VENTURING INTO THE UNKNOWN:

UNDERSTANDING HOW ENTREPRENEURS AND EMPLOYEES NAVIGATE UNCERTAINTY

Dissertation

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ABBREVIATIONS

ANOVA	Analysis of Variance
CEO	Chief Executive Officer
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CI	Confidence Interval
df	Degrees of Freedom
DV	Dependent Variable
GEM	Global Entrepreneurship Monitor
HR	Human Resources
ICC	Inter-Coder-Reliability
JCM	Job-Characteristics-Model
M	Mean
M&A	Mergers and Acquisitions
RMSEA	Root Mean Square Error of Approximation
SD	Standard Deviation
SE	Standard Error
SMEs	Small and Medium-Sized Enterprises
TLI	Tucker-Lewis-Index
VIF	Variance Inflation Factor
WEF	World Economic Forum
2-SLS	Two-Stage Least Squares

ABSTRACT

Uncertainty is a fundamental and pervasive feature of modern business environments. As uncertainty harbors both opportunities and potential threats to business development, it poses a challenge to the decision-making of entrepreneurs and employees and has a decisive influence on the success and performance of businesses. In this vein, this dissertation investigates how entrepreneurs and employees navigate uncertainty and examines the individual and contextual influences that shape these processes. The dissertation analyzes individual entrepreneurs and employees within start-ups and established organizations, focusing on how they perceive and respond to uncertainty. Using various research approaches, the dissertation illuminates entrepreneurs' psychological reactions and action strategies in response to uncertainty, explores how social class perceptions serve as a boundary condition in entrepreneurial decision-making regarding uncertain opportunities, examines the influence of entrepreneurial leaders' passion on employees' uncertainty perceptions and decision-making, and analyzes the antecedents and boundary conditions of employees' uncertainty regulation processes within broader organizational settings. By investigating these aspects, this dissertation offers a multi-faceted exploration of navigating uncertainty in entrepreneurial and organizational environments and provides valuable insights for both scholars and practitioners in the field of entrepreneurship and management.

INTRODUCTION

Uncertainty is a fundamental feature of today's rapidly evolving and unpredictable business environment (McMullen & Shepherd, 2006; Milliken, 1987; Townsend et al., 2018). The success and survival probability of businesses heavily depend on their ability to navigate uncertainty, as it enables them to capitalize on emerging opportunities and mitigate potential threats (Bromiley et al., 2015; Griffin & Grote, 2020; McMullen et al., 2007). Central to this process are entrepreneurs and employees, whose efforts to navigate uncertainty and leverage its inherent business opportunities are significant drivers of economic growth and innovation (Baumol et al., 2011; Schumpeter, 1934; Van Praag & Versloot, 2007). While entrepreneurs identify unmet customer needs and create new market opportunities (Shane & Venkataraman, 2000), employees support innovative efforts by contributing to the operational and strategic success of their ventures (DeSantola & Gulati, 2017; Liu et al., 2024; Van Lancker et al., 2022). Thus, embracing uncertainty and identifying effective ways to deal with it appears essential (Griffin & Grote, 2020; Packard et al., 2017; Yin et al., 2024). This is a particularly challenging task for entrepreneurs and employees as ineffective approaches to uncertainty involve a high risk of failure and can negatively affect the performance of a business (Griffin et al., 2007; Jauch & Kraft, 1986). Accordingly, exploring how entrepreneurs and employees perceive and respond to uncertainty in both entrepreneurial and organizational environments is a relevant field of study. However, existing research primarily focuses on the negative aspects of uncertainty, often viewing it only as a risk to be avoided (Bromiley et al., 2015; McMullen & Shepherd, 2006), and overlooks how entrepreneurs and employees actively navigate uncertainty to create opportunities and drive innovation (Griffin & Grote, 2020). Therefore, this dissertation aims to contribute to an understanding of how entrepreneurs and employees perceive and respond to uncertainty and which individual and contextual determinants shape these processes within entrepreneurial and organizational environments.

Research Questions

Two overarching research questions guide the following analyses. Initially, this dissertation explores how entrepreneurs perceive and respond to uncertainty. Since entrepreneurship is fundamentally associated with navigating uncertainty, entrepreneurs must strategically respond to uncertainty and evaluate inherent opportunities to capitalize on unknown means-end connections (McMullen & Shepherd, 2006; Ott et al. 2017; Shane & Venkataraman, 2000). Entrepreneurs permanently face environmental uncertainties, such as volatile market demands (Chen et al., 2005), rapid technological developments (Song & Montoya-Weiss, 2001), and changing competitive landscapes for limited resources (Castrogiovanni, 1991). These uncertainties necessitate entrepreneurs to engage in strategies to effectively deal with emerging challenges and take advantage of evolving opportunities (Ott et al., 2017; Sarasvathy, 2001; Van Gelderen et al., 2000). Additionally, uncertainty often arises during opportunity evaluation, where entrepreneurs must assess market desirability (Gruber et al., 2015), feasibility (Dimov, 2010), and potential gains and losses before committing limited resources to the pursuit of new opportunities (Keh et al., 2002; Kim et al., 2010; Scheaf et al., 2020). Since these uncertainties dictate entrepreneurial decisions and actions in business settings (Duncan, 1972; McKelvie et al., 2011; Milliken, 1987), entrepreneurs need to become more aware of how they perceive and respond to uncertainty, and which individual and contextual determinants influence them in their decision-making in order to effectively deal with it. Therefore, the first research question is:

Research question 1: *How do entrepreneurs perceive and respond to uncertainty?*

However, navigating uncertainty to capitalize on opportunities and mitigate potential threats is often a collaborative endeavor. Employees are frequently highly involved in the pursuit of entrepreneurial opportunities (Van Lancker et al., 2022) and form the backbone of

uncertainty regulation within organizations (Griffin & Grote, 2020; Liu et al., 2024; Yin et al., 2024). Therefore, this dissertation also analyzes how employees perceive and respond to uncertainty within both entrepreneurial and organizational environments. For one, the analyses contain an examination of the impact of entrepreneurs' action guiding passion signals that might determine how they perceive uncertainty and make decisions within start-ups. Existing literature indicates that decision-makers within start-up contexts often refer to entrepreneurs' passion signals to make decisions under uncertainty (e.g., Fu et al., 2022; Oo et al., 2019; Warnick et al., 2018). In addition, the analyses focus on the exploration of the antecedents and boundary conditions of employees' uncertainty regulation within broader organizational contexts. The prevailing literature indicates that the work environment in entrepreneurial firms is different from the work environment in more established organizations (Barrett & Mayson, 2008; Marlow et al., 2010). Thus, navigating uncertainty within general organizational environments may differ from entrepreneurial ventures and depend on distinct antecedents, mechanisms and boundary conditions. For this reason, this dissertation aims to contribute to the understanding of how employees perceive and respond to uncertainty within both entrepreneurial and organizational environments by addressing the second research question:

Research question 2:	*How do employees perceive and respond to uncertainty within entrepreneurial and organizational environments?*

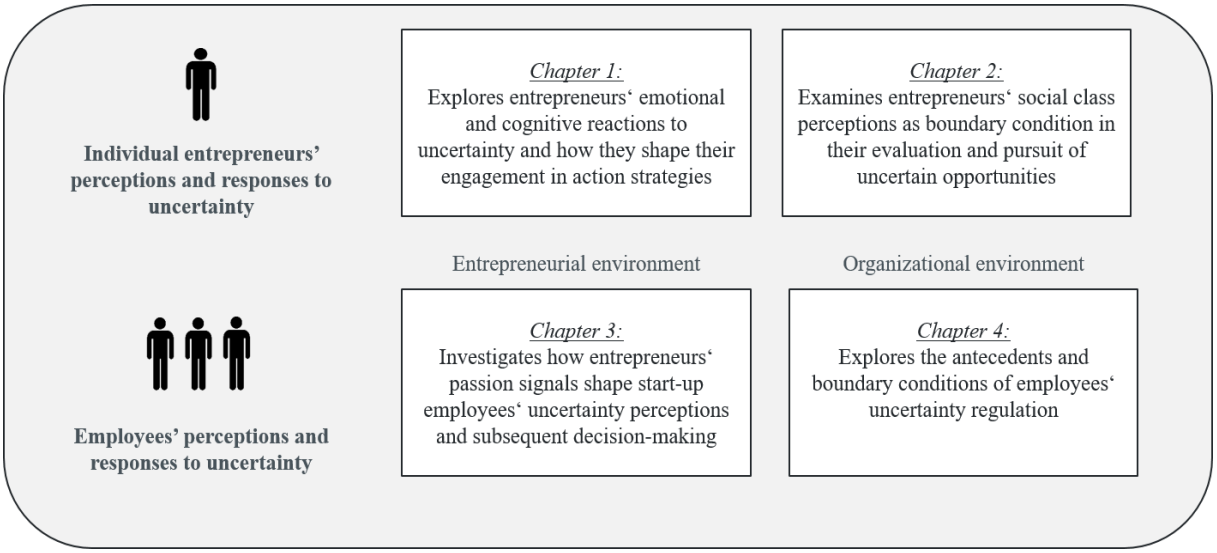
Outline and Contributions

This dissertation contains four chapters that address different aspects of these two research questions. Figure 0-1 gives an overview of all four chapters. Chapter one and two focus on the first research question, which asks how entrepreneurs perceive and respond to uncertainty, by exploring entrepreneurs' decision-making under uncertainty regarding

changes in their environment and uncertain opportunities. Chapter three targets the first part of the second research question by discussing how employees perceive and respond to uncertainty within start-ups when being influenced by their entrepreneurial leaders' passion. Chapter four focuses on the second part of the second research question, as it conceptually explores the antecedents and boundary conditions of employees' uncertainty regulation within broader organizational contexts. These chapters aim to contribute to the current literature as follows.

Figure 0-1: Overview of the dissertation

Four perspectives on entrepreneurs' and employees' navigation of uncertainty within entrepreneurial and organizational environments



Chapter one, which is co-authored by Prof. Dr. Sylvia Hubner-Benz and Prof. Dr. Matthias Baum, contributes to the discussion of why entrepreneurs engage in specific action strategies under uncertainty (Ott et al., 2017). We examined how entrepreneurs emotionally and cognitively react to uncertainty and how this, in turn, influences their engagement in specific action strategies, shaped by their uncertainty preferences. To this end, we combined a field study with a scenario-based vignette experiment. Our findings complement previous studies on entrepreneurial decision-making logics under uncertainty (e.g., Chandler et al., 2011; Jiang & Tornikoski, 2018; Sarasvathy, 2001), which often overlook entrepreneurs'

action-guiding psychological reactions to uncertainty. We first examined entrepreneurs' action strategies (i.e., ignorant actions, analytical and experimental strategies) when they perceive uncertainty in their real-life environment and then used the experiment to probe into the underlying causal effects and the psychological mechanisms in a more controlled setting. In addition, chapter one enhances our understanding of the pivotal role of entrepreneurs' uncertainty preference (Griffin & Grote, 2020) as a boundary condition determining their strategic responses to uncertainty. Thereby, we revealed the importance of incorporating psychological processing and individual differences when studying the effects of uncertainty in entrepreneurial decision-making.

Chapter two, which is co-authored by Prof. Dr. Sylvia Hubner-Benz, Prof. Dr. Matthias Baum, and Prof. Dr. Zhaoli Song, introduces entrepreneurs' social class perceptions as a moderator in the relationship between opportunity-related uncertainty (i.e., desirability, feasibility, achievable gain, and preventable loss) and entrepreneurs' willingness to exploit opportunities. A comparative analysis of a conjoint-experiment conducted in the USA and Germany – two developed countries with different economic systems (liberal vs. coordinated market economy) – suggested that entrepreneurs who perceive themselves as belonging to a low social class are generally more prone to shy away from uncertain opportunities compared with entrepreneurs from higher social classes. However, this effect was found to be significantly influenced by a country's economic system, which can potentially reverse the effect. Chapters two adds to an understanding to the critical role of social class perceptions in shaping entrepreneurs' evaluation and willingness to pursue opportunities because previous studies on the consequences of (perceived) social class in entrepreneurship tend to focus on labor market or economic perspectives. In addition, the chapter provides crucial insights for the field of entrepreneurial decision-making as it uncovers how social cognitive tendencies associated with different social classes influence actual entrepreneurial decisions. This provides a valuable complement to resource-based perspectives, which do not sufficiently

explain the conditions under which entrepreneurs from lower social classes pursue uncertain entrepreneurial opportunities. Taken together, Chapter 1 and 2 contribute to a better understanding of how entrepreneurs perceive and respond to uncertainty during business development and opportunity evaluation and identify relevant individual and contextual boundary conditions in these processes.

Chapter three, which is co-authored by Dr. Andreas Schunk (co-lead author), Dr. Jens Schüler, and Prof. Dr. Matthias Baum, contributes to the discussion of how entrepreneurial leaders' passion signals influence start-up employees' decision-making under uncertainty. In this chapter, we examine how entrepreneurial leaders' passion signals (passion type and strength) influence start-up employees' uncertainty perceptions and how these, in turn, influence employees' readiness to support the pursuit of new business opportunities via exploitative or exploratory efforts (Griffin & Grote, 2020; Mom et al., 2015). Thus, we combined two conjoint experiments to test different aspects of our theoretical model. Our findings complement previous studies, which report ambivalent signaling effects of leaders' passion on employees' decision-making (Breugst et al., 2012; Hubner et al., 2020; Piva & Stroe, 2022; Sirén et al., 2016). We first analyzed the signaling effects of entrepreneurs' passion on employees' uncertainty perception in a first conjoint experiment and then used another conjoint experiment to delve deeper into how these uncertainty perceptions translate in employees' contributions to exploration and exploitation efforts, shaped by their own dualistic passion inclination (harmonious vs. obsessive passion). Therefore, chapter 3 not only enhances the understanding of employees' decision-making in the collaboration with their leaders in start-ups, but also introduces employee passion as a critical boundary condition in regulating their behavior under uncertainty.

Chapter four, which is co-authored by Dr. Jens Schüler and Prof. Dr. Matthias Baum, is a systematic literature review on the antecedents and boundary conditions that shape employees' uncertainty regulation within broader organizational settings. This chapter offers

an organizing framework on employees' uncertainty regulation processes within organizational environments by mapping out the relevant individual- and contextual determinants that illuminate how and under which boundary conditions employees handle uncertainty as either a threat or an opportunity. This framework transcends the prevailing "downside loss" perspective on uncertainty and adds to a broader theoretical understanding of how organizations can navigate uncertainty in a positive and opportunity-driven way. Additionally, this study lays the groundwork for future research on the nuanced interactions between uncertainties in employees' operational environments, their individual characteristics and the structural and social aspects of their operational environments. Thereby, it provides insights for organizational decision-makers to develop effective strategies to navigate uncertainty. In sum, chapter 3 and 4 contribute to a better understanding of how employees perceive and respond to uncertainty within entrepreneurial and organizational environments and identify relevant individual and contextual boundary conditions in these processes.

Methodological Approaches and Data

The dissertation is based on various methodological approaches to address the research questions and based the analyses on separate datasets. For an overview of the methodological approaches and datasets, see Table 0-1.

In chapter one, we conducted two complementary empirical studies – a field study and a scenario-based experiment – to examine how entrepreneurs psychologically react and respond to uncertainty. First, we used a field study to investigate entrepreneurs' action strategies when they perceive uncertainty in their real-life environment. The data was collected via an online questionnaire. The final dataset consisted of 134 entrepreneurs from Germany. We conducted multiple confirmatory factor analyses to validate our measurements and specified multiple linear regression models to test our hypotheses. Additionally, we performed robustness-checks with various control variables and alternative specifications to ensure the stability our results and controlled for potential threats of endogeneity and reversed

causality bias. Second, we used a scenario-based vignette experiment to explore the underlying causal effects and the psychological mechanisms in a more controlled setting. By manipulating uncertainty, we were able to test how changes in uncertainty drive the proposed mechanisms and how entrepreneurs' uncertainty preferences moderate these effects. The data was collected via an online scenario-based vignette experiment. The final dataset consisted of 102 entrepreneurs (and therefore 306 observations) from Germany. We validated our measurements via multiple confirmatory factor analyses and conducted ANOVAs and T-tests to perform manipulation checks. We specified multiple mixed regression models to test our hypotheses. In addition, we conducted simple slope analyses to investigate the observed interaction effects of entrepreneurs' uncertainty preferences and explored the mediating effects of inhibitory emotions and activating cognitions through post-hoc moderated-mediation analyses. To control for a potential threat of endogeneity of our measured mediators, we applied a two-stage least squares (2-SLS) procedure.

