation are surprising. Theoretical work and most previous process studies have suggested a negative relationship between uncertainty and causation – specifically, it was assumed that entrepreneurs use causation when they perceive low levels of uncertainty (Berends et al., 2014; Reymen et al., 2015; Sarasvathy, 2001a, 2008). Nevertheless, the results relating perceived uncertainty to causation suggest the opposite pattern: entrepreneurs use causation when they perceive higher levels of state, effect, and response uncertainty. The effect of response uncertainty in particular is the strongest predictor of causation, persisting even when the shared effects of all three types of uncertainty are partialed out. Thus, entrepreneurs use causation in their actions when they perceive missing information in relation to the most suitable course of action in response to changes in the environment. I believe Packard & Clark's (2020) distinction between information that is unknown but knowable in principle (i.e. mitigable or epistemic uncertainty), or unknown and ultimately unknowable (i.e. immitigable or aleatory uncertainty) can help interpret our findings. Specifically, they

propose that entrepreneurs will use causation under conditions of mitigable uncertainty, when predictive information can be known. Milliken's (1987) typology of uncertainty types does not distinguish between mitigable and immitigable uncertainty – it does not specify whether the missing information is knowable in principle. Thus, one possibility is that entrepreneurs in this study perceived uncertainty as mitigable, and as such used causation and sought to mitigate the lack of information by predicting and planning. This possibility that entrepreneurs perceive uncertainty about how to act during the new venture creation process as mitigable is a fascinating proposition that should be explored in future research.

Furthermore, the results of this study show that two effectual principles – flexibility and focus on means – enable entrepreneurs to respond to situations in which they perceive lack of information about how to respond to changes within the environment. Given entrepreneurs' need to act in order to make progress on their ventures (McMullen & Shepherd, 2006; Uy, Foo, & Ilies, 2015), uncertainty relating to the options that entrepreneurs have in relation to how to act in a given environment can stifle progress and stop new venture creation in its tracks. Thus, the focus on means and flexibility principles offer entrepreneurs strategies for initiating, and then sustaining action, despite perceived response uncertainty. Firstly, the focus on means principle allows entrepreneurs to focus on the knowns of the situation – who they are, whom they know, and what they know (Sarasvathy & Dew, 2005) – and seek to combine these givens to create new artifacts. Thus, the entrepreneur can focus on what is within their control (i.e., their means), rather than outside their control (i.e., missing knowledge about appropriate response actions). Given the unique combination of means an entrepreneur has at their disposal, an infinite number of potential actions

and decisions can result, thus explaining the creation of new artifacts, and ultimately new ventures (Sarasvathy, 2001a). Due to the incrementality of the focus on means principle (Packard & Clark, 2020), entrepreneurs using this principle do not seek to create a clear vision and do not plan over long time horizons. Instead, given the perceived lack of information about how to respond to changes within the environment, entrepreneurs use flexibility to change and adapt depending on the feedback they get from the environment about the outcomes of their incremental actions. The combination of focus on means and flexibility action principles illustrates the incrementality of the effectual logic, which enables entrepreneurs to still act and make progress on their ventures even in the absence of knowledge about how to best respond to environmental changes.

4.6.2 The relationship between effectuation and causation

A secondary contribution of our study involves a clarification of the relationship between the effectuation and causation constructs. Our findings show that when acting under conditions of perceived response uncertainty, entrepreneurs tend to use a combination of causation and effectuation. Thus, this suggests that entrepreneurs do not view effectuation and causation as contrasting approaches, but rather as complementary and synergistic approaches that can mutually enhance one another. Several authors have theorised and provided some evidence for the effectiveness of an approach to new venture creation that combines effectuation and causation (e.g., Reymen et al., 2015; Smolka et al., 2018), however I provide some nuance and further extension of this proposition.