In the second chapter, we conducted a conjoint experiment within two developed countries (the USA and Germany) with differing economic systems (liberal vs. coordinated market economy) to examine the how (opportunity-related) uncertainty effects depend on entrepreneurs' social class perceptions. We conducted the same conjoint experiment with entrepreneurs recruited from both the USA and Germany. The data from both conjoint experiments was collected using prolific.co (cf. Palan & Schitter, 2018). The final dataset included a total of 226 entrepreneurs (and therefore 3616 observations), of which 135 entrepreneurs (2160 observations) were from the USA and 91 entrepreneurs (1456 observations) were from Germany. We specified multiple hierarchical regression models to test our hypotheses. To analyze the hypothesized (three-way) interaction effects, we combined (three-way) interaction analyses and in-depth simple slope analyses.

In the third chapter, we conducted two conjoint experiments to disentangle the effects of entrepreneurial leaders' passion signals on employees' uncertainty perceptions and

subsequent decision-making. We combined two conjoint experiments to test different aspects of our theoretical model. In the first conjoint experiment, we manipulated signals of entrepreneurial leaders' passion type and strength and tested the effects on employees' perceived uncertainty and their decision to exploit or explore business opportunities. The data from the first conjoint-experiment was collected using a German panel provider (Cint). The final dataset consisted of 90 start-up employees (1440 observations) from Germany. We employed multi-level structural equation models to test our hypotheses. In addition, we conducted simple slope analyses to investigate the interaction effects of employees' dualistic passion and explored mediating effects of employees' uncertainty perception in post-hoc tests. In the second conjoint experiment, we examined how employees' uncertainty perception affects their willingness to support exploitative or explorative efforts, shaped by their own dualistic passion inclination (harmonious vs. obsessive passion). The data from the second conjoint-experiment was collected using another German panel provider (Consumerfieldwork). The final dataset of the second conjoint study consisted of 92 start-up employees (1472 observations) from Germany. We specified multiple hierarchical regression models to test our hypotheses. In addition, we employed simple slope analyses to examine the interaction effects of employees' dualistic passion. In both studies, we performed robustness-checks with various control variables and alternative specifications to ensure the stability of our results.

In the fourth chapter, we conducted a systematic literature review on the antecedents and boundary conditions that shape employee uncertainty regulation within broader organizational settings. We systematically searched for peer-reviewed articles in Business Source Premier (EBSCOHost) and Web of Science (Thompson Reuters) without time constraints (up until August 2024). In addition, we conducted a systematic issue-by-issue search to double-check our results and performed forward and backward searches to include all relevant contributions, tracing papers citing key articles and those cited within them. The

final dataset included a total of 315 articles, comprising 109 conceptual, 193 quantitative, and 3 qualitative articles, and 10 book chapters. We applied a narrative approach to synthesize our findings and develop an organizing framework.

Table 0-1: Overview of methodological approaches and data

	Chapter 1	**Chapter 2**	**Chapter 3**	**Chapter 4**
Title	How Entrepreneurs Respond to Uncertainty: Emotional and Cognitive Mechanisms Determining Entrepreneurial Action	Under the Sword of Damocles: How Social Class Impacts the Pursuit of Uncertain Opportunities	Driven by Passion – How Do Entrepreneurs' Passion Signals Influence Employees' Decision-Making Under Uncertainty?	Antecedents and Boundary Conditions of Employee Uncertainty Regulation: A Review and Organizing Framework
Type of study	Multi-study approach including a field study and a scenario-based vignette experiment	Multi-study approach including two metric conjoint experiments within two countries (one in the USA and one in Germany)	Multi-study approach including two metric conjoint experiments	Systematic literature review
Data	Field study: 134 entrepreneurs from Germany Experimental study: 102 entrepreneurs (306 observations) from Germany	Conjoint study 1: 135 entrepreneurs (2160 observations) from the USA Conjoint study 2: 91 entrepreneurs (1456 observations) from Germany Total dataset (used for analytical procedures): 226 entrepreneurs (3616 observations)	Conjoint study 1: 90 start-up employees (1440 observations) from Germany Conjoint study 2: 92 start-up employees (1472 observations) from Germany	Literature basis: 315 articles, comprising 109 conceptual, 193 quantitative, and 3 qualitative articles, and 10 book chapters
Analytical procedure	Field study: Confirmatory factor analyses (CFA), Multiple linear regression analyses Experimental study: Confirmatory factor analyses (CFA), Two-way ANOVA, T-tests, Multiple mixed regression analyses, Moderated-mediation analyses, Simple slope analyses, Two-staged ordinary least square procedure (2-SLS)	Multiple hierarchical regression models, (Three-way) Interaction analyses, Simple slope analyses, Simple slope difference tests	Conjoint study 1: Multilevel structural equation modeling, Simple slope analyses Conjoint study 2: Multiple hierarchical regression models, Simple slope analyses	Narrative approach to synthesize the findings

Chapter Overview and Research Project Information

Overall, this cumulative dissertation investigates how entrepreneurs and employees perceive and respond to uncertainty. To achieve this aim, three empirical papers and one conceptual paper were developed each contributing complementary insights into this complex phenomenon. The knowledge generated from all four studies forms the basis for the results and contributions of this dissertation. Table 0-2 provides an overview of the chapters and corresponding papers included in this dissertation and presented below, along with detailed information about the author team for each research project.

Table 0-2: Status of publication and contributors to the chapters of the dissertation

Chapter and corresponding papers	Presentations and Conference Proceedings	Theoretical Basis	Personal contribution	Authors
Chapter 1 How Entrepreneurs Respond to Uncertainty: Emotional and Cognitive Mechanisms Determining Entrepreneurial Action (Paper 1)	• Esmaili Konari, N., Hubner-Benz, S., & Baum, M. (2022). How Entrepreneurs Treat Uncertainty: Entrepreneurial Strategies Under Uncertainty and How They Are Shaped by Uncertainty Preferences. Presented at the AMJ Paper Development Workshop at the Nanyang Technological University (NTU), in Singapore. • Esmaili Konari, N., Hubner-Benz, S., & Baum, M. (2023). How Entrepreneurs Respond to Uncertainty: Psychological Mechanisms Determining Entrepreneurial Action. Presented at the 23rd EURAM Annual Conference the European Academy of Management (EURAM) in Dublin, Ireland. • Esmaili Konari, N., Hubner-Benz, S., & Baum, M. (2023). How Entrepreneurs Respond to Uncertainty: Psychological Mechanisms Driving Entrepreneurial Action. Academy of Management Proceedings, 2023(1), 17916. Presented at the 83rd Annual Meeting of the Academy of Management (AOM) in Boston, Massachusetts, USA. • Esmaili Konari, N., Hubner-Benz, S., & Baum, M. (2023). How Entrepreneurs Respond to Uncertainty: Psychological Mechanisms Determining Entrepreneurial Action. Presented at the 26th Annual Interdisciplinary Conference on Entrepreneurship, Innovation and SMEs (G-Forum), 09/2023, Darmstadt, Germany. • Currently, the manuscript is submitted to a journal. Status: Under review.	Entrepreneurial decision-making literature, Action regulation theory	• Project lead • Conceptualization • Study design • Data collection • Data analysis • Writing, reviewing and editing of the manuscript • Presenting at conferences • Submitting to journals	Nima Esmaili Konari (lead author) Prof. Dr. Sylvia Hubner-Benz Prof. Dr. Matthias Baum
Chapter 2 Under the Sword of Damocles: How Social Class Impacts the Pursuit of Uncertain Opportunities (Paper 2)	• Currently, the manuscript is submitted to a journal. Status: Under review.	Entrepreneurial decision-making literature, Social-cognitive theory of social class	• Project lead • Conceptualization • Study design • Data collection • Data analysis • Writing, reviewing and editing of the manuscript • Submitting to journals	Nima Esmaili Konari (lead author) Prof. Dr. Sylvia Hubner-Benz Prof. Dr. Matthias Baum Prof. Dr. Zhaoli Song

Chapter 3 Driven by Passion – How Do Entrepreneurs' Passion Signals Influence Employees' Decision-Making Under Uncertainty? (Paper 3)	• Schunk, A., Esmaili Konari, N., Schüler, J., & Baum, M. (2023). Driven by Passion – Do Passionate Leaders Help or Inhibit Employees' Behavior under Uncertainty?. Presented at the 26th Annual Interdisciplinary Conference on Entrepreneurship, Innovation and SMEs (G-Forum), 09/2023, Darmstadt, Germany. • In preparation for journal re-submission.	Entrepreneurial decision-making literature, Signaling theory, Dualistic model of passion	• Conceptualization • Study design • Data collection • Data analysis • Writing, reviewing and editing of the manuscript	Dr. Andreas Schunk (co-lead author) Nima Esmaili Konari (co-lead author) Dr. Jens Schüler Prof. Dr. Matthias Baum
Chapter 4 Antecedents and Boundary Conditions of Employee Uncertainty Regulation Processes: A Review and Organizing Framework (Paper 4)	• Esmaili Konari, N. & Schüler, J. (2022). Antecedents and boundary conditions of employees' uncertainty regulation: A systematic literature review. Academy of Management Annual Meeting Proceedings, 2022(1), 16793. Presented at the 82rd Annual Meeting of the Academy of Management (AOM) in Seattle, Washington, USA. • In preparation for journal submission.	Various theoretical perspectives on employee uncertainty regulation	• Project lead • Conceptualization • Study design • Data collection • Data analysis • Writing, reviewing and editing of the manuscript	Nima Esmaili Konari (lead author) Dr. Jens Schüler Prof. Dr. Matthias Baum

CHAPTER 1[1]

HOW ENTREPRENEURS RESPOND TO UNCERTAINTY: EMOTIONAL AND COGNITIVE MECHANISMS DETERMINING ENTREPRENEURIAL ACTION

Abstract

Acknowledging that entrepreneurs proactively choose – rather than avoid – uncertain environments, we suggest a new perspective on entrepreneurial action under uncertainty. Drawing on entrepreneurial action and action regulation theory, we develop and test a theoretical model suggesting uncertainty leads to different psychological reactions, namely inhibitory emotions and activating cognitions, which influence whether entrepreneurs act ignorantly or engage in analytical or experimental action strategies - and these effects depend on uncertainty preferences. Two studies, one field study (N = 134) and one experiment (N = 102), provide empirical support for our theoretical model and show under which conditions entrepreneurs may embrace uncertainty.

[1] Chapter one is co-authored by Prof. Dr. Sylvia Hubner-Benz and Prof. Dr. Matthias Baum.

1.1 INTRODUCTION

Entrepreneurs have to overcome uncertainty, which is an omnipresent feature of entrepreneurial action (e.g., McKelvie et al., 2011; McMullen & Shepherd, 2006; Townsend et al., 2018)[2]. But why do some entrepreneurs ignore uncertainty, while others diligently analyze the situation, while still others engage in experimentation to strategically leverage the opportunities inherent in uncertainty? While entrepreneurs' action repertoire has received some attention in previous studies (Frese & Gielnik, 2023; Ott et al., 2017), when and why they choose particular action responses to uncertainty remains largely in the dark. Specifically, how entrepreneurs psychologically process uncertainty is unclear, although their psychological processing may explain their engagement in specific action strategies (Frese, 2009; McKelvie et al., 2011). To shed light on the reasons for entrepreneurs' action strategy choices, we introduce a new perspective that differentiates the effects of entrepreneurs' emotional (inhibitory) and cognitive (activating) reactions to uncertainty, and how these, in turn, influence their action strategies, shaped by their uncertainty preferences (Griffin & Grote, 2020).

Building on action regulation theory (Frese & Zapf, 1994; Zacher & Frese, 2018), we argue that uncertainty perceptions trigger both inhibitory emotions (e.g., doubt and anxiety), and activating cognitions (e.g., thinking about how to reduce uncertainty), which influence entrepreneurs' action strategies (Frese et al., 2000; Ott et al., 2017; Van Gelderen et al., 2000). Inhibitory emotions may lead to analytical strategies focusing on analyzing the uncertain situation and refraining from immediate action (e.g., Hirsh et al., 2012; McMullen & Shepherd, 2006). Simultaneously, activating cognitions likely prompt analytical and experimental strategies to address the uncertainty, preventing ignorant actions (Andries et al.,

[2] Entrepreneurs' perception of uncertainty stems from a lack of knowledge regarding changes in the objective firm environment (Townsend et al., 2018). It is defined as the (perceived) inability to predict the state of the business environment, and its associated effects (McKelvie et al., 2011; Milliken, 1987).

2013; Brinckmann et al., 2011; Ott et al., 2017). We propose that these psychological mechanisms determine entrepreneurs' action strategies.

We further argue that entrepreneurs' uncertainty preference strengthens the effects of their activating cognitions. This preference, an individual trait, defines entrepreneurs' propensity to embrace upcoming changes as an exciting challenge instead of perceiving them as threats (Anderson et al., 2019; Griffin & Grote, 2020). We theorize that these preferences play a vital role in how entrepreneurs process uncertainty, subsequently influencing their action strategies. More specifically, when entrepreneurs have a high uncertainty preference, their thoughts are more likely to lead them to experimental strategies and prevent ignorant actions. Conversely, when entrepreneurs have a low uncertainty preference, their thoughts about reducing uncertainty are more likely to hinder experimental strategies and promote ignorant actions.

We test our model in two complementary empirical studies – a field study and a scenario-based experiment. The field study (N = 134 entrepreneurs) investigates entrepreneurs' action strategies when they perceive uncertainty in their real-life environment, while the scenario-based experiment (N = 102 entrepreneurs) allows us to explore the underlying causal effects and the psychological mechanisms in a more controlled setting. Through combining both studies, we elevate the ecological validity of our results (Grégoire et al., 2019), while rigorously testing our causal assumptions within a setup of heightened internal validity (Aguinis & Bradley, 2014).

Our research makes several contributions. First, we develop a novel perspective on entrepreneurial responses to uncertainty by integrating research on entrepreneurial action (Chandler et al., 2011; Frese et al., 2000; Ott et al., 2017; Sarasvathy, 2001) with action regulation theory (Zacher & Frese, 2018). While existing approaches focus on decision-making logics like causation and effectuation to manage uncertainty (e.g., Jiang & Tornikoski, 2018; Sarasvathy, 2001), they often overlook entrepreneurs' action-guiding

psychological reactions to uncertainty. Our model disentangles inhibitory emotions and activating cognitions as reactions to uncertainty by taking into account that uncertainty may be seen as both, a threat and an opportunity, and thus enables a more accurate assessment of entrepreneurs' responses to uncertainty.

Second, we contribute to appeasing paradigmatic conflicts in the literature on entrepreneurial action (e.g., Miller, 2007; Ott et al., 2017) by introducing entrepreneurs' uncertainty preference (Griffin & Grote, 2020) as a pivotal boundary condition determining their course of action. Acknowledging that different entrepreneurs' process uncertainty differently (Zacher & Frese, 2018), our findings shed light on why some entrepreneurs maintain their envisioned course of action while ignoring potential threats, while others focus on detailed analyses and seek predictable rewards, and still others prefer experimental actions. This nuanced understanding redefines the conventional view of uncertainty as merely an undesirable contextual element (McMullen & Shepherd, 2006) and provides a comprehensive insight into the intricacies of entrepreneurial action under uncertainty.

1.2 THEORETICAL BACKGROUND

1.2.1 Uncertainty as Threat and Opportunity for Entrepreneurs

Entrepreneurs encounter uncertainty as a knowledge problem, a challenge they must navigate when venturing into new territories to capitalize on unknown means-end connections (McMullen & Shepherd, 2006; Townsend et al., 2018). Their perceptions of uncertainty are rooted in assessments of their environment and dictate their actions in business settings (Duncan, 1972; Milliken, 1987). We therefore conceptualize uncertainty as the (perceived) inability to predict the state of the entrepreneurial environment and its associated effects (McKelvie et al., 2011; Milliken, 1987; Packard et al., 2017). This knowledge gap necessitates strategizing to address uncertainty through entrepreneurial thinking and acting (Frese, 2009; Ott et al., 2017; Sarasvathy, 2001).

To explain how entrepreneurs psychologically process and strategically respond to uncertainty, we draw on action regulation theory (Hacker, 2003; Johnson et al., 2006; Zacher & Frese, 2018). This theory elucidates goal-directed and successful (entrepreneurial) action by delving into the psychological processes and personality dispositions of actors, which is necessary to understand the engagement in entrepreneurial actions from a psychological perspective (Frese, 2009; Frese & Gielnik, 2014; Schmitt et al., 2017). According to action regulation theory, responding to uncertainty does not occur automatically.

On the one hand, uncertainty generates inhibitory emotions, which can impede entrepreneurial action (Frese, 2009; McMullen & Shepherd, 2006). Inhibitory emotions are negative feelings that arise when uncertainty disrupts routine actions and creates ambiguity about whether the current course of action remains appropriate or must be changed (Gray & McNaughton, 2000; Hirsh et al., 2012). This disruption and ambiguity can call the rewards and success of current effortful goal-directed actions into question, inducing doubts about what to do and anxiety about what will happen (Frese, 2009; McMullen & Shepherd, 2006). Entrepreneurs are particularly concerned about these inhibitory emotions as the degree of success or failure resulting from their entrepreneurial actions often depends on their capacity to appropriately interpret and respond to uncertainty (McMullen et al., 2007; McMullen, 2021; Uy et al., 2017).