Past research studies have tended to emphasise how entrepreneurs switch between effectuation and causation depending on the environmental conditions they encounter (Berends et al., 2014; Jiang & Tornikoski, 2019; Reymen et al., 2015). In other words, it was shown that the antecedents underpinning entrepreneurs' use of effectuation were distinct from those that underpinned their use of causation. Instead, I find that under conditions of perceived response uncertainty, entrepreneurs mobilise both causation and certain effectual principles, suggesting a hybrid or combined approach. This is different from switching and shifting between effectuation and causation at different stages of creation of a new venture (Berends et al., 2014; Reymen et al., 2015), and instead suggests a combined logic whereby entrepreneurs predict and plan (i.e. causation), however at the same time focus on the means they possess as given and maintain flexibility in their decision-making and actions to leverage unexpected contingencies.

In terms of implications for future research, I also suggest an additional line of enquiry. While researchers have made calls to clarify specifically when and why entrepreneurs should use effectuation and causation respectively (Arend et al., 2015; Packard & Clark, 2020), I suggest an additional, complementary research question that future research should address: when and why do, and should, entrepreneurs use effectuation and causation in tandem? In other words, I suggest that there are environmental conditions (in this study, perceived response uncertainty), when entrepreneurs should not use one approach instead of the other, but rather they should elements of both logics *at the same time*. I propose that process studies focusing on the micro-level of individual decisions and actions will be particularly suitable designs for investigating this new direction for research. I also think that future research

should clarify whether all effectual principles can be used in tandem with causation, or whether some principles cannot be mixed or combined with causation. In this study, I find evidence for the focus on means and flexibility principles being used in tandem with causation, however affordable loss and co-creation did not seem to co-occur in this investigation. Future research should further investigate this issue.

4.6.3 Limitations and future research opportunities

Notwithstanding the contributions of this work, the study I conducted suffers from a number of limitations. Firstly, it must be noted that the data presented in this study was collected during the COVID-19 pandemic. Whilst this was deemed a suitable context for answering this research question given the high levels of uncertainty that have characterised this global crisis due to the disruption it has caused (O'Connor et al., 2020), some researchers have made a case that many of the assumptions we typically make in entrepreneurship research have been challenged in this crisis (Shepherd, 2020). Thus, whilst COVID-19 presented a good opportunity to investigate how entrepreneurs cope and navigate with high uncertainty levels, the type of uncertainty typically encountered by entrepreneurs during less disruptive times may be quantitatively, and qualitatively distinct, which may limit the generalisability of the findings. Thus, future research is needed to replicate this pattern of results.

Secondly, I only investigate the types of actions that entrepreneurs take in response to different types of uncertainty, however I do not investigate the effectiveness of these principles in helping entrepreneurs mitigate and navigate uncertainty. Specifically, future research should investigate whether effectual principles indeed help entrepreneurs make progress on their ventures by allowing them to act despite

high levels of uncertainty. Furthermore, this study did not investigate any potential learning effects – it could be that entrepreneurs try a particular action principle first to respond to uncertainty, and may use feedback from their action to inform whether they should use the same action principle again in the future, or try a different one instead.

Thirdly, I only investigate the typology of uncertainty proposed by Milliken (1987). Many other conceptualisations of uncertainty have emerged in recent years (Packard & Clark, 2020; Packard et al., 2017; Townsend et al., 2018), and as such the study of uncertainty within the entrepreneurship literature is gaining a lot more nuance and better understanding of both how it objectively manifests in the environment, and how entrepreneurs perceive and interpret uncertainty in the environment in which they operate. Future research should investigate alternative conceptualisations of uncertainty and how they relate to entrepreneurs' use of effectuation and causation.