On the other hand, uncertainty is suggested to trigger activating cognitions that motivate entrepreneurs to reduce uncertainty and potentially associated threats through proactive strategic actions (Frese, 2009; Frese et al., 2000; Van Gelderen et al., 2000). Activating cognitions are productive cognitive conflicts regarding how to successfully achieve entrepreneurial goals, which actions to engage in, and which feedback to trust (Frese & Zapf, 1994). This initial resource-consuming state of disorientation directs more attention to the task at hand, prompting individuals to cognitively re-assess the situation and develop new strategic approaches to adapt to potential changes. By engaging in strategic

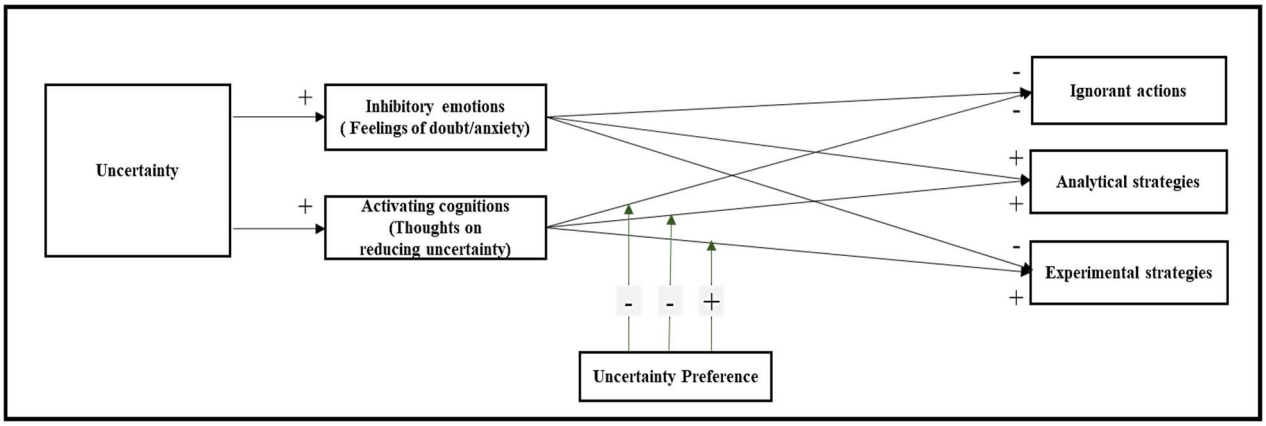
entrepreneurial actions, entrepreneurs can acquire valuable knowledge, ultimately reducing uncertainty and improving their chances of success despite uncertainty (Ott et al., 2017; Townsend et al., 2018). In doing so, entrepreneurs engage in different action strategies as a result of their activating cognitions, which are influenced by their individual uncertainty preferences (Griffin & Grote, 2020).

1.2.2 Different Entrepreneurial Action Strategies under Uncertainty

Entrepreneurs operate in uncertain environments in which they must constantly develop new action strategies to adapt to (anticipated) changes and lead their business to success (Frese, 2009; Ott et al., 2017; Sarasvathy, 2001). We conceptualize entrepreneurs' action strategy as an individual action template that can be applied to a variety of comparable business situations and helps entrepreneurs achieve business-related goals under uncertainty (Frese et al., 2000; Frese & Zapf, 1994). According to entrepreneurial action literature (Ott et al., 2017), entrepreneurs employ different approaches to address uncertainty. These approaches include ignorance (Lipshitz & Strauss, 1997; McMullen & Shepherd, 2006; Shepherd et al., 2007), analytical, and experimental action strategies (Chandler et al., 2011; Frese et al., 2000; Sarasvathy, 2001). Entrepreneurs ignore uncertainty when they decide to stick to their approach, pursue their ideas, and avoid distractions from their envisioned course of action, without engaging with the perceived uncertainty (Lipshitz & Strauss, 1997). Entrepreneurs engage in analytical strategies when they gather and analyze information to generate a holistic understanding of the uncertain situation, trying to predict potential outcomes and develop an action plan before committing to a strategy (Gary & Wood, 2011; Gavetti & Levinthal, 2000; Ott et al., 2017). In contrast, they engage in experimental strategies when they immediately and continuously focus on doing, by experimenting and learning from practical experiences, to incrementally develop their understanding of the situation on the way – rather than marshalling a lot of resources for situational analysis and upfront planning (Andries et al., 2013; Camuffo et al., 2019; Ott et al., 2017). To account for

these differences in entrepreneurial action, we distinguish three action strategies in which entrepreneurs may engage, when perceiving uncertainty: (1) ignorant actions, (2) analytical strategies, or (3) experimental strategies. We chose this distinction despite its similarity with concepts such as causation and effectuation logics (Harmeling & Sarasvathy, 2013; Nielsen & Sarasvathy, 2016; Sarasvathy, 2001) or exploitation and exploration behaviors (Choi et al., 2004; March, 1991; Schmitt et al., 2017), because it reflects the variance within strategizing through thinking and acting (Ott et al., 2017). Acknowledging this variance enables us to consider nuanced entrepreneurial actions rather than broad entrepreneurial logics that include both attitudinal and behavioral aspects (Brettel et al., 2012), which is necessary for our focus on specific psychological processing. The theoretical model is presented in Figure 1-1.

Figure 1-1: Theoretical model



***Note*:** In the first study, perceived uncertainty was measured and in the second study it was experimentally manipulated.

1.3 HYPTHOTHESES DEVELOPMENT

1.3.1 How Uncertainty Drives Different Action Strategies

When entrepreneurs perceive high levels of uncertainty, they are unlikely to ignore it. Uncertainty is a salient feature of entrepreneurship that creates doubt in entrepreneurs about whether they can achieve their business goals (McMullen & Shepherd, 2006). At the same time, uncertainty triggers stress (Rauch et al., 2018). Such experiences put strain on entrepreneurs who usually already operate with scarce time and financial resources (Lanivich, 2015). Experiencing such strain, they are unlikely to leave their success to chance by willfully

ignoring new information that increases uncertainty about market trends or technological changes in the entrepreneurial environment (Lipshitz & Strauss, 1997; McKelvie et al., 2011). As entrepreneurs are generally proactive and performance-oriented (McClelland, 1961; Frese & Gielnik, 2014), they are unlikely to respond with such ignorant actions (McMullen & Shepherd, 2006). Instead, they may rather want to learn more about the uncertain situation and rethink their actions to make sure they achieve their business goals (Frese et al., 2000; Van Gelderen et al., 2000).

How entrepreneurs approach uncertain situations can differ substantially. For one, entrepreneurs may postpone their decisions and actions as they may feel that first analyzing the situation and preparing an action plan will help them determine and justify what they should do and give them guidance and confidence in establishing their ventures (Brinckmann et al., 2010; Gary & Wood, 2011; Gavetti et al., 2007). For example, when entrepreneurs perceive uncertainty about whether and how the firm environment will change, they might prefer to (over-)analyze and try to understand the changing situation instead of proactively venturing into the unknown (Lipshitz & Strauss, 1997; Weick, 1993). Thus, perceived uncertainty may favor analytical strategies that focus on information search and situational analysis to predict potential outcomes and reduce perceived uncertainty (McGrath & MacMillan, 2000; McMullen & Shepherd, 2006).

Alternatively, entrepreneurs may enact experimental strategies. Uncertainty has been suggested to offer a starting point for experimentation (Andries et al., 2013; Andries & Debackere, 2007; Van Gelderen et al., 2005). Experimental strategies aim to accumulate insights by iterating business models based on market feedback; they are also considered as an appropriate means to overcome resource constraints, which are prevalent in entrepreneurial environments (Alvarez & Busenitz, 2007; Sarasvathy & Dew, 2005). Entrepreneurs have been shown to draw on experimental strategies to iteratively improve their business models and novel products. Through experimentation, they aim to gradually cope with and leverage

uncertainty to their own advantage. This suggests that entrepreneurs, when they perceive high uncertainty, may engage in experimental strategies as they expect that the respective experimental actions generate experiences that allow them to update their subjective stock of knowledge and overcome the uncertainty that they perceive. In sum, we come to the following hypothesis:

Hypothesis 1:	*With higher perceptions of uncertainty, entrepreneurs are a) less likely to engage in uncertainty-ignorant actions, b) more likely to engage in analytical strategies, and c) more likely to engage in experimental strategies.*

1.3.2 The Pathways from Uncertainty to Action Strategies – Inhibitory Emotions and Activating Cognitions

The above reasoning suggests entrepreneurs respond to uncertainty with different action strategies, proposing that more uncertainty reduces ignorant actions, while stimulating analytical and experimental strategies. In order to understand when and why these different action strategies are utilized, we draw on action regulation theory (Zacher & Frese, 2018) and elaborate on two specific mechanisms – inhibitory emotions and activating cognitions – that likely determine entrepreneurs' action strategy choices (Frese & Gielnik, 2014; Ott et al., 2017).

Under uncertainty, new information can come up at any time and indicate that an approach or business model is no longer appropriate. That way, uncertainty calls into question the rewards and potential success of entrepreneurs' effortful goal-directed action, and thus jeopardizes the success of their business. Therefore, uncertainty signals a threat to the entrepreneur's approach and success. Perceiving uncertainty as a potential threat likely induces experiences of inhibitory emotions such as doubt and anxiety in entrepreneurs (Kautonen et al., 2015; McMullen & Shepherd, 2006).

Moreover, action regulation theory suggests that uncertainty triggers activating cognitions as a reaction to uncertainty. Uncertainty increases attention such that experiencing uncertainty is accompanied by numerous plausible interpretations of the situation and leads to a cognitive conflict, which disrupts automatic processing and fosters increased conscious cognitive elaboration of the situation and task at hand (Hirsh et al., 2012). Additionally, uncertainty makes salient that the desired goal has not (yet) been achieved and may not be achievable with the current approach. It interferes with established assumptions and signals that the current approach may need to be re-appraised and adjusted to be effective (Sitkin, 1992). Considering that uncertainty poses a threat and increases information processing, we assume that perceiving uncertainty triggers (a) inhibitory emotions (i.e., feelings of doubt and anxiety) and (b) activating cognitions (i.e., thoughts on reducing uncertainty).

Hypothesis 2: *Perceived uncertainty triggers (a) inhibitory emotions (i.e., doubt and anxiety), and (b) activating cognitions (i.e., thoughts on reducing the uncertainty).*

Inhibitory Emotions and Action Strategies. We argue inhibitory emotions make ignorant actions less likely. When entrepreneurs experience inhibitory emotions stemming from the perception of uncertainty, this emotional experience triggers a heightened sense of vulnerability and a focus on potential threats (DeYoung, 2015). The salience of vulnerability and potential threats likely comes along with a higher alertness and with a need to explore the situation, control the uncertainty, and prevent potential negative outcomes (Baas et al., 2011; Schmitt et al., 2017). Although ignoring the uncertainty could potentially reduce doubts and anxiety, such ignorant actions provide only temporary comfort and a false sense of security (Lipshitz & Strauss, 1997). Entrepreneurs most likely are well aware that ignoring information on threats and adversity can seriously harm their business. Due to the salience of potential threats, they probably are unable to remain ignorant in a way that would allow them

to settle on one approach and suppress distractions. They likely would still ponder that ignorant actions could prevent timely and effective strategic responses (Lipshitz & Strauss, 1997; Matlin & Stang, 1978) or that holding on to their current business model despite dynamic changes in the environment could consume scarce resources with no returns. Therefore, we expect that the more inhibitory emotions, i.e., doubt and anxiety, entrepreneurs experience, the less likely they are to ignore the uncertainty.

Hypothesis 3a:	*The higher the level of inhibitory emotions, the less likely entrepreneurs engage in uncertainty-ignorant actions.*

When entrepreneurs experience inhibitory emotions due to uncertainty, they will aim to reduce uncertainty. To avoid assertively venturing into the unknown (Lipshitz & Strauss, 1997), they are likely to postpone decisions on whether and how to change their course of action (McMullen & Shepherd, 2006; Yates & Stone, 1992) until they have a better understanding of the situation. To get to this understanding, they may analyze the uncertain situation and search for indications of how to proceed (Laureiro-Martinez et al., 2010; Laureiro-Martinez et al., 2015; March, 1991). Indeed, entrepreneurs perceiving a situation as uncertain and potentially adverse have been shown to allocate resources to tasks for which return-on-invest is backed by prior experience, rather than to activities with uncertain outcomes (Markman et al., 2005). Accordingly, entrepreneurs' inhibitory emotions such as doubt and anxiety may trigger a focus on information search and situational analysis, which they hope will give them guidance, justification, and confidence for their actions (Wood et al., 1990). Therefore, we expect that the more inhibitory emotions, i.e., doubt and anxiety, entrepreneurs experience, the more likely they are to engage in analytical strategies.

Hypothesis 3b:	*The higher the level of inhibitory emotions, the more likely entrepreneurs engage in analytical strategies.*

Inhibitory emotions draw attention to potential negative consequences resulting from uncertainty and distract from possibilities for immediate action (McMullen & Shepherd, 2006; Shepherd & Cardon, 2009). Therefore, when experiencing doubt and anxiety, entrepreneurs may feel blocked from embracing uncertainty through experimental actions. Experimental strategies address uncertainty through proactive actions and by iteratively developing the business model based on their experiences and market feedback (Andries et al., 2013; Andries & Debackere, 2007; Gruber et al., 2008). Gathering experiences and feedback includes the risk of negative experiences, getting negative customer feedback, and detecting unforeseen product development problems (e.g., Eisenhardt & Tabrizi, 1995), which could harm their self-confidence to continue the business (e.g., Howell, 2021). Entrepreneurs already experiencing strong inhibitory emotions are likely to shy away from such potentially uncomfortable insights. Therefore, even though experimental actions are considered as an appropriate action strategy to gain control over uncertainty (e.g., Blank et al., 2013; Camuffo et al., 2019; Ries, 2011), we expect that experiencing doubts and anxiety leads entrepreneurs to minimize negative consequences and potential setbacks, and hence to refrain from experimental strategies. Accordingly, we assume the following:

Hypothesis 3c:	*The higher the level of inhibitory emotions, the less likely entrepreneurs engage in experimental strategies.*

Activating Cognitions and Action Strategies. In addition to inhibitory emotions, which generally paralyze immediate action, we expect that uncertainty perception leads to activating cognitions, i.e., intense thoughts about how to reduce uncertainty. According to

action regulation theory (Zacher & Frese, 2018), uncertainty triggers thoughts focused on identifying possible alternative approaches to adapt the course of action and avoid emerging problems (Frese & Keith, 2015; Funken et al., 2020; Schmitt et al., 2017).

When entrepreneurs think about how to reduce uncertainty, they likely consider the potential threats and opportunities that may result from the uncertain situation. They seek for more information and understanding of the uncertainty and its effects. Thus, entrepreneurs who intensely think about how to reduce uncertainty are unlikely to ignore the uncertainty and potential threats. They likely are aware that engaging with the uncertain situation enables them to discover new opportunities inherent in uncertain environments. Therefore, we expect that the more entrepreneurs experience activating cognitions, i.e., intense thoughts about how to reduce uncertainty, the less likely they are to simply ignore the uncertainty they perceive.

Hypothesis 4a:	*The stronger entrepreneurs' activating cognitions, the less likely entrepreneurs engage in uncertainty-ignorant actions.*

We further hypothesize that entrepreneurs' activating cognitions enhance thoughtful situation analysis and prediction efforts (Avnet & Higgins, 2003; Wiltbank et al. 2006; Zenger, 2015). Their intense thoughts likely draw their attention to prior assumptions about their environment and management, leading them to re-evaluate their perspective and reorient themselves in the pursuit of new opportunities (Frese & Zapf, 1984; Johnson et al. 2006; Zacher & Frese, 2018). To inform their evaluation, they may tend to analyze the ever-changing situation (Brinckmann et al., 2010; Galbraith, 1973; Mintzberg & Waters, 1985). Their cognitive processing of the uncertainty likely makes them realize that they need more information and understanding, i.e., that they may benefit from analyzing the uncertain situation and developing an action plan. Therefore, we expect that the more entrepreneurs

perceive activating cognitions, i.e., intense thoughts about how to reduce uncertainty, the more likely they are to engage in analytical strategies.

Hypothesis 4b:	*The stronger entrepreneurs' activating cognitions, the more likely entrepreneurs engage in analytical strategies.*

Further, we expect that entrepreneurs' activating cognitions push them to take concrete actions and to actively and immediately develop an approach to address the uncertainty. Thinking about how to address the uncertainty, entrepreneurs feel that they require more information and experiences with the uncertain situation to better understand potential courses of action. They thus may feel an urge to experiment and learn from experiences, which could help them generate new insights and perform well in the future. With activating cognition, entrepreneurs may recognize the potential of taking incremental actions, which may allow them to engage with, overcome, and leverage uncertainty to their own advantage (Chandler et al., 2011; Sarasvathy, 2001). Accordingly, entrepreneurs' activating cognitive reactions likely push them to embrace and control the uncertainty through experimentation (Andries et al., 2013; Andries & Debackere, 2007). Therefore, we expect that the more entrepreneurs experience activating cognitions, i.e., intense thoughts about how to reduce uncertainty, the more likely they are to engage in experimental strategies.

Hypothesis 4c:	*The stronger entrepreneurs' activating cognitions, the more likely entrepreneurs engage in experimental strategies.*

1.3.3 The Moderating Role of Uncertainty Preferences

Cognitions are generally more controllable than emotions (Breckler & Wiggins, 1989; Lavine et al., 1998; Zajonc, 1980). Therefore, while we assume that inhibitory emotions

generally paralyze entrepreneurial actions, independent of individual preferences, we suggest that activating cognitions, in the form of intense thoughts about reducing uncertainty, can lead to different action strategies depending on entrepreneurs' individual predisposition (Frese, 2009; Frese & Gielnik, 2014). When intensely thinking about reducing uncertainty, some may tend to make quicker decisions than others, and some may increase their alertness and persistence more than others (Baas et al., 2011).

Entrepreneurs with a low uncertainty preference are particularly uncomfortable with uncertainty (Griffin & Grote, 2020). When they think about reducing uncertainty, they may want either to avoid the uncertain situation and its inherent threats, or engage in careful analyses, trying to forecast the situation and figure out how to reduce the uncertainty before engaging in any action. Entrepreneurs with a low uncertainty preference may therefore tend to ignore the uncertainty or focus on analyzing the situation without taking concrete actions. In contrast, entrepreneurs with a high uncertainty preference are more likely to keep a "cool head" under uncertainty, and perceive uncertainty as an exciting challenge (Griffin & Grote, 2020). Therefore, they can better process the unpleasant thoughts related to the uncertainty, making them less likely to ignore or over-analyze their uncertainty-related thoughts – but instead engage with them. Entrepreneurs with a high uncertainty preference likely find it easier to rationally evaluate uncertainty and thus consider potentially negative and business-damaging consequences. They are more likely than those with a lower uncertainty preference to actively engage with the uncertainty and thus to engage in experimental strategies. We therefore expect that entrepreneurs with a high uncertainty preference are less likely to ignore the uncertainty or focus on (over-)analyzing, but instead more likely to respond by engaging in experimental strategies.

Hypothesis 5:	*Entrepreneurs' uncertainty preference moderates the effects of their activating cognitions such that, for entrepreneurs with higher uncertainty preferences, activating cognitions have (a) an even stronger negative effect on engaging in uncertainty-ignorant actions, (b) a weaker positive effect on engaging in analytical strategies, and (c) an even stronger positive effect on engaging in experimental strategies.*

1.4 METHODOLOGY

To rigorously test our hypotheses, we followed recent recommendations in the entrepreneurship literature (Hsu et al., 2017) and designed two complementary empirical studies – a field study and a scenario-based vignette experiment. The field study (Study 1) enables us to test the relationships between perceived uncertainty and entrepreneurs' pursued action strategies in a real-life setting, which promotes ecological validity (Grégoire et al., 2019). Moreover, with this approach we can empirically validate the three action strategies in a first step, helping us to secure discriminant and convergent validity among our main dependent variables. These insights also inform the design choices for our second study – the experiment. Study 2, the scenario-based vignette experiment allows us to produce strong tests of the causal mechanisms that we propose in our theorizing (Aguinis & Bradley, 2014; Hsu et al., 2017). Further, vignette studies can rule out potential biases, e.g., self-report biases, that survey data can be prone to (Podsakoff et al., 2003; Podsakoff et al., 2012) and limit potential threats of endogeneity (Anderson, 2022). By manipulating uncertainty, we can test how changes in uncertainty drive the proposed mechanisms and how entrepreneurs' uncertainty preferences moderate these effects. While a scenario-based approach is assumed to have limitations in ecological validity, it is a strong design to elevate internal validity and to test

causal assumptions. Thus, by combining both studies we can use the individual strengths of both approaches and balance their respective weaknesses.

1.5 STUDY 1 – FIELD STUDY

1.5.1 Sample

Our sample for Study 1 consists of German entrepreneurs that we searched for and contacted via the professional social network LinkedIn. We first contacted 746 entrepreneurs who met our inclusion criteria – being a (co-)founder of companies that were either registered or had participated in an incubation/acceleration program – and invited them to our study. Of those, we received 209 responses (response rate 28%), with 149 participants answering the survey completely. After controlling for careless responses using the careless-package in R (Curran, 2016), we ended up with a final sample size of 134 entrepreneurs who were on average 30.7 years old, with 17.3% being female. On average, the entrepreneurs had 3.76 years (SD = 0.42) entrepreneurial experience in leading their firms, and the firms had a median firm size of 2 employees. Most participants (79.1%) had either completed a vocational training or received a university degree. 68.9% of the enterprises operated in the services sector, 17.6% in manufacturing, and 13.4% were commercial trade companies. To evaluate a potential non-response bias (Armstrong & Overton, 1977; Scheaf et al., 2022), we compared the information (gender, education) obtained from participants' LinkedIn profiles and found no significant differences across respondents and non-respondents. Additionally, we compared answers from entrepreneurs whose answers we received as the first 10% versus the last 10% of responders (Armstrong & Overton, 1977; Haeussler & Colyvas, 2011). Answers did not significantly differ for any of the variables of interest: uncertainty perception (mean difference = 0.80; T[27] = 1.92; $p > .05$), ignorant actions (mean difference = -0.57; T[27] = -1.22; $p > .10$), analytical strategies (mean difference = 0.25; T[27] = 0.75; $p > .10$), and experimental strategies (mean difference = -0.33; T[27] = -1.11; $p > .10$).

1.5.2 Measures

All items in Study 1 were translated from English into German using a double back-translation procedure recommended by Brislin (1980) involving two native English and German speakers (Schaffer & Riordan, 2003). To check for comprehension of our survey, we conducted a pre-test with two entrepreneurs.

Independent Variable - Uncertainty Perception. Drawing from previous studies on entrepreneurs' perceptions of uncertainty (McKelvie et al., 2011; Schmitt et al., 2017), we employed two items to measure entrepreneurs' perceptions of uncertainty, which are grounded in Milliken's (1987) distinction between state and effect uncertainty concerning the unpredictable and dynamic entrepreneurial environment (Packard et al., 2017). The two items refer to different environmental elements and are operationalized as indicators of general uncertainty perception, while their common theme is that they refer to the lack of predictability of the business environment, and its associated effects (McKelvie et al., 2011). A composite measure was constructed by combining both items, demonstrating satisfactory internal consistency (Cronbach's $\alpha = .69$). The items were related to perceptions over the past 2-3 weeks. The sample items for uncertainty perception were "I perceive a lot of uncertainty at work in my business", and "I am very uncertain about how future changes in the market will affect my start-up project". Both items were evaluated on a 7-point Likert scale from "fully disagree" to "fully agree".

Dependent Variables - Entrepreneurial Action Strategies. To measure how far entrepreneurs are ignorant, or engage in analytical and experimental strategies, we derived three items for each action type from the previous entrepreneurship literature. While entrepreneurs likely tend to one action more than the others, we assume that the chosen actions reflect a large part of the entrepreneurial repertoire of actions under uncertainty (Ott et al., 2017), but can be used simultaneously in real business practice (Frese et al., 2009).

For measuring ignorant actions, we referred to three items of the “suppression of competing activities” scale in the COPE inventory (Carver 1997; Carver & Scheier, 1989). In selecting our items, we followed Carver's (1997) brief measurement criteria, akin to short measurements in related studies (e.g., Knoll et al., 2005; Zacher et al., 2021). We selected at least two items that had a high loading on the corresponding factor in the original factor analyses and that had high face validity and were easy to communicate for our research audience (Carver et al., 1989). We modified the items such that they had a strong reference to perceived uncertainty and measured to what extent the entrepreneurs suppress competing information and activities in order to stay with their envisioned course of action. For instance, we modified the original item "I keep myself from getting distracted by other thoughts or activities.“ to " We (or I) do not allow ourselves to be distracted from the current course and continue to offer the originally conceived product/service.“. The Cronbach’s α for the ignorant actions composite was .75.

Following Futterer et al. (2018), we measured the analytical strategies of entrepreneurs by selecting and modifying three formative items of the "competitive market analyses" inventory in the causation battery of Brettel et al. (2012). Similar to prior research (e.g., Futterer et al., 2018; Smolka et al., 2018), our approach centers on inventory items pertinent to our research context, while avoiding tautological items that offer minimal value to the measurement. For example, we modified the original item " We analyzed long run opportunities and selected what we thought would provide the best returns" to " We (or I) analyzed long-term opportunities and selected what we believed would provide the best returns.“. Due to a poor factor loading, we had to drop one item (see Appendix A-1). The Cronbach’s α for the analytical strategy composite was .68.

In accordance with Smolka et al. (2018), we measured the experimental strategy with three adapted formative items of the Chandler et al. (2011) experimentation inventory, while excluding the fourth reverse-phrased item in order to avoid measurement issues. In line with

definitions of experimentation (Camuffo et al., 2019; Sarasvathy, 2001; Wiltbank et al., 2006), we adapted the items such that they had a strong reference to perceived uncertainty and measured to what extent the entrepreneurs continuously reiterated their products/services according to market feedback. For example, we modified the original item "We experimented with different products and/or business models" into "To deal with uncertainty, we (or I) experiment with different products and/or business models in the process." The Cronbach's α for the experimental strategy composite was .74.

Control Variables. Besides entrepreneurs' gender (coded 1 = male, 2 = female), we measured individual characteristics of entrepreneurs that may potentially affect their decision-making, i.e., their age, education, and entrepreneurial experience (assessed in months). Moreover, we assessed characteristics of their firms that indicate their daily decision situations, i.e., firm age (years of operation) and the industry of operation (services, manufacturing or commercial trade). Finally, we used two items (e.g., "My approach helps me to reduce the uncertainties in my business activities.") to control for the uncertainty reduction perceived by the entrepreneurs through their engagement in the action strategies (Cronbach's α = .89).

Measurement Validation. To validate our measurements, we conducted multiple confirmatory factor analyses (CFAs). We tested a five-factor model, showing an acceptable model fit (χ^2 (df) = 81.35 (55); $p < .05$; *CFI* = .95; TLI = 0.93; *RMSEA* = .06; *SRMR* = .072). The model comprised following variables as latent factors: *uncertainty perception*, *ignorant action*, *analytical strategy*, *experimental strategy* and *perceived uncertainty reduction*. We excluded one item from the *analytical strategies* scale from our subsequent analysis due to an unacceptable factor loading below < .50 (Hair et al., 2019). A second five-factor CFA was then conducted without this item, showing an improved model fit (χ^2 (df) = 57.74 (44); p = .08; *CFI* = .97; TLI = 0.96; *RMSEA* = .048; *SRMR* = .06). In order to confirm the absence of superior-fitting models, we performed several additional CFAs with variations in variable

structure and quantity. The findings indicated that none of the alternative models demonstrated a better fit compared to the second five-factor model (items and reliabilities of the final measures are outlined in Appendix A-1). Next, we employed the two-step discriminant validity approach proposed by Rönkkö and Cho (2022) to evaluate potential threats to the validity of our study arising from overlaps between the measured action strategies. The results indicate that the factors are all statistically distinct from each other, which supports the empirical validity and distinctiveness of our action strategies.

1.5.3 Results Study 1

Table 1-1 presents the descriptive statistics and correlations for Study 1. While ignorant actions correlate negatively with uncertainty perception (r = -.25, p < .01). No significant correlations were observed between uncertainty perception and the engagement in analytical strategies (r = .02, ns) and experimental strategies (r = .16, ns). None of the correlations was extremely high, thus, there appears to be no major risk of multicollinearity (Anderson et al., 2018).

Table 1-1: Means, standard deviations, and correlations of Study 1 (field study)

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
1. Uncertainty perception	3.42	1.35										
2. Ignorant action	4.51	1.19	-.25**									
3. Analytical strategy	5.36	0.90	.02	-.01								
4. Experimental strategy	5.26	1.06	.16	-.25**	.38**							
5. Entrepreneurial experience	3.76	4.85	-.12	.16	.06	.11						
6. Entrepreneur-ship education	-	-	-.24**	.10	.03	.10	.12					
7. Firm size	6.04	8.51	-.12	.26**	-.02	.04	.15	.02				
8. Industry	-	-	.01	-.23*	.12	.08	-.07	-.02	-.04			
9. Age	30.72	7.75	-.10	.05	.04	.09	.17	.23**	.08	-.04		
10. Gender	-	-	.13	-.14	-.09	.13	.02	-.00	-.06	.12	-.03	
11. Perceived uncertainty reduction	5.28	0.98	-.26**	.22*	.44**	.29**	.13	.14	.23**	.03	.23**	-.15

***Note*: $N = 134$. *M* and *SD* are used to represent mean and standard deviation, respectively. * Correlation is significant at the $p < .05$ level (2-tailed), ** Correlation is significant at the $p < .01$ level (2-tailed), *** Correlation is significant at the $p < .001$ level (2-tailed).

To test our hypotheses on the direct effects (H1a-H1c), we specified linear regression models for each action strategy. Table 1-2 presents the results for the respective regression models. We observed that entrepreneurs with higher perceptions of uncertainty are less likely to engage in uncertainty-ignorant actions (B = -.19, SE = 0.08, p < .05), yielding support for hypothesis H1a. We found no significant effects for perceived uncertainty on the engagement in analytical strategies (B = .02, SE= 0.06, ns), yielding no support for hypothesis H1b. Finally, testing H1c, consistently with our expectations, we observed that entrepreneurs with higher perceptions of uncertainty are more likely to engage in experimental strategies (B = .17, SE = 0.07, p < .05).

Table 1-2: Linear regression models of Study 1 (field study)

	Model 1 Ignorant actions			**Model 2 Analytical strategy**			**Model 3 Experimental strategy**		
Variable	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
(Intercept)	6.271	0.783	<.001***	4.860	0.662	<.001***	3.370	0.744	<.001***
Uncertainty perception	-0.193	0.082	.020*	0.027	0.069	.689	0.170	0.078	.031*
Entrepreneur-ship education	0.071	0.238	.763	-0.029	0.201	.885	0.215	0.226	.344
Entrepreneurial experience	0.028	0.028	.321	0.023	0.023	.337	0.030	0.026	.265
Age	-0.007	0.015	.643	0.007	0.013	.543	0.005	0.014	.072
Gender	-0.251	0.296	.399	-0.329	0.250	.192	0.287	0.281	.310
Firm size	0.024	0.012	.053	-0.003	0.010	.773	0.012	0.012	.318
Industry	-0.513	0.193	.009**	0.258	0.163	0.117	0.192	0.184	0.297
R^2	0.190			0.043			0.083		

***Note*:** $N = 134$. B = unstandardized regression coefficients; SE = standard errors. * B is significant at the $p < .05$ level, ** B is significant at the $p < .01$ level, *** B is significant at the $p < .001$ level. For all models we use linear regression models employing the lm function in R.

Robustness Checks. We further performed robustness checks by specifying the model with various control variables and alternative specifications, and our results remained consistent and stable. To reduce the threat of endogeneity and potential reversed causality bias, we followed the suggested residual correlation test procedure suggested by Antonakis et al. (2010). Firstly, we conducted a regression of the endogenous variable on our controls as instruments (instrumental variable model). Subsequently, we calculated our model as outlined in our hypotheses testing section. Finally, we assessed the significance of the correlation between the residuals derived from the instrumental variable model and the linear regression. These analyses showed no significant correlations between the residuals of our models and suggest that endogeneity and common method variance were not responsible for our results. However, to further support causal relationships as hypothesized in our theoretical model, we conducted an experiment (Study 2).

1.6 STUDY 2 - SCENARIO-BASED VIGNETTE EXPERIMENT

Study 2 is a scenario-based vignette experiment investigating the effects of uncertainty on entrepreneurs' emotional and cognitive reactions as mediators of subsequent action strategies, and the role of their uncertainty preferences. In such, we can retest hypotheses H1a-H1c and test the remaining hypotheses.