Lastly, whilst a strength of the study is the use of a longitudinal design to follow entrepreneurs' perceptions of environmental uncertainty and their dynamic responses to these perceptions over time, I sampled a fairly heterogeneous sample of entrepreneurs at relatively different stages of development of their new ventures (the ages of the ventures included in the sample varied from 20 days to almost 5 years). This heterogeneity could be masking important effects that venture stage may have on the relationship between perceived uncertainty and entrepreneurs' use of effectuation. Specifically, entrepreneurs may respond to perceived uncertainty differently in the earlier stages of development of a venture, compared to the later stages of development of a venture (cf. Jiang & Tornikoski, 2019). Whereas the relationship between uncertainty and stage of development of a new venture is thought to be

negative (i.e. uncertainty reduces in the later stages of development; Berends et al., 2014), this relationship may not be linear and instead entrepreneurs may suffer from crises that temporarily increase perceived uncertainty levels even in the later stages of development of a new venture (Reymen et al., 2015), or entrepreneurs may encounter unanticipated consequences (Jiang & Tornikoski, 2019) that result in heightened perceived uncertainty. Thus, more research using longitudinal designs enabling a better understanding of the inter-relationships between perceptions of environmental uncertainty, venture development stage, and entrepreneurs' use of effectuation, is needed.

4.7 Conclusion

In this study, I sought to investigate how entrepreneurs' changing perceptions of uncertainty drive their use of effectual and causal action principles during the new venture creation process. By integrating effectuation and action theory, in a longitudinal study I show that entrepreneurs use distinct action principles in response to the different types of uncertainty. In particular, perceptions of missing information about future changes in the environment (i.e. state uncertainty) and missing information about how to respond to these changes (i.e. response uncertainty) seem to drive entrepreneurs' effectual and causal actions. This study provides a more nuanced understanding of the relationship between uncertainty and effectuation.

Chapter 5 General discussion

This final chapter contains a general discussion of the research presented in this thesis. The aim of this thesis was to extend our understanding of the antecedents of effectuation, by integrating effectuation (Sarasvathy, 2001a, 2008), ecological rationality (Gigerenzer & Gaissmaier, 2011; Todd et al., 2012), and action (Hacker, 2003; Suchman, 1987) theories. This theoretical integration enabled us to better our understanding of when, how, and why entrepreneurs use effectuation during the new venture creation process. Given the dynamism characterising entrepreneurial environments (Davis, Eisenhardt, & Bingham, 2009; Mauer et al., 2018), and the speed at which entrepreneurs typically make progress in the creation and growth of their ventures (Uy et al., 2015), it is important to investigate how entrepreneurs adapt to these changing conditions and environments. Uncertainty, described as the boundary condition of effectuation in early theoretical work, has tended to be a catch-all term for a number of different constructs describing the environments in which entrepreneurs operate (Mauer et al., 2018; C. Welter et al., 2016). Thus, in this thesis, I seek to decompose the construct of uncertainty and clarify how entrepreneurs use effectuation and causation to cope with the demands of different environmental challenges they encounter in the new venture creation process.

The main theoretical contributions of each empirical study have already been discussed in chapters 2, 3, and 4, however in this chapter I seek to draw some general implications emerging from the approach I followed, and to suggest some future directions. Firstly, I discuss the theoretical contributions of this thesis.

5.1 Theoretical contributions

5.1.1 The antecedents of effectuation

The primary aim of this thesis was to further our understanding of the antecedents of effectuation. Specifically, I argued that there was a need for more precision and granularity when operationalising the environment in which entrepreneurs operate. Specifically, the theoretical integration between effectuation, ecological rationality, and action theories highlights the need to better understand how entrepreneurs make sense of and structure the environment in which they operate, and in turn how this influences their use of effectuation and causation in the new venture creation process. A key contribution to the study of antecedents of effectuation that this thesis attempts to make is to better our understanding of the interaction between the environment and the entrepreneur, through entrepreneurs' adaptive use of decision-making logics and actions.

In chapter 2, I introduce a new concept – that of *decision fit* - to illustrate how entrepreneurs' usage of effectual and causal decision-making logics is driven by their respective fit with the particular decision content and structure they are encountering. The findings of the study suggest that firstly, it is decision content rather than development stages per se that drives entrepreneurs' use of effectual decision-making logics. This lends support to studying the antecedents of effectuation at the micro-level of the decision. Secondly, the findings presented in this chapter also show that distinctive decision structures drive entrepreneurs' use of effectuation and causation. Specifically, these findings suggest that entrepreneurs' perceptions of uncertainty in decision-making can be decomposed into the dimensions of decision complexity and costs of experimentation. This contribution answers calls for further clarifying the

nature of the uncertainty construct, and in turn how it influences entrepreneurs' use of effectuation (C. Welter et al., 2016). In turn, this conceptualisation allows us to get a better understanding of *why* entrepreneurs use effectual or causal decision-making logics for particular decisions, thus addressing a key limitation of past research on the antecedents of effectuation (Grégoire & Cherchem, 2020; S. Read et al., 2016). Future research on the antecedents of effectuation can also use this novel conceptualisation of uncertainty in entrepreneurs' decision-making to predict when and understand why entrepreneurs use effectuation and causation in the new venture creation process.

In chapter 4, I turned my focus from effectuation as a decision-making logic to its behavioural manifestation as entrepreneurial action. Specifically, I sought to investigate whether the nature of entrepreneurs' perceptions of uncertainty as missing information influenced their use of effectual and causal action principles. In line with action theory (Hacker, 2003; Suchman, 1987), the results of this study suggest that entrepreneurs seek to use action principles that fit with the type of uncertainty they are experiencing at a given time. The results suggest that while entrepreneurs use the effectual principle of co-creation in response to perceptions of missing information about future changes in the environment, entrepreneurs use a combination of causal actions and effectual principles (focus on means and flexibility) when they perceive lack of knowledge about how to respond to these changes. Thus, entrepreneurs use distinctive combinations of action principles to cope with the demands of different perceived environmental challenges. This highlights the adaptive role of effectual and causal principles, and the need for future theorising and research to decompose and better understand the nature of the challenges that entrepreneurs encounter in the environment they operate in. To the best of my knowledge, this is one of the first

quantitative studies within the effectuation literature to investigate longitudinally the antecedents of effectuation. Thus, the results of this study provide further nuance to theorising about the relationship between effectuation and uncertainty. The results highlight how effectuation and causation can offer entrepreneurs a repertoire of strategies they can leverage in response to different perceived environmental challenges, and the importance of better understanding the specific antecedents associated with each principle, given they serve different functions in the new venture creation process.

In sum, these two empirical chapters contribute to our understanding of the antecedents of effectuation, and specifically provide two ways of operationalising and conceptualising uncertainty in entrepreneurs' decision-making and actions that enables us to better predict and understand when and why entrepreneurs use effectuation in the new venture creation process.

5.1.2 Levels and units of analysis in effectuation research

Empirical research on effectuation theory has significantly expanded in recent years (Grégoire & Cherchem, 2020), and this increase has been accompanied by a lack of clarity in the levels and units of analysis studied (McKelvie et al., 2020). Past research has typically focused on the whole new venture creation process (or stages within), and on the founding team (e.g., Berends, Jelinek, Reymen, & Stultiëns, 2014; Reymen et al., 2015; Smolka, Verheul, Burmeister-Lamp, & Heugens, 2018). Concomitantly, research on the individual-level has made modest inlays in the effectuation literature, owing to the inconclusive results of studies attempting to identify personal characteristics as antecedents to effectuation (Grégoire & Cherchem,

2020). Nevertheless, the results presented in this thesis suggest that a focus on the individual-level holds promise in terms of clarifying when and why entrepreneurs use effectuation in the new venture creation process. At the same time, it is important to study the interaction between the entrepreneur (as a decision-maker and agent of action in entrepreneurial ventures) and the environment in which they operate (cf. Simon, 1990). Specifically, this approach entails an investigation of the micro-foundations of entrepreneurial decision-making and action, in other words an understanding of how individual entrepreneurs approach specific decisions and actions in the entrepreneurial journey (Shepherd, 2015). Through the theoretical integration between effectuation, ecological rationality, and action theory, this thesis highlights a novel approach to the study of antecedents of effectuation that focuses on decisions as a unit of analysis, and on the individual entrepreneur as a level of analysis in research. These are two important contributions to the effectuation literature as they outline promising avenues for further clarifying the mechanisms that underpin entrepreneurs' use of effectuation (Arend et al., 2015; Grégoire & Cherchem, 2020; S. Read et al., 2016).