1.6.1 Sample

To collect data for Study 2, we re-contacted the 134 participants from Study 1 and identified additional 267 entrepreneurs using their public profiles on LinkedIn, applying the same inclusion criteria as in Study 1. After two reminders, 154 entrepreneurs participated, of which 119 participants completed the experiment. After conducting a careless-response

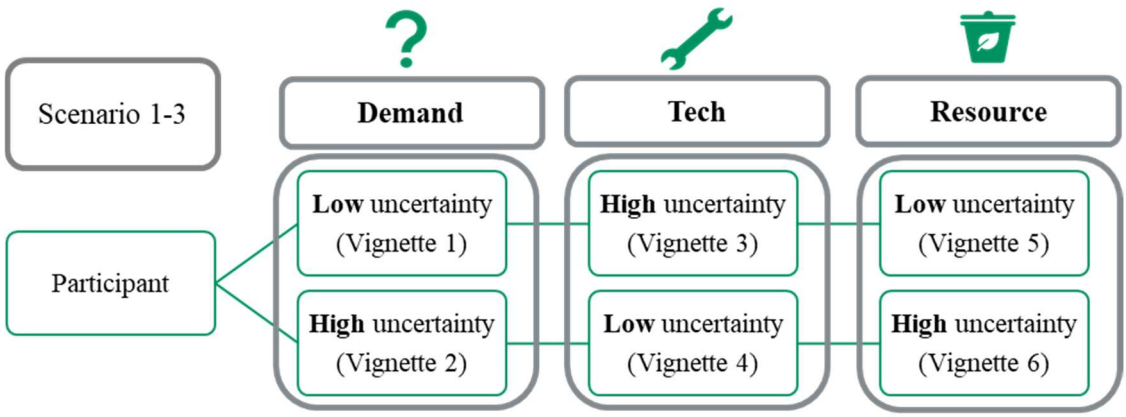
analysis (Curran, 2016) as in Study 1, we ended up with complete responses from 102 entrepreneurs in Study 2. 54.9% of the included participants in Study 2 ($N = 56$) also participated in Study 1. To control for a potential selection bias in the sampling strategy, we created a dummy variable for the participant IDs with dual participation and included this as a control variable in all calculations. The effect of dual participation was not significant across all calculations and the effect sizes of the hypothesis tests remained stable. On average, participants were 31.4 years old, with 22.5% being female. On average, the entrepreneurs had 27.4 months of entrepreneurial experience ($SD = 26.11$) and their firms had a median firm size of 3 employees. With 90.2%, most participants had either completed a vocational training or received a university degree. 56.9% of the enterprises operated in the services sector, 22.5% in manufacturing, and 20.6% were commercial trade companies. Again, to evaluate non-response bias (Armstrong & Overton, 1977; Scheaf et al., 2022), we compared the information (gender, education) obtained from their LinkedIn profiles and found no significant differences across respondents and non-respondents indicating that non-response bias is not a major threat. Moreover, we compared answers from entrepreneurs whose answers we received as the first 10% versus the last 10% of responders (Armstrong & Overton, 1977; Haeussler & Colyvas, 2011). Answers did not significantly differ for any of the variables of interest: uncertainty preference (mean difference = 0.31; T[19] = 0.79; $p > .10$), uncertainty perception (mean difference = 0.31; T[19] = -1.49; $p > .10$), activating cognitions (mean difference = -0.01; T[19] = -0.02; $p > .10$), inhibitory emotions (mean difference = -0.28; T[19] = -0.69; $p > .10$), ignorant actions (mean difference = 25.41; T[19] = 2.09; $p > .05$), analytical strategies (mean difference = -10.86; T[19] = 1.80; $p > .05$), and experimental strategies (mean difference = -14.54; T[19] = -1.08; $p > .10$).

1.6.2 Experimental Design

We chose a randomized cross-over design (Jones & Kenward, 2014) to examine the impact of different levels of uncertainty on entrepreneurs' psychological reactions and action responses. The study involved 6 vignettes, each describing a hypothetical entrepreneurial opportunity characterized by the most typical sources of uncertainty in entrepreneurship (Castrogiovanni, 1991; McKelvie et al., 2011; Rosenbusch et al., 2013): changes in market demand or customer interest (demand uncertainty; Chen et al., 2005), changes in technology (technological uncertainty; Song & Montoya-Weiss, 2001), and changes in the competitive landscape for limited resources (resource uncertainty; Castrogiovanni, 1991).

The participants were randomly assigned to two fixed sequences of vignettes, each including alternating levels of manipulated uncertainty: "uncertainty = low" (coded as 1) and "uncertainty = high" (coded as 2). They were either assigned to sequence 1 with the vignettes 1 (demand condition/low uncertainty), 4 (technology condition/high uncertainty), and 5 (resource condition/low uncertainty) or to sequence 2 with the vignettes 2 (demand condition/high uncertainty), 3 (technology condition/low uncertainty) and 6 (resource condition/high uncertainty) (see Figure 1-2).

Figure 1-2: Experimental procedure of the scenario-based vignette study



This design allowed us to compare responses between groups without requiring each participant to experience every combination of conditions (Ratkowsky et al., 1992, p. 122). Thus, we were able to achieve a high number of observations per participant while avoiding participation fatigue due to a large sequence of identical scenarios, which can lead to difficulties in data quality and collection (such as high dropout rates or careless responses) (Tourangeau & Rasinki, 1988). Moreover, the alternating scenarios with reverse manipulation and changed type of uncertainty source within each sequence allowed us to minimize sequence-related biases (such as possible order effects or carry-over effects between scenarios), while all participants experienced both high and low uncertainty conditions within their assigned sequences (Cook et al., 2002, p. 109).

In each scenario, participants were instructed to imagine they were starting a business developing an innovative product using a novel, sustainable and cost-saving production process. Each vignette provided uncertainty-inducing information specific to the manipulated type of uncertainty (demand, technology, and resource) and varied in the level of uncertainty (low vs. high uncertainty). In the demand uncertainty condition, participants received a market trends report indicating potential changes in T-shirt demand. In the technological uncertainty condition, they received forecasts about new technological developments in the beverage industry that potentially introduce new competition. In the resource uncertainty condition, participants received information about the entry of international competitors into the packaging market. For low uncertainty conditions, the information suggested moderate changes to the status quo, implying low uncertainty. For high uncertainty conditions, the information indicated significant changes, implying high uncertainty. After reading each scenario, participants were instructed to report their perceived uncertainty, their doubt/anxiety, thoughts about reducing uncertainty, and their action strategies. An example vignette can be found in Appendix B-1. We measured the perceived uncertainty in every

scenario using the same instrument as in Study 1 to conduct manipulation checks. Results of pairwise t-tests for all conditions (e.g., $t(88) = -4.31$, $p < .001$ for high vs. low uncertainty treatment in the demand condition) and a Two-Way ANOVA ($F(1, 300) = 122.56$, $p < .001$) suggested that the manipulations worked as intended.

Moreover, to ensure ecological validity (Grégoire et al., 2019), we pre-tested our study design with 10 entrepreneurship students using a thinking-aloud approach to ensure that the scenarios and manipulated variables are well understood (Ericsson & Simon, 1993; Volkmer et al., 2024). In addition, we consulted with several experts in psychological experiments and research on entrepreneurial action to increase the validity of our manipulated scenarios and the overall soundness of our design.

1.6.3 Measures

All items of the survey questions and the vignette experiment were translated into German using the same back-translation procedure as in Study 1 (Brislin, 1980).

Uncertainty Preference. We measured the participant's uncertainty preference (before they entered the scenario) by adapting the 11-item intolerance for uncertainty scale of Carleton et al. (2007). The items focus on the experience of motivation and excitement when perceiving uncertainty, since uncertainty not only results in active defense and passive avoidance responses, but also increases action motivation to obtain uncertain rewards (Gray & McNaughton, 2000; Quilty et al., 2014). For example, we modified the original item "I always want to know what the future has in store for me." into "I find it exciting not yet knowing what the future has in store for me." to capture the preference for uncertainty that leads entrepreneurs to consciously embrace rather than avoid uncertainty. Participants answered these statements on a 7-point Likert scale from "fully disagree" to "fully agree". The Cronbach's α for the uncertainty preference scale was .78.

Inhibitory Emotions and Activating Cognitions. We asked the participants to rate their inhibitory emotions regarding the uncertain situation. Based on the measurement of momentary emotion (i.e., emotions experienced at that moment) by Podoynitsyna et al. (2012), participants indicated on a 5-point Likert scale to what extent they felt "anxious" and "doubtful". Similar to other studies on the role emotions in entrepreneurial decision-making (Foo, 2011; Podoynitsyna et al. 2012), we followed an emotion-centered approach and selected our two inhibitory emotion descriptors from a list of 25 adjectives presented by Smith and Ellsworth (1987; 1985), while we chose to use "doubtful" instead of "confident" to better reflect the inhibitory effects of uncertainty. We then generated a composite measure (α = .76) of these inhibitory emotion components.

To assess entrepreneurs' simultaneous experience of activating cognitions, respectively thoughts on reducing uncertainty, we adapted the two attentional activity items from Smith and Ellsworth's (1987; 1985) cognitive response measure. We adapted both original items so that they are directed rather than open-ended and refer to uncertainty rather than emotions, which we assessed separately. For example, we modified the item: "When you were feeling anxious, to what extent did you try to devote your attention to this thing, or divert your attention from it?" into "I would focus my actions in this situation on achieving more certainty." to assess their thoughts on how to reduce uncertainty. The variable was measured on a 7-point Likert scale from 1 (fully disagree) to 7 (fully agree) and the Cronbach's α was .87.

Engagement in Entrepreneurial Action Strategies. We operationalized participants' engagement in action strategies adapting the action items of Brettel et al. (2012), Carver et al. (1989; 1997), and Chandler et al. (2011). We created single item measures (cf. Wanous et al., 1997) capturing each action (see Appendix B-1). The measurement was operationalized by an allocation of limited resources to the different strategic options, i.e., participants could

indicate how they would allocate their resources (in percent) to ignorant actions, analytical and experimental strategies. This approach has high ecological validity, because entrepreneurs have to engage in a wide array of activities simultaneously, which can have severe opportunity costs in the resources-scarce entrepreneurial environment (Alvarez & Barney, 2005; Alvarez & Busenitz, 2007).

Control Variables. Similar to Study 1, we measured entrepreneurs' age, gender, entrepreneurial education, and entrepreneurial experience (in months) as relevant control variables, which may influence entrepreneurs' decision-making.

Measurement Validation. We evaluated our measured mediators using a confirmatory factor analysis (CFA). Here we treated the two variables, entrepreneurs' inhibitory emotions as well as activating cognitions, as latent factors, reflected by the items outlined above. All fit indices suggest a good model fit (χ^2 (df) = 3.01(1), p = .08; CFI = .99; TLI = 0.97; RMSEA = .08; SRMR = .01). To further examine the discriminant validity of our mediators, we conducted a chi-square difference test (Anderson & Gerbing, 1988). The findings support their discriminant validity, with the chi-square values of the one-factor model significantly exceeding those of the two-factor model.

1.6.4 Results Study 2

Table 1-3 presents the descriptive statistics and correlations for Study 2. A negative correlation was observed between manipulated uncertainty and ignorant actions (r = -.32, p < .000). In contrast, analytical strategies (r = .28, p < .000) and experimental strategies (r = .15, p < .000) correlated positively with manipulated uncertainty. The emotional and the cognitive reactions to uncertainty correlated with the action strategies in the expected direction, while uncertainty preference showed significant correlations with experimental strategies (r = .12, p < .05) and analytical strategies (r = -.11, p < .05). The correlations among the action strategies suggest that there are no multicollinearity problems.

Table 1-3: Means, standard deviations, and correlations of Study 2 (experimental study)

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
1. Uncertainty manipulation	1.53	0.50										
2. Inhibitory emotions	2.21	0.80	.43**									
3. Activating cognitions	4.18	1.57	.38**	.43**								
4. Uncertainty preference	4.52	0.80	-.02	.00	.08							
5. Ignorant action	34.24	25.81	-.32**	-.34**	-.41**	-.03						
6. Analytical strategy	25.71	17.76	.28**	.38**	.39**	-.11*	-.47**					
7. Experimental strategy	40.06	23.42	.15**	.08	.16**	.12*	-.74**	-.24**				
8. Entrepreneurial experience	27.39	26.12	.02	-.08	-.08	-.13*	.10	-.19**	.03			
9. Entrepreneur-ship education	-	-	.02	.08	.03	-.12*	-.03	.08	-.02	.17**		
10. Age	31.42	8.39	.06	-.08	-.01	-.12*	.18**	-.09	-.13*	.14*	-.10	
11. Gender	-	-	.04	.12*	.09	-.07	-.16**	.14*	.07	-.11	.21**	-.09

Note: $N = 134$. *M* and *SD* are used to represent mean and standard deviation, respectively. * Correlation is significant at the $p < .05$ level (2-tailed), ** Correlation is significant at the $p < .01$ level (2-tailed), *** Correlation is significant at the $p < .001$ level (2-tailed).

In Study 2, we used the lme4-package in R to specify mixed regression models and test our hypotheses. This allowed us to account for variation between scenarios as a random effect and analyze all observations effectively, considering the cross-over design. The results provide support for H1a-H1c and suggest that entrepreneurs are less likely to engage in uncertainty-ignorant actions (H1a: B = -.17.48, SE = 2.78, p < .001), more likely to unfold analytical strategies (B = 10.30, SE = 1.91, p < .001), and more likely to engage in experimental strategies (B = 7.02, SE = 2.64, p < .01).

As shown in Table 1-4, we further found that uncertainty triggers inhibitory emotions (anxiety and doubt; B = 0.66, SE = 0.08, p < .001), and activating cognitions (thoughts on reducing the uncertainty; B = 1.22, SE = 0.17, p < .001), yielding support for hypotheses H2a and H2b. Our results further suggest that entrepreneurs with stronger inhibitory emotions are less likely to engage in uncertainty-ignorant actions (B = -4.42, SE = 1.86, p < .05) and more likely to engage in analytical strategies (B = 4.32, SE = 1.07, p < .001), whereas we found no significant direct effect on the engagement in experimental strategies (B = -1.07, SE = 1.85, p = ns). Thus, we find support for H3a and H3b, but not for H3c. Moreover, entrepreneurs with stronger activating cognitions were less likely to engage in uncertainty-ignorant actions (B = -7.57, SE = 1.58, p < .001) and more likely to engage in analytical strategies (B = 4.32, SE = 1.07, p < .001), as well as experimental strategies (B = 3.21, SE = 1.57, p < .05). Hence, hypotheses H4a-H4c receive support.

As shown in Table 1-4, we also observed that entrepreneurs' uncertainty preference negatively moderated the effects of their activating cognitions on ignorant actions (B = -6.23, SE = 2.36, p < .01), lending support for H5a. Simple slope analyses show that the effect of activating cognition becomes insignificant only at very low levels of uncertainty preference. For analytical strategies, no significant moderation effect of uncertainty preference was observed, hence H5b is rejected (B = -1.01, SE = 1.61, p = ns). Consistent with H5c, we found

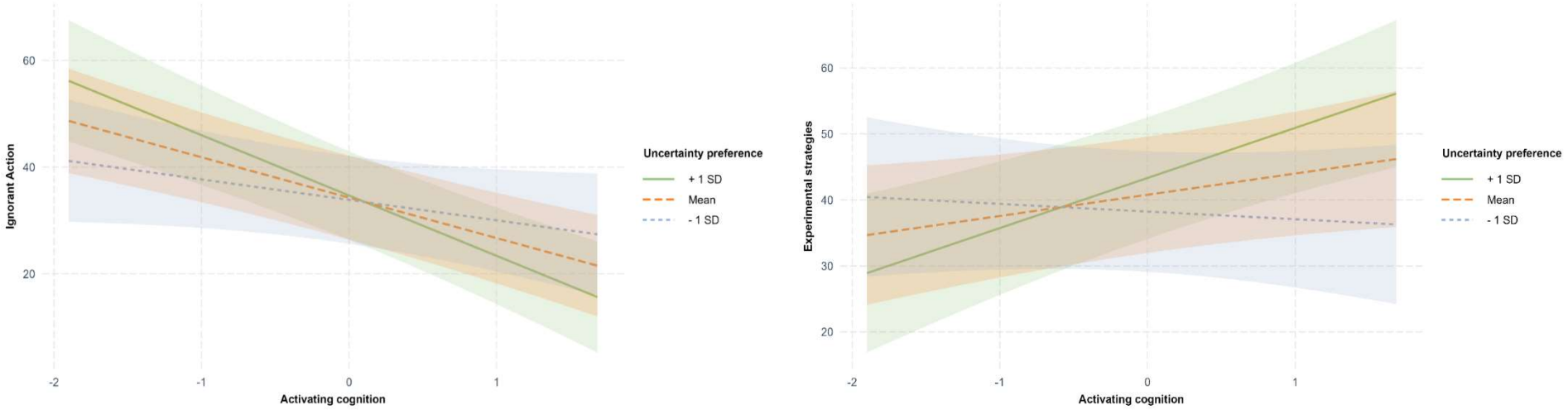
that entrepreneurs' uncertainty preference positively moderated the effect of activating cognitions on experimental strategies ($B = 7.29$, $SE = 2.35$, $p < .01$). Simple slope analyses suggest that the positive effect of activating cognitions on experimental strategies becomes insignificant only at very low levels of uncertainty preference. Figure 1-3 presents the interaction plots and the detailed results of the simple slope tests. To further substantiate our findings, we performed additional robustness checks by specifying the models with (and without) control variables and alternative specifications (e.g., with original and purified scales), and our results remained consistent and stable.