5.1.2.1 Focusing on decisions as a unit of analysis

The integration of effectuation and ecological rationality theory (Gigerenzer & Gaissmaier, 2011; Todd et al., 2012) highlights the interaction between the decision-maker and their perception of the environment in which they operate (i.e. decision structure). When considering decision-making out of its context, we cannot understand why decision-makers may choose particular strategies or logics over others. By aggregating processes across many different decisions, we can lose sight of important adaptive mechanisms that entrepreneurs use to cope with the different

challenges they encounter at various stages in the new venture creation process. Instead, when we consider decision-making as an adaptive response to the structure of the environment that the decision-maker perceives, we can start making sense of why decision-makers use particular logics over others for distinct decisions, and how this helps them overcome particular challenges. Thus, by focusing on the micro-level of decisions, we can gain a more granular and in-depth understanding of how and why entrepreneurs use different logics to adapt to these changing demands. This thesis provides empirical evidence of heterogeneity across the many decisions entrepreneurs have to make in the new venture creation process, and theorises on the fit between effectual and causal logics, and specific decision structures. This provides evidence that focusing on decisions as a unit of analysis in the study of effectuation is a worthwhile and promising avenue for future research, and can clarify some of the contradictory findings that past research has highlighted when investigating the whole new venture creation process as a whole, or stages thereof.

5.1.2.2 Individual-level research

Effectuation theory initially developed as a theory of entrepreneurial expertise, seeking to explain how entrepreneurs develop particular logics to make decisions and act in the face of uncertainty as a result of years of deliberate practice (S. Read & Sarasvathy, 2005; Sarasvathy, 2001b). However, since Sarasvathy's seminal work, research in the effectuation field has not made much progress in better understanding the individual-level determinants and manifestations of effectuation. Instead, most research has utilised case studies of ventures, with a recent review summarising the evidence on individual-level antecedents as inconclusive (Grégoire & Cherchem, 2020). However, the research presented in this thesis provides evidence that our

knowledge about the effectuation construct can be significantly extended by integrating insights from psychological theories. In particular, research at the individual-level can provide a better understanding of how effectuation psychologically manifests itself in entrepreneurs' cognitions and behaviours, how it emerges, and what consequences it has for the individual entrepreneur. Both ecological rationality and action theory are individual-level theories that explain how individuals' cognitions and actions interact with their environment. Given the central role of the entrepreneur in the creation of new ventures (M. Frese & Gielnik, 2014; Gartner, Shaver, Gatewood, & Katz, 1994), we need to better understand how individual-level processes relate to new venture outcomes, and to do so we need to focus on individual-level cognitions and actions. The findings of the three empirical chapters of this thesis highlight how an individual-level study of effectuation can help us further our understanding of when, and especially *why* effectuation is used during the new venture creation process. Whereas chapters 2 and 4 show how individual-level perceptions of the environment can help clarify the relationship between uncertainty and effectuation, chapter 3 provides evidence supporting the measurement of effectuation at the individual-level. The explanation of why entrepreneurs use effectuation emerges from the interaction between the individual entrepreneur and the environment in which they operate, and needs to recognise the role of personal, subjective perceptions of the environment.