Table 1-4: Mixed regression models of Study 2 (experimental study)

	Model 1 Inhibitory emotions			**Model 2 Activating cognitions**			**Model 3 Ignorant actions**			**Model 4 Analytical strategy**			**Model 5 Experimental strategy**		
Variable	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
(Intercept)	1.586	0.402	<.001***	2.678	0.803	<.001***	47.172	9.826	<.001***	10.636	6.378	.097	42.325	9.996	<.001***
Age	-0.008	0.005	.135	-0.013	0.010	.198	0.533	0.161	.001**	-0.178	0.109	.088	-0.355	0.160	.027*
Gender	0.233	0.109	.033*	0.284	0.218	.193	-6.020	3.287	.068	2.592	2.239	.247	3.425	3.272	.296
Entrepreneur-ship education	0.030	0.097	.757	0.055	0.193	.775	0.135	2.911	.962	2.586	1.982	.193	-2.703	2.897	.351
Entrepreneurial experience	-0.001	0.001	.565	-0.004	0.003	.211	0.055	0.058	.352	-0.149	0.040	<.001***	0.092	0.058	.113
Uncertainty manipulation	0.661	0.085	<.001***	1.220	0.171	<.001***	-9.275	2.940	.001**	3.426	2.001	.088	5.781	2.927	.049*
Inhibitory emotions	-	-	-	-	-	-	-4.429	1.864	.018*	5.486	1.269	<.001***	-1.070	1.855	.564
Activating cognitions	-	-	-	-	-	-	-7.576	1.585	<.001***	4.329	1.079	<.001***	3.215	1.577	.042*
Uncertainty preference	-	-	-	-	-	-	0.682	2.135	.749	-4.919	1.454	<.001***	4.240	2.125	.047*
Activating cognition x Uncertainty preference	-	-	-	-	-	-	-6.236	2.366	.008**	-1.015	1.611	.528	7.296	2.355	.002**
Cond. R^2	0.207			0.181			0.351			0.333			0.203		

***Note*: ** $N = 102$; 276 observations. *B* = unstandardized regression coefficients; *SE* = standard errors. * *B* is significant at the $p < .05$ level, ** *B* is significant at the $p < .01$ level, *** *B* is significant at the $p < .001$ level. For all models we use hierarchical mixed regression models employing the lme4 package in R.

Figure 1-3: Simple slope analyses for interaction effects



***Note*:** 1) The effect of activating cognitions on uncertainty-ignorant actions was significantly negative, when entrepreneurs' preference for uncertainty was + 1 *SD* above the mean (B = -13.91, SE = 1.00, $p < .001$) and around the mean level (B = -7.81, SE = 1.58, $p < .001$), but insignificant - 1 *SD* below the mean level (B = -1.82, SE = 2.19, p = ns). 2) The effect of activating cognitions on experimental strategies was significantly positive when entrepreneurs' preference for uncertainty was + 1 SD above the mean (B = 10.51, SE = 2.23, $p < .001$) and at the mean level (B = 3.36, SE = 1.51, $p < .05$), but insignificant - 1 SD below the mean (B = -3.2, SE = 2.97, p = ns).

1.6.5 Additional Analyses

Even though not part of our main hypotheses testing, we further explored the mediating effects of inhibitory emotions and activating cognitions in additional post-hoc tests. *For ignorant actions*, we observed that only activating cognitions (indirect effect = -5.79, 95%-CI [-6.52, -5.05]) partially mediated the effects of manipulated uncertainty. For the engagement in *analytical strategies*, we also found that only activating cognitions (indirect effect = 3.09, 95%-CI [1.94, 4.25]) partially mediated the effects of manipulated uncertainty. For the engagement in *experimental strategies*, we found a marginal significant mediating effect of inhibitory emotions (indirect effect = -0.56, 95%-CI [-1.20, 0.08]) and a significant mediating effect of activating cognitions (indirect effect = 2.69, 95%-CI [1.25, 4.13]). The detailed results of the moderated mediation analyses can be found in Appendix C-1.

Since both inhibitory emotions and activating cognitions were measured, we followed the suggestions of Antonakis et al. (2010) and applied a two-stage least squares (2-SLS) procedure to reduce the threat of endogeneity. We first predicted entrepreneurs' inhibitory emotions and activating cognitions using our exogenous treatment and then recalculated our mixed regression models using the predicted variables for inhibitory emotions and activating cognitions. The hypothesized effects remained stable. These analyses suggest that endogeneity and common method variance were not responsible for our results.

1.7. DISCUSSION

Our research offers novel insights into how entrepreneurs psychologically react and respond to uncertainty (McKelvie et al., 2011; Packard et al., 2017). Drawing on entrepreneurial action (Frese et al., 2000; Ott et al., 2017; Van Gelderen et al., 2000) and action regulation theory (Frese & Zapf, 1994; Zacher & Frese, 2018), we developed and tested a model of entrepreneurial action under uncertainty. This model disentangles the complementary effects of entrepreneurs' emotional and cognitive reactions in reference to

their uncertainty preference, explaining why entrepreneurs engage in different action strategies under uncertainty.

1.7.1 How Psychological Reactions Determine Action Strategies under Uncertainty

Our examination of entrepreneurs' psychological reactions to uncertainty reveals that inhibitory emotions and activating cognitions involved in uncertainty processing contribute to explaining entrepreneurs' engagement in action strategies. So far, the entrepreneurship literature was unclear about whether uncertainty acts as an undesirable impediment to action and favors overthinking and procrastination (McMullen & Shepherd, 2006), or whether it facilitates entrepreneurial action by signaling the need for increased effort and proactive actions to capitalize on the situation (Baas et al., 2011; Schmitt et al., 2017). Our results indicate that while entrepreneurs perceive inhibitory emotions related to uncertainty that inhibit immediate entrepreneurial actions, they simultaneously experience activating cognitions that nudge them to find a reasonable way to reduce uncertainty and produce unconventional solutions. Specifically, our findings support our theorizing by showing that, overall, uncertainty promotes analytical and experimental strategies while deterring ignorant actions.

Our research expands existing theorizing by introducing a new perspective, focusing on the psychological reactions to uncertainty as central determinants of entrepreneurial action under uncertainty. Illuminating the complementary nature of psychological reactions as determinants of entrepreneurial actions under uncertainty, we find evidence that entrepreneurs process uncertainty in different ways with implications for their actions. In this way, our research clarifies *how* uncertainty influences the efforts of individual entrepreneurs and paves the way for future research on potential psychological drivers and boundary conditions influencing how entrepreneurs respond to uncertainty. That way, our study underscores that uncertainty cannot be positioned only as a stressful contextual element (e.g., Lanivich, 2015; Rauch et al., 2018) that entrepreneurs manage through the application of entrepreneurial

decision logics. To provide a comprehensive understanding of entrepreneurial action under uncertainty, future research needs to acknowledge that psychological processes play a key role.

1.7.2 The Role of Uncertainty Preference as a Boundary Condition

Our study indicates that entrepreneurs' uncertainty preference determines how their activating cognitions related to uncertainty shape their action strategies. More specifically, when thinking about how to reduce uncertainty, entrepreneurs with a high uncertainty preference are more likely to engage in uncertainty-embracing experimental strategies, that emphasize learning by doing and are considered as promising for long-term entrepreneurial success (Andries et al., 2013; Camuffo et al., 2019), than those with a lower uncertainty preference. Probably because they are better able to keep a cool head despite uncertainty, they are less likely to ignore potential threats or over-analyze the situation, but actively engage with the uncertainty.

Previous literature often has conceptualized uncertainty primarily from an uncertainty avoidance perspective (McMullen & Shepherd, 2006), which is too simplistic since entrepreneurs often choose to voluntarily engage in uncertain ventures and are likely to differ in their reactions to uncertainty and subsequent strategies from non-entrepreneurs (Chandler et al. 2011; Griffin & Grote, 2020). Our consideration of uncertainty preferences helps reduce the current disagreement about the relationship between uncertainty and entrepreneurial action, and points to the importance of considering individual differences in uncertainty processing in future research on entrepreneurs responses to uncertainty.

1.7.3 Practical Implications

Research on entrepreneurial action (Alvarez & Barney, 2005; Camuffo et al., 2019; Sarasvathy, 2001; Zenger & Zellweger, 2022) and lean start-up (Blank, 2013; Ries, 2011) suggests experimental strategies as most appropriate and adaptive approach to navigate uncertainty in dynamic start-up environments. Different psychological reactions and

predispositions influence entrepreneurs' action strategy, with some psychological reactions proving more beneficial for business development. Our findings suggest that managing their psychological processes may help entrepreneurs to promote appropriate strategies such as experimentation and avoid detrimental ignorant actions and excessive analytical efforts (Lipshitz & Strauss, 1997). In addition, we show that a high uncertainty preference leads entrepreneurs to adopt promising experimental strategies and avoid ignorant actions that are likely to be detrimental to success. This points to the strong practical relevance of cultivating a preference and positive mindset towards uncertainty (Griffin & Grote, 2020) in the context of entrepreneurship. Overall, our research stimulates the current discussion in entrepreneurship theory and practice to acknowledge both the threats (McMullen & Shepherd, 2006) and opportunities (Griffin & Grote, 2020; Shen et al., 2015; Smith & Lewis, 2011) embedded in uncertainty and paves the way for rethinking already established concepts in entrepreneurial action literature in light of psychological uncertainty processing.

1.7.4 Limitations and Future Directions

Although our multi-study design has several methodological advantages, some limitations exist. In Study 1 (field study), we had to rely on an acceptable yet comparatively small sample size and accept a potential common-method-bias. Nevertheless, Study 1 offered the possibility to validate the entrepreneurial action strategies and to show external validity. Study 2 (experiment) manipulated uncertainty and thus replicated the findings with reduced potential common-method bias, and a better test for causality. While the effects are generally consistent across our two studies, we found the effect of the uncertainty perception on the engagement in analytical strategies only in the model that includes mediation effects through the psychological reactions to uncertainty (Study 2). Since our two studies examined decisions at a single point in time, future longitudinal studies that shed light on temporal dynamics would be useful to better understand how psychological reactions to (changing)

uncertainty and the corresponding decision processes evolve over time (e.g., Jiang & Tornikoski, 2018; Welter & Kim, 2017).

Furthermore, there are other limitations with regard to the scope of the study. For example, as we focused on general uncertainty perception, and thus did not differentiate different kinds of uncertainty, such as state, effect, and response uncertainty (Milliken, 1987), future research is needed to investigate if and under which circumstances these differences matter for entrepreneurial action under uncertainty. Moreover, future research can benefit from investigating further entrepreneurial action strategies, such as asking people for help (e.g., Van Gelderen et al., 2005) to find answers to the unresolved question of under what conditions entrepreneurs pursue further action strategies, which we do not cover in our studies. Moreover, our analysis focused on the moderating effects of uncertainty preference, although there are other psychological traits, such as self-efficacy (e.g., Schmitt et al., 2017), and contextual boundary conditions, such as the availability of support structures and resources (Lanivich, 2015), that can interfere with the reactions to uncertainty and effective action in entrepreneurial environments. Future research is needed to discover further individual and contextual boundary conditions. Lastly, our study focuses on the decision-making of a single entrepreneur. However, it must be taken into account that most decision-making in start-ups take place in teams. Therefore, future research requires to go beyond the individual and to investigate how entrepreneurial teams collaboratively respond to uncertainty and thereby mutually influence each other.

1.8 CONCLUSION

Our results suggest that the engagement in different action strategies in the course of venture development is highly concerned with entrepreneurs' perception and psychological reactions to uncertainty. Interestingly, psychological reactions to uncertainty and the engagement in specific action strategies are co-determined by individual characteristics, such as the uncertainty preferences of entrepreneurs. This can lead to adopting uncertainty-embracing

experimental strategies or remaining focused on analytical efforts to predict potential outcomes. Our study highlights the importance of not only considering uncertainty as a contextual element of entrepreneurship, as has been done in the past, but also focusing on individual reactions to uncertainty and the individual and contextual boundary conditions that co-determine actions under uncertainty in future research. Moreover, this is an important insight for entrepreneurship educators, who should not only teach the most promising strategies for dealing with uncertainty, but also stimulate reflection on how uncertainty preferences (and possibly other boundary conditions) may lead to (in-) appropriate responses, helping entrepreneurs counteract their potentially adverse tendencies. In summary, our study suggests that it is not only the uncertain entrepreneurial environment but also entrepreneurs' uncertainty processing that is critical to entrepreneurial action.

CHAPTER 2[3]

UNDER THE SWORD OF DAMOCLES: HOW SOCIAL CLASS IMPACTS THE PURSUIT OF UNCERTAIN OPPORTUNITIES

Abstract

Entrepreneurship offers a powerful pathway for individuals' social advancement. However, entrepreneurship research provides contradictory views, assuming that belonging to a low social class can be either an obstacle or a driving force for entrepreneurial activity. Drawing on entrepreneurial decision-making literature and the social cognitive theory of social class, we introduce a nuanced perspective on the role of perceived social class as a boundary condition in entrepreneurial decision-making. We test our hypotheses by conducting a metric conjoint experiment in two developed countries with differing economic systems, in the USA (2160 decisions nested within 135 entrepreneurs) and in Germany (1456 decisions nested within 91 entrepreneurs). Our results indicate that entrepreneurs who perceive themselves as belonging to a low social class are more likely to shy away from uncertain opportunities when operating in liberal market economies, but this effect can reverse when operating in coordinated market economies. In this way, we contribute to a better understanding of the ambivalent role of social class in entrepreneurship and help decipher under which conditions belonging to a low social class may be an obstacle or even a catalyst for entrepreneurship.

[3] Chapter two is co-authored by Prof. Dr. Sylvia Hubner-Benz, Prof. Dr. Matthias Baum and Prof. Dr. Zhaoli Song.

2.1 INRODUCTION

Entrepreneurship is recognized as an effective force for overcoming societal challenges and provides disadvantaged individuals with opportunities to combat inequality and advance in society (Bruton et al., 2013; Bruton et al., 2021; McMullen, 2011). However, whether entrepreneurs are willing to exploit opportunities depends on their evaluation of the associated uncertainties, as these can cast doubts on the potential success of a new venture (Davidsson, 2015; McMullen & Shepherd, 2006; Shepherd et al., 2007). Although research suggests that different social class backgrounds can be associated with unequal starting positions and ramifications of business failure, there are ambivalent perspectives on whether and how social class perceptions affect the evaluation and pursuit of uncertain opportunities (Alvarez & Barney, 2014; Bruton et al., 2021; Kish-Gephart et al., 2022).

The perception of social class, defined as the subjective interpretation of available resources such as job opportunities and financial wealth (Loignon & Woehr, 2018), serves as a socio-cognitive framework through which individuals evaluate environmental stimuli (Kish-Gephart et al., 2022; Kraus et al., 2012). From a resource-centered perspective, entrepreneurs from higher social classes should be more inclined to pursue uncertain opportunities, due to the security afforded by their resources, whereas those from lower social classes may be more likely to avoid uncertainty due to resource constraints (Audretsch et al., 2013; Kim et al., 2006; Lim et al., 2016). However, alternative viewpoints suggest that the privileges associated with higher social classes may lead to resource conservation and aversion to uncertainty, while the resource constraints associated with lower social classes may encourage venturing into uncertain futures, driven by a belief in having "less to lose" (Harris et al., 2002; Kish-Gephart, 2017; Kish-Gephart & Campbell, 2015; Lanivich, 2015).

Our research aims to address this puzzle. We suggest that entrepreneurs' perceptions of their social class shape their decision-making under uncertainty, and national economic systems determine whether these social class perceptions encourage or discourage them.

Drawing on entrepreneurial decision-making literature (McMullen & Shepherd, 2006; Osterwalder & Pigneur, 2010), we propose that entrepreneurs' willingness to exploit opportunities hinges on their subjective evaluation of potential success or failure (McMullen & Shepherd, 2006; Shane & Venkataraman, 2000). In this evaluation, they take into account the desirability of the offering (Gruber et al., 2015), the feasibility of the implementation (Dimov, 2010), and the viability of the business, assessed in terms of achievable gains and preventable losses (Keh et al., 2002; Kim et al., 2010; Scheaf et al., 2020). That is, with increasing uncertainty in desirability, feasibility, achievable gains and/or preventable losses, entrepreneurs are generally less likely to pursue an opportunity (McMullen & Shepherd, 2006; Scheaf et al., 2020; Shepherd et al., 2007). We argue that entrepreneurs' perceptions of their social class determine how sensitive they are to uncertainty, shaping the strength of uncertainty effects.

Drawing on the social-cognitive theory of social class (Kraus et al., 2012), entrepreneurs from lower social classes, who have correspondingly fewer resources, may exhibit heightened sensitivity to environmental changes and threats, driven by an external orientation, motivating them to avoid uncertainties associated with entrepreneurship. Conversely, entrepreneurs from higher social classes and correspondingly abundant resources are inclined to adopt an internal orientation, prioritizing internal states, goals, and emotions, thus exhibiting less reservation towards uncertainty inherent in opportunities as a means to achieve their aspirations (Johnson & Krueger, 2005; Lachman & Weaver, 1998).

We acknowledge that the impact of belonging to a low social class varies based on the national economic system in which entrepreneurs operate (Domhoff, 1998; Hacker & Pierson, 2010; Kraus et al., 2012; Phillips, 2002). In nations with a liberal market economy (such as the USA), entrepreneurs more easily profit from venturing successes but similarly face greater social risks due to reduced governmental regulation (Dilli, 2021; Hall & Soskice, 2001). In such environments, entrepreneurs from lower classes may avoid uncertain opportunities to

mitigate severe repercussions, while their higher-class counterparts are enticed by the promise of substantial rewards despite uncertainty. In contrast, in countries with a coordinated market economy (such as Germany), entrepreneurs have stronger social protections and higher social obligations, such as through tax contributions and minimum wages (Dilli, 2021; Hall & Soskice, 2001), reducing the perceived impact of rewards and risks from uncertain ventures. Due to these protections, entrepreneurs from lower classes in those countries may be more willing to pursue opportunities for social advancement, whereas higher-class entrepreneurs may be deterred by uncertain opportunities due to the risk of social demotion and heavier economic regulation burdens on potential gains.

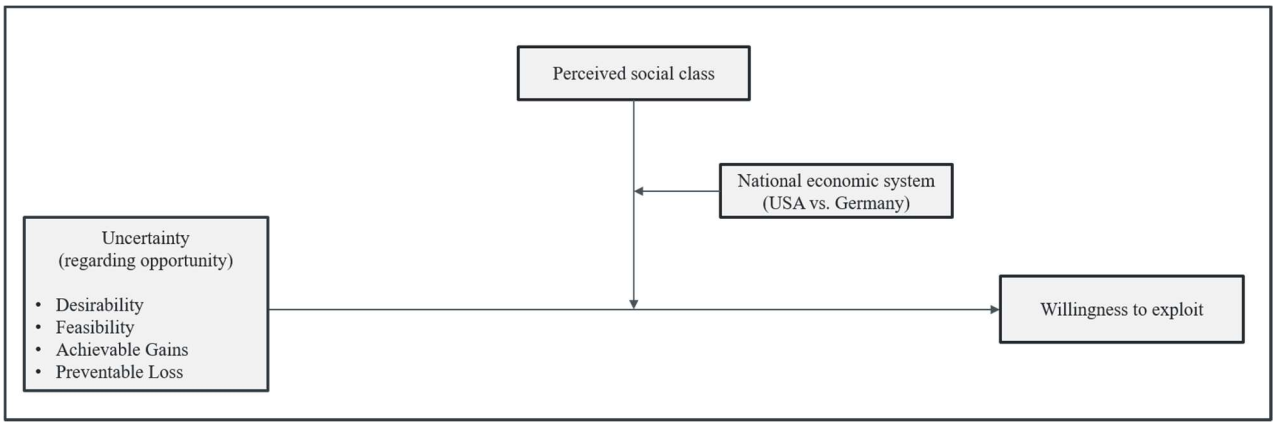
We tested the dependency of uncertainty effects on entrepreneurs' perceptions of social class in two developed countries with different economic systems (liberal vs. coordinated market economy) by conducting the same conjoint experiment in the USA (2160 decisions among 135 entrepreneurs) and in Germany (1456 decisions among 91 entrepreneurs). Specifically, we examined how perceived social class moderates the effect of opportunity uncertainty (regarding the desirability, feasibility, achievable gain and preventable loss) on entrepreneurs' evaluation and exploitation of opportunities – across both countries (refer to the theoretical model in Figure 2-1).

Our research contributes to the entrepreneurship literature in two ways. Firstly, our study contributes to existing social class and entrepreneurship literature by conceptualizing and testing a model that emphasizes the critical role of social class perceptions in shaping entrepreneurs' evaluation and willingness to pursue opportunities. By taking a psychological perspective, we complement previous studies on the consequences of (perceived) social class in entrepreneurship, which tend to focus on labor market or economic perspectives (e.g., Bruton et al, 2021; Frid et al., 2016; Lewellyn, 2018; Perry-Rivers, 2016). Our study illuminates whether and under what circumstances the perception of belonging to a low (vs. high) social class inhibits or drives entrepreneurs' willingness to pursue uncertain

opportunities. This insight is crucial for the field of entrepreneurial decision-making as it uncovers how the social cognitive tendencies associated with different social class perceptions influence actual entrepreneurial decisions, thereby providing a valuable complement to resource-based perspectives, which do not sufficiently explain the conditions under which entrepreneurs of lower social classes pursue uncertain entrepreneurial opportunities.

Secondly, our comparative analysis challenges prevailing assumptions on the role of low social class perceptions in entrepreneurship and introduces cross-national boundary conditions. Contrary to common opinions, our study reveals that entrepreneurs from lower social classes are not inherently less willing to exploit opportunities compared to their higher-class counterparts. By comparing nations with varying economic systems, we demonstrate that belonging to a low social class can even be a driving force behind entrepreneurial action in regulated coordinated market economies. Moreover, our study demonstrates the necessity of considering national differences in understanding social class effects in entrepreneurial decision-making, providing insights for policy-making aimed at fostering inclusive conditions across diverse social backgrounds and national contexts.

Figure 2-1: Theoretical model



2.2 THEORETICAL BACKGROUND

2.2.1 Social Class Perceptions and the Exploitation of Uncertain Opportunities

Entrepreneurship has been shown to alleviate poverty, improve adverse life circumstances in emerging economies (Alvarez & Barney, 2014; Bruton et al., 2013; Sutter et

al., 2019) and create opportunities to overcome societal constraints such as stigma and disadvantaged gender roles (Alkhaled & Berglund, 2018; Jennings et al., 2016). In order to be an effective way for social advancement, entrepreneurial opportunities need to be converted into successful business models (Blank, 2013; McMullen & Shepherd, 2006; Osterwalder & Pigneur, 2010; Ries, 2011). Whether this can be achieved is fundamentally uncertain and depends on a variety of unpredictable factors including desirability (Gruber et al., 2015), feasibility (Dimov, 2010), and viability, which can be assessed based on achievable gains and preventable losses (Keh et al., 2002; Kim et al., 2010; Scheaf et al., 2020). If entrepreneurs cannot ensure sufficient market demand and develop a feasible and viable offering, it often leads to business failure and results in the loss of limited resources such as time and money, potentially harming the entrepreneur (Lanivich, 2015; McMullen & Shepherd, 2006; McMullen et al., 2023). Accordingly, these unpredictable opportunity dimensions create uncertainty, which typically is perceived as a potential threat and tends to discourage entrepreneurs to invest resources in an entrepreneurial opportunity (Choi & Shepherd, 2004; McKelvie et al., 2011; McMullen & Shepherd, 2006).

We argue that different uncertainty dimensions may hold different meanings for entrepreneurs from different social classes (Kraus et al., 2012). To substantiate this idea, we draw on the social cognitive theory of social class, a concept that has been extensively studied in decision-making research in various fields (Côté, 2022; Kish-Gephart et al., 2022), including the willingness to compete (Almås et al., 2016), risk-taking (Kish-Gephart, 2017; Kish-Gephart & Campbell, 2015), and leadership behavior (Barling & Weatherhead, 2016; Loignon & Kodydek, 2022; Martin et al., 2016).

In their seminal work on the social cognitive theory of social class, Kraus and colleagues (2012) contend that individuals' social class perceptions create different social contexts that set a coherent frame of social cognitive tendencies, which guides their thoughts, feelings, and decisions. This is attributable to the observation that people from different

classes often have different life experiences. Within a social class, they are taught similar values and have comparable experiences due to similar resource endowments. These processes reinforce each other, as people tend to maintain contact with others from their own social class. We therefore assume that this also applies to entrepreneurs and that the perception of social class not only contextualizes entrepreneurs in the course of their development, but also shapes their cognitive decision-making framework for the evaluation of environmental stimuli, such as entrepreneurial opportunities.

When entrepreneurs believe that they belong to a lower social class and have correspondingly fewer resources than the social average, they tend to exhibit heightened sensitivity to environmental changes and threats, driven by an external orientation, motivating them to avoid additional uncertainties (Kraus et al., 2012). Their social class perceptions refer to their perceived position in society regarding available resources such as job opportunities and financial wealth (Loignon & Woehr, 2018). People are likely to have lower class perceptions when they chronically experienced constraining external social influences in the past due to above-average social and resource-based disadvantages, such as unsafe neighborhoods and job insecurity that prevented them to pursue their goals and interests – uncertain and potentially threatening conditions beyond their control, which they want to avoid in the future.

Conversely, when entrepreneurs see themselves as belonging to a high social class and have correspondingly more resources than the social average, they tend to adopt an internal orientation prioritizing internal states, goals, and emotions, thus exhibit less reservation towards uncertain opportunities as a means to achieve their aspirations. They grew up in an environment with higher social status and relatively abundant resources that provided them with the freedom to pursue self-determined goals and interests (Johnson & Krueger, 2005; Lachman & Weaver, 1998) – privileged conditions that making them less sensitive to threats arising from uncertain environments (Kraus et al., 2012). Ultimately, whether entrepreneurs

feel they belong to a low or high social class may influence the evaluation of an uncertain situation such as the decision to pursue an uncertain entrepreneurial opportunity.

2.2.2 The Role of the Economic System in the Effects of Social Class Perceptions

According to the social cognitive theory of social class, social class effects are likely to vary across nations and their socio-economic policies determining the separation between the rich and the poor (Domhoff, 1998; Hacker & Pierson, 2010; Kraus et al., 2012; Phillips, 2002). These socio-economic policies are reflected by a country's economic system, serving as a framework that governs the structure, operations, and interactions of economic actors like entrepreneurs and governments (Cantor & Schor, 1997). In order to satisfy the needs and desires of a society, this system sets the rules for production, distribution, and consumption of resources (Gregory & Stuart, 2013). Capitalist nations usually adopt either a liberal market or coordinated market model, differing in the state's economic role and provision of structural resources and incentives for social advancement through entrepreneurship (Audretsch, 2007; Hall & Soskice, 2001; Hall & Thelen, 2009). These structural differences provide different frames of reference that shape the (unequal) ability and willingness of individuals to move up the social hierarchy via entrepreneurship (Boettke & Coyne, 2009; Dilli, 2021; Henrekson et al., 2010; Stenholm et al., 2013; Van der Zwan et al., 2007).

Nations characterized by a liberal market economy (e.g., the USA) are highly competitive and only intervene in the market in exceptional cases, which mostly regulates itself through supply and demand (Hall & Soskice, 2001). In such nations, entrepreneurs have only limited access to structural resources to reduce social inequality, such as free education, alternative employment opportunities, and social protection benefits, and must bear the entire risk inherent in entrepreneurial activities themselves (Audretsch, 2007; Dilli, 2021; World Economic Forum, 2020). As a result, entrepreneurs must expect the rewards and risk arising from the success or failure of entrepreneurship to have a greater impact on their lives.

In contrast, nations with a more coordinated market economy (such as Germany) tend to regulate the market through stronger state intervention (e.g., tax redistribution, minimum wages, state subsidy programs) in order to ensure that social class differences are evened out (Hall & Soskice, 2001). In such nations, entrepreneurs have a higher access to structural resources such as free education, alternative employment opportunities, and financial aid (Audretsch, 2007; Dilli, 2021; World Economic Forum, 2020). In the event of entrepreneurial failure, they can count on state social protection benefits to reduce the damage, while income from entrepreneurial activities is more strongly distributed through higher tax levies. With greater social equality, the rewards and risks associated with entrepreneurship may appear less significant, reducing the relevance of undesirable consequences in the event of failure, but also reducing the relative attractiveness of potential rewards, especially the effect of a social climb (Henrekson et al., 2010; Henrekson, 2014; Hessels et al., 2008). Given these distinctive characteristics of liberal and coordinated market economies, belonging to a low (or high) social class may have different implications for entrepreneurs' sensitivity towards uncertainty related to opportunities contingent upon in which national economic system they operate (Baker et al., 2005; Kraus et al., 2012).

2.3 HYPOTHESES DEVELOPMENT

2.3.1 How Uncertainty Shapes Entrepreneurial Decision-Making

When entrepreneurs face high levels of uncertainty (such as unpredictable desirability, feasibility, achievable gain, and preventable loss), they lack important information on the opportunity's outcome, making it difficult to predict whether it is worthwhile (Blank, 2013; Osterwalder & Pigneur, 2010; Ries, 2011). Therefore, these uncertainties diminish entrepreneurs' willingness to exploit opportunities, as they create doubts and anxiety regarding the right course of action (McMullen & Shepherd, 2006) and trigger the avoidance of potential negative consequences, such as threats to self-esteem or financial problems (Cacciotti et al., 2020; Choi & Shepherd, 2004; McKelvie et al., 2011). Unpredictable

desirability, feasibility, achievable gain, and preventable loss are independent sources of uncertainty and do not necessarily relate to one another in a consistent manner (i.e., be simultaneously high or low) (e.g., Scheaf et al., 2020). For example, in some cases, the feasibility of a project may be predictable, but not the expected gains from its implementation. In other cases, high gains in the event of success are readily predictable, while the costs in the event of failure are highly unclear.

Entrepreneurs typically lack the necessary experience, routines, and information to evaluate the uncertain desirability of their products and services on the market, which may indirectly affect the success of their ventures by preventing market entry, or possibly making fundraising more difficult due to a lack of market traction (Gruber et al., 2015). Similarly, uncertainty regarding the feasibility of an opportunity, including doubts about their knowledge and ability to develop the envisioned solution, can hinder the development of realistic business models and increase investment costs and losses due to unsuccessful attempts (Dimov, 2010). Moreover, uncertainty about achievable gains diminishes entrepreneurs' willingness to pursue opportunities, as they struggle to evaluate potential monetary gains and whether they justify pursuing opportunities despite the possible downside risks in case of business failure (Keh et al., 2002; Kim et al., 2010; Scheaf et al., 2020). Likewise, uncertainty regarding preventable losses can hinder entrepreneurs' willingness to pursue opportunities, as they are concerned with the potential personal costs of entrepreneurial failure and are unable to assess whether they can bear those potential negative consequences (Grichnik et al., 2010; Keh et al., 2002; Kim et al., 2010; Scheaf et al., 2020). In sum, uncertainty regarding desirability, feasibility, achievable gain, and preventable loss likely reduces an entrepreneurs' willingness to exploit opportunities.

Hypothesis 1:	*With higher uncertainty about an opportunity regarding its a) desirability, b) feasibility, c) achievable gain, and d) preventable loss, entrepreneurs exhibit less willingness to exploit an opportunity.*

2.3.2 How Social Class Shapes Decision-Making under Uncertainty

Entrepreneurs' social class perceptions create different social contexts with specific experiences and resource endowments that set a coherent frame of social cognitive tendencies and guide their thoughts, feelings, and decisions (Côté, 2022; Côté, 2011; Kish-Gephart et al., 2022; Kraus et al., 2012). Therefore, we argue that uncertainties associated with entrepreneurial opportunities are evaluated differently of entrepreneurs from lower vs. higher social classes, leading to different decisions regarding opportunity exploitation.

Drawing of the social cognitive theory of social class, we argue that entrepreneurs who believe that they belong to a lower social class are scared away by uncertainty, as their negative experiences associated with social and resource-based disadvantages have probably sensitized them to environmental changes and threats in the outside world (Kish-Gephart et al., 2022; Kraus et al., 2012). When they perceive uncertainty around opportunities, their external orientation leads them to assume that outside constraints could have a major impact on their venture and jeopardize potential success (e.g., Haushofer & Fehr, 2014; Kish-Gephart, 2017; Leana et al., 2012). Therefore, they likely prefer to forego an opportunity to avoid further strain on their social situation.