5.1.3 Contributions to the ecological rationality literature

A central tenet of ecological rationality theory is that decision-makers use strategies that fit with the structure of the environment in which they operate (Gigerenzer & Brighton, 2009; Todd & Gigerenzer, 2012). Nevertheless, how

decision-makers make sense of the environment through perceptions of decision structure is currently poorly understood (Pleskac, Conradt, Leuker, & Hertwig, 2020; Todd & Gigerenzer, 2012). Chapter 2 uses an inductive approach to explore how entrepreneurs make sense of the decisions they encounter in the new venture creation process, and what information they use in their decision-making. Thus, the results of this study can enrich ecological rationality theory by proposing two elements of decision structure – namely complexity and experimentation costs – to help explain how decision-makers perceive and interpret the environment, and in turn how these perceptions of decision structure drive their use of specific decision-making logics. Future research can investigate whether these two decision structure elements found to impact decision-making in the entrepreneurship domain also extend to other domains of decision-making.

Furthermore, I also hope to contribute to ecological rationality theory by clarifying the relationship between decision content (what the decision is about) and structure (what information about the decision is represented in the decision-maker's mind). Specifically, the results of chapter 2 suggest that decision content interacts with decision-makers' beliefs, domain expertise, and societal and cultural expectations, to form an internal representation of decision structure. This can help improve the generalisability of findings within the decision-making literature. For instance, past research in decision-making has typically investigated decisions in a limited number of domains, including lotteries, medical decision-making, and ethical decision-making (Gigerenzer, 1995; Goldstein & Weber, 1995). However, it was unclear how generalisable these findings were to decision-making in other domains. Thus, by better

understanding how decision content and structure are related, better inferences and predictions can be made about decision-making processes in a wide range of domains.

5.2 Methodological contributions

In chapter 3, I make a methodological contribution to the effectuation literature by developing and validating a novel scenario-based measure of effectuation. This enables future research to operationalise effectuation as a decision-making logic used by individual entrepreneurs, for specific decisions, as argued in section 5.1.2 above. This complements existing measures of effectuation that operationalise the construct as behaviours carried out by the whole founding team, across the new venture creation process. Instead, this newly developed measure enables entrepreneurs to express situated preferences for either effectual or causal logics across a series of representative decisions in the new venture creation process. This methodology also counters other limitations of self-report measures, including response biases (March & Sutton, 1997; Paulhus, 1991). Due to it being a quantitative measure, it enables large-scale quantitative research to be carried out on both the antecedents and outcomes of effectuation. In chapter 3, I provide preliminary evidence of construct validity for this measure. This is a promising development that I hope will contribute to future research on effectuation at the individual-level, on the decision unit of analysis.

5.3 Future research

Whereas this thesis contributes to our understanding of the antecedents of effectuation, it also opens up several opportunities for future research to further expand on its empirical findings and its theoretical elaboration. In this thesis, I focus on investigating the cognitive factors impacting on entrepreneurs' use of effectuation

and causation, namely perceptions of decision fit and different types of perceived uncertainty as missing information. Nevertheless, future research on the antecedents of effectuation should also explore the role of non-cognitive factors, such as emotion and affect. There have been multiple calls and papers highlighting the role of non-cognitive factors in entrepreneurial processes (Baron, 2008; Baron, Hmieleski, & Henry, 2012; Cardon, Foo, Shepherd, & Wiklund, 2012), however not much is known on how emotion and affect impact on entrepreneurs' use of effectual and causal decision-making logics. Whereas non-cognitive factors are likely to have direct effects on entrepreneurial decision-making (cf. Hayton & Cholakova, 2012), it is also plausible that non-cognitive factors interact with cognitive actors in significant ways. Research in psychology on emotion activation suggests that emotion may modulate individuals' perceptions and responses to different environments (De Dreu, Baas, & Nijstad, 2008). For instance, future research could investigate whether entrepreneurs experiencing high activation emotions (e.g., excitement, anger) differ in their response to uncertainty from entrepreneurs experiencing lower activation emotions (e.g., contentment, sadness).

A second potential direction for future research stems from the theoretical integration between effectuation and ecological rationality theory. In this thesis, I show how entrepreneurs adapt to different decisions and environments by using distinct decision-making logics and behaviours. Nevertheless, I do not explore (as this is beyond the scope of the thesis) what the effectiveness of these logics is for particular decision and environment structures. Thus, future research could investigate for which decisions or in which environments a given logic performs better than other decision-making logics. Building on some of the research insights I have gained through this

thesis, experimental methodologies typically used in ecological rationality research (e.g., comparative model testing using simulation; Luan, Reb, & Gigerenzer, 2019) could be used to help us better understand what logics work best in different types of environments, for instance depending on the amount (and type) of uncertainty, ambiguity, or complexity the entrepreneur is encountering in their environment. This would also counter criticisms leveraged at effectuation theory that it does not specify under what conditions effectuation can provide performance advantages to entrepreneurs using this logic (Arend et al., 2015).

5.4 Practical contributions

This thesis shows how entrepreneurs tend to adaptively use distinct logics that fit the particular requirements of the decisions and environments they encounter in the new venture creation process. Thus, a key entrepreneurial capability emerges – entrepreneurs need to be able to adaptively switch and use logics and actions that match a dynamically changing environment. This entails firstly, paying attention to the environment and the nature of the decisions they are encountering during the new venture creation process, and secondly choosing logics and actions that fit these decisions and environments. Whereas this process of matching logics to decisions and environments seems to be an automatic rather than a deliberative process, it is possible that entrepreneurs can enhance their dynamic ability to switch and fit logics by harnessing increased metacognitive abilities – being able to think about the decision at hand and selecting an appropriate logic for that particular decision (Haynie et al., 2010). This suggests that entrepreneurship education could develop entrepreneurs' knowledge of distinct logics and how they fit different decisions and different environments, thus enabling them to dynamically adapt the decision-making logics

they use to the decisions they encounter. Furthermore, decision-making aids could be developed to assist entrepreneurs in using the right logic for specific decisions, for instance by creating boosts that foster entrepreneurs' competence to make good decisions (Hertwig & Grüne-Yanoff, 2017).

5.5 Conclusion

Effectuation theory has emerged as one of the most promising theoretical frameworks for conceptualising and better understanding how entrepreneurs make decisions (Grégoire & Cherchem, 2020). Despite significant advances in our understanding, the antecedents of effectuation still remain vague, underspecified, and not as well understood as they should be. The primary aim of this thesis was to address this gap within the literature, and advance our understanding of when and why entrepreneurs use effectuation and causation throughout the new venture creation process.

This thesis introduces a micro-level investigation of the role that the environment plays in driving entrepreneurs' use of effectuation and causation. It integrates effectuation theory with insights stemming from ecological rationality theory (Gigerenzer & Gaissmaier, 2011; Todd et al., 2012) and action theory (Hacker, 2003; Suchman, 1987). Its main insight is that entrepreneurs' perceptions of the environment in which they operate – in particular, perceptions of decision structure and perceptions of different types of missing information about the environment – drive their use of effectuation and causation. This is a novel conceptualisation explaining how entrepreneurs perceive and interpret environmental uncertainty when deciding and acting in the new venture creation process. This thesis also makes a

methodological contribution to the effectuation literature by developing and validating a new scenario-based measure of effectuation, that assesses entrepreneurs' use of effectual logics for specific decisions characterising the new venture creation process. This complements existing measures that assess generalised self-reported use of effectuation across longer periods of time, and enables effectuation research to extend towards new directions.

In conclusion, this thesis proposes an inter-disciplinary theoretical integration between effectuation, ecological rationality, and action theories that can help us significantly extend our understanding of when and why entrepreneurs use effectuation in the new venture creation process.

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Appendix

Venture scenario for the measure described in Chapter 3:

Please use your imagination and put yourself in the context of the scenario:

Allison is the founder and CEO of a start-up building wearable technology intended to work in tandem with Virtual Reality environments. She aims to create products that enhance user experience and engagement by enabling users to have real-time, two-way interactions with the Virtual Reality environment.

Allison has previously worked in the tech industry. She has some limited resources to invest in the start-up from personal savings. Please use your imagination and put yourself into Allison's shoes; imagine how you would approach the following critical decisions Allison has to make during the early stages of setting up and growing her company.