In contrast, entrepreneurs who believe that they belong to a higher social class tend to be less reserved towards uncertainty, as their experienced social and resource-based privileges have probably encouraged them to pursue their individual goals (such as stabilizing or advancing their social situation) despite potential threats associated with environmental changes (Kish-Gephart et al., 2022; Kraus et al., 2012). When they perceive uncertainty

around opportunities, their internal orientation leads them to assume that they have still control over outside constraints and provide them the confidence to navigate their ventures to success (e.g., Belmi et al., 2019). Therefore, they are likely to exploit an opportunity, even when it is associated with uncertainty, to take the chance to stabilize and/or further improve their privileged situation. In sum, we assume that entrepreneurs who feel that they belong to a lower social class tend to shy away from opportunities when perceiving higher levels of uncertainty, while this is less likely to be the case for entrepreneurs who feel that they belong to a higher social class.

Hypothesis 2:	*Entrepreneurs' social class perceptions moderate the effects of uncertainty of an opportunity (regarding its (a) desirability, b) feasibility, c) achievable gain, d) preventable loss) such that for entrepreneurs with lower (higher) social class perceptions, the uncertainty of an opportunity has an even stronger (weaker) negative effect on their willingness to exploit an opportunity.*

2.3.3 How Social Class Effects Vary in Reference to the National Economic System

We further argue that perceiving oneself as belonging to a lower social class may only intensify the negative effects of uncertainty when entrepreneurs operate in liberal market economies, but these effects may change when entrepreneurs operate in coordinated market economies (Dilli, 2021; Domhoff, 1998; Hacker & Pierson, 2010; Kraus et al, 2012; Phillips, 2002). With higher competition and economic responsibility in liberal market economies (Gregory & Stuart, 2013; Hall & Soskice, 2001), entrepreneurs from low social classes may be systematically reinforced in their heightened sensitivity and reservation to uncertainties associated with entrepreneurship, as failures and concomitant losses can result in existential threats (Kraus et al., 2012). In contrast, their higher social class counterparts are likely to have fewer reservations about uncertain opportunities in liberal market economies, as the rewards

and risks associated with entrepreneurship are more pronounced (Boettke & Coyne, 2009; Hessels et al., 2008; Shepherd & Douglas, 2002). While they are better able to deal with potential setbacks, opportunities may offer them an attractive pathway to leverage their social advantage to significantly stabilize or extend their privileged status.

Entrepreneurs in coordinated market economies shoulder less responsibility for entrepreneurial outcomes than those in liberal market economies because in coordinated market economies the state intervenes in economic activity for the purpose of social mobility (e.g., social protection benefits, tax redistribution) (Dilli, 2021; Henrekson et al., 2010; Hessels et al., 2008), which lowers the impact of perceived differences in social class. Therefore, the typical reservation towards uncertain opportunities of entrepreneurs who believe they belong to a lower social class, and the attraction to uncertain opportunities for entrepreneurs from higher social classes, as described in hypothesis 2, are reduced.

What is more, when entrepreneurs operate in a coordinated market economy, belonging to a low social class may even serve as the driving force behind entrepreneurial action. In coordinated market economies, the government intervenes in the market to reduce social class disparities and promote social mobility through robust social protection nets and subsidy programs (Dilli, 2021; Hall & Soskice, 2001). This munificent environment created by the government may encourage entrepreneurs from lower social classes to exploit uncertain opportunities as a means of social advancement (Hessels et al., 2007). In the event of entrepreneurial failure, they can rely on state-offered social benefits to mitigate the damage. In contrast, the higher tax contributions, that ensure an equitable distribution of entrepreneurial income and foster social equality, reduce potential gains, making them less attractive (Henrekson et al., 2010), which is particularly relevant for those from higher social classes as they likely see entrepreneurship as means to increase their wealth. Consequently, the rewards and risks associated with entrepreneurship appear less significant, reducing both the relevance of undesirable consequences in the event of failure and the relative

attractiveness of potential rewards (Boettke & Coyne, 2009; Hessels et al., 2008; Shepherd & Douglas, 2002). With fewer stakes at risk, entrepreneurs from lower social classes may be incentivized to compete vigorously, while entrepreneurship becomes less attractive for entrepreneurs from higher social classes, as they have less to gain relative to the risk of social demotion and heavier social security burdens on potential gains. Therefore, we hypothesize that the typical reservation to pursue uncertain opportunities among entrepreneurs who feel they belong to a lower social class should be lower in coordinated market economies and may be reversed.

Hypothesis 3: *There will be a three-way interaction between the type of market economy, uncertainty of an opportunity, and social class perception in predicting entrepreneurs' willingness for exploitation, whereby entrepreneurs' perceived belongingness to a low social class intensifies the negative effects of opportunity uncertainty in nations with a liberal market economy, while dampening these effects in nations with a coordinated market economy.*

2.4 METHODOLOGY

We conducted a metric-conjoint experiment to assess the role of perceived social class differences on entrepreneurs' decision-making regarding uncertain opportunities, in two different national contexts. Entrepreneurship research has widely used conjoint studies as they are particularly useful for examining decision-making processes and resistant to potential biases, e.g., self-reporting biases associated with survey data (Choi & Shepherd, 2004; Lohrke et al., 2010; Shepherd & Zacharakis, 2018). Our conjoint experiments tested the direct effects of uncertainty related to an opportunity (from different sources, i.e., high vs. low uncertainty regarding desirability, feasibility, achievable gain, and preventable loss) on entrepreneurs'

decision to exploit business opportunities, and the moderating role of entrepreneurs' perceived social class in countries with varying economic systems.

We conducted the same conjoint experiment with entrepreneurs recruited from both the USA and Germany. Both the USA and Germany are developed countries, which ensures a certain level of economic stability, infrastructure, and institutional support conducive to entrepreneurship, while having contrasting economic systems fostering different levels of social mobility (World Economic Forum, 2020). The comparable developmental stage is important for our research as it allows us to illuminate the pivotal role of economic systems in the effects of social class perceptions on entrepreneurship in developed countries, without confounding variables related to economic development, such as in emerging economies. Despite their high level of development, the USA pursues a liberal market economy model, while Germany follows a coordinated market economy model (Dilli, 2021; Hall & Soskice, 2001). The varying economic roles of the state are reflected in differences in the provision of structural resources and incentives that promote social advancement through entrepreneurship (GEM, 2023; Welter, 2011; World Economic Forum, 2020). This is in line with the social mobility index of the most recent Global Social Mobility Report (World Economic Forum, 2020), showing that the USA (ranked 27th in the WEF Report, 2020) exhibits a limited social mobility score of 70.4, while Germany exhibits high social mobility with a score of 78.8 (Germany, ranked 11th in the WEF Report, 2020). The different socio-economic policies in both nations lead to differences in social mobility conditions in terms of access to education (USA: 67; Germany: 85), work (e.g., employment opportunities, fair wage distribution, working conditions) (USA: 63; Germany: 73), and social protection (USA: 62; Germany: 73), shaping the effects of perceived social class on entrepreneurial decision-making (Welter, 2011; Zahra et al., 2014).

2.4.1 Sample

For the conjoint experiment, we collected data using prolific.co (cf. Palan & Schitter, 2018 for an analysis of the effectiveness of Prolific as data collection platform). Prolific can maintain high response quality because participants must be paid at an effective rate of at least £5 per hour (Peer et al., 2017). Moreover, unlike other online platforms (such as MTurk), Prolific enables users to specify exact and stringent pre-screening criteria that help us to make sure that the recruited respondents are suitable for our particular study. Therefore, we recruited only (former) entrepreneurs who were over 18 years old, were native language speakers (English in the USA and German in Germany), and had at least 3 months entrepreneurial experience with an own business (in the USA or in Germany) using multiple pre-screening criteria on the platform itself. Additionally to the platform-based pre-screening, we asked participants to self-validate their entrepreneurial experience and asked them for more detailed information on their entrepreneurial experience within our survey to double-screen their suitability for our sample. We collected a total of 226 responses (and therefore 3616 observations), of which 135 (2160 observations) were from the USA and 91 (1456 observations) from Germany. We combined both samples into one large total sample to test our hypotheses and report our results. In the following, we present the country-specific sample characteristics.

In the USA, we recruited 163 participants. After controlling for carelessness, slow responses, fast responses, and our sampling criteria, we retained 135 participants (see Appendix A-2 for the detailed and nation-specific data filtering process). We ended up with a total of 2160 decisions nested within 135 (former) entrepreneurs operating in the USA. On average, participants were 36 years old, 36.3% were female, and had 53.7 months of entrepreneurial experience, while with 66% most participants had either completed a vocational training or received a university degree. 71.9% of the participants identified themselves as White. 88.9% of the entrepreneurs classified their company as a small business

(0-50 employees), while 6.7% entrepreneurs classified it as a medium-sized business (51-250 employees), and 4.4% as a large-sized business (over 250 employees), with the median firm age being 5.00 years, and 45.2% having a technology-focus. 69.6% of the enterprises operated in the services sector, 10.4% in manufacturing, and 20.0% were commercial trade companies.

In Germany, we recruited 109 participants. After controlling for carelessness, slow responses, fast responses, and our sampling criteria, we retained 91 of them in our final sample. We ended up with a total of 1456 decisions nested within 91 (former) entrepreneurs operating in Germany. On average, participants were 34.3 years old, 28.9% were female, and had an entrepreneurial experience of 51.2 months, while with 58.9% most participants had either completed vocational training or received a university degree. All participants identified themselves as White. 97.8% of the entrepreneurs classified their company as a small business (0-50 employees), while 2.2% entrepreneurs classified it as a medium-sized business (51-250 employees), with the median firm age being 3.00 years and 52.7% having a technology-focus. 82.2% of the enterprises operated in the services sector, 8.8% in manufacturing, and 8.8% were commercial trade companies.

2.4.2 Design

We employed a full factorial design (four attributes with two levels each) resulting in 16 decision scenarios (Gunst & Mason, 2009; Hahn & Shapiro, 1966). Similar to prior conjoint studies (Küsshauer & Baum, 2023; Warnick et al., 2018), we chose to partially replicate the conjoint experiment to assess respondents' test-retest reliability and minimize their response fatigue by randomly picking four scenarios (Aiman-Smith et al., 2002; Karren & Barringer, 2002). Moreover, all participants read definitions for all four manipulated attributes and received a practice scenario prior to the experiment to become acquainted with the decision-making task.

In each scenario, we asked participants to evaluate business opportunities (see Appendix B-2 for a detailed description of the scenarios and the manipulations). To

manipulate the level of uncertainty for each business opportunity, we provided participants with information on the (un-)predictability of the desirability (Gruber et al., 2015), feasibility (Dimov, 2010), and viability, reflected in the achievable gain and preventable loss associated with the opportunity (Keh et al., 2002; Kim et al., 2010; Scheaf et al., 2020). After reading each scenario, participants indicated if they would be willing to exploit the presented business opportunity. In sum, the participants evaluated 21 conjoint scenarios, which is comparable to other conjoint experiments (see Schüler et al., 2023 for a review). Moreover, we randomized all scenarios to avoid order effects (Shepherd & Zacharakis, 2018).

Uncertainty Manipulation (Independent Variable). We derived and carefully manipulated our independent variables based on conceptualizations and measurements in prior research (Dimov, 2010; Gruber et al., 2015; Keh et al., 2002; Kim et al., 2010; Scheaf et al., 2020). All attributes differed in two dimensions. All uncertainty attributes (i.e., the desirability, feasibility, achievable gain and preventable loss) were presented as either "highly predictable" (coded 0) or "highly unclear" (coded 1). We thoroughly pre-tested our conjoint experiments by conducting 10 interviews with entrepreneurs from different social backgrounds using a thinking-aloud approach (Ericsson & Simon, 1993; Volkmer et al., 2024). Interviewees articulated their understanding of our materials and indicated any issues. Furthermore, interviewees validated the relevance of our manipulated attributes and confirmed that differences in the perception of the presented uncertainty sources play a significant role in their decision-making. Based on these interviews we further improved the ecological validity of our experiment. In addition to the conjoint experiment, participants responded to a post-experiment questionnaire. All items in the German sub-sample were translated from English into German using a double back-translation procedure following (Brislin, 1980), which was supported by researchers in our network (Schaffer & Riordan, 2003). All items were assessed using a 7-point Likert scale.

Uncertainty Perception Measurement (Manipulation-Check). After reading each decision profile, participants indicated their level of perceived uncertainty when evaluating the presented business opportunity, responding to the statement "If I would pursue this business opportunity, I would feel very uncertain.". Following other studies on entrepreneurial decision-making under uncertainty (McKelvie et al., 2011; McMullen & Shepherd, 2006; Schmitt et al., 2017), we created this measure based on the conceptualization of state uncertainty associated with the perceived unpredictability of the environment during decision-making (Milliken, 1987). The scale ranged from 1 (not at all) to 7 (fully agree). The results of mixed regressions showed that the manipulations significantly predicted entrepreneurs' uncertainty perception (desirability ($B = 0.68$, $p < .001$), feasibility ($B = 0.73$, $p < .001$), c) achievable gain ($B = 0.62$; $p < .001$) and d) preventable loss ($B = 0.80$; $p < .001$) suggesting that the manipulations worked as intended.

2.4.3 Measures

Willingness of Opportunity Exploitation (Dependent Variable). To measure entrepreneurs' willingness to exploit business opportunities, we adopted the measurement of willingness to exploit given opportunities by McKelvie et al. (2011). Thus, participants indicated on a 7-point Likert scale if they would find the displayed business opportunity attractive and would be willing to exploit it, answering to the two items: "I think this business opportunity is very attractive." and "It is very likely that I would take advantage of this business opportunity if I had the chance.". The willingness of opportunity exploitation measure showed good internal consistency (Cronbach's $\alpha = .95$).

Perceived Social Class (Moderator Variable). We measured entrepreneurs' perceived social class by adopting the measure of Adler et al. (2000). Participants rated their perceived social class regarding access to money and jobs by answering two items: "Think of this ladder as representing where people stand in our society. At the top of the ladder are the people who are the best off, those who have the most money (best jobs). At the bottom are the people who

are the worst off, those who have me least money (worst jobs or no job). How would you personally rate your social rank?". We measured one item for each dimension and formed a formative composite of overall perceived social class.

Control Variables. Besides entrepreneurs' gender (coded 1 = male, 2 = female, and 3 = diverse), we assessed several control variables regarding entrepreneurs' human capital (Unger et al., 2011) that may potentially affect entrepreneurs' decision-making such as age, education, and entrepreneurial experience (measured in months). In addition, we controlled for firm-related variables such as firm age (years of operation) and firm size (number of employees: 1-50; 51-250; 250+).

2.5 RESULTS

Following the recommendations by Schüler et al. (2023), we assessed the test-retest reliability for all dependent variables by calculating ICCs (ICC 3k ranging from .57 to .79; mean ICC = .71). Correlations and descriptive statistics are displayed in Table 2-1. We calculated variance inflation factors (VIFs) to control for multi-collinearity. All VIFs were below 1.51, thus, we inferred that multicollinearity was not a problem for our analysis (O'Brien, 2007). For testing our hypotheses, we specified hierarchical regression models for nested data using the lme4 package in R. Table 2-2 presents our model testing the described effects. In addition, descriptive and inferential post-hoc analyses, separated by country, can be found in Appendices C-2 and D-2.

Table 2-1: Means, standard deviations, and correlations

Variable	*M*	*SD*	1	2	3	4	5	6	7	8
1. Exploitation	3.45	1.74								
2. Social class perception	5.32	1.73	.08**							
3. Education	3.40	1.11	.03	.24**						
4. Gender	1.38	0.53	-.07**	-.29**	-.17**					
5. Age	35.32	10.45	-.08**	-.10**	-.03	.09**				
6. Entrepreneurial experience	52.66	53.78	-.06**	-.12**	-.04**	-.02	.49**			
7. Firm size	1.10	0.38	.07**	.14**	-.11**	.10**	-.17**	-.10**		
8. Firm age	8.34	15.66	-.02	.02	-.12**	.02	.16**	.30**	.15**	
9. Industry	2.06	0.50	-.07**	-.07**	-.11**	-.03	.05**	-.00	-.24**	-.08**

***Note*:** $N = 226$. *M* and *SD* are used to represent mean and standard deviation, respectively. * Correlation is significant at the $p < .05$ level (2-tailed), ** Correlation is significant at the $p < .01$ level (2-tailed), *** Correlation is significant at the $p < .001$ level (2-tailed).

Testing hypotheses H1a-H1d, we observed significant effects for uncertainty, yielding support for our hypothesis that uncertainty regarding a) desirability (B = -1.31, p < .001), b) feasibility (B = -1.43, p < .001), c) achievable gain (B = -1.73, p < .001), and d) preventable loss (B = -1.44, p < .001) negatively affects entrepreneurs' willingness to exploit opportunities. Testing H2a-H2d, we found that entrepreneurs' perceived social class did moderate the negative effect of uncertainty regarding achievable gain (B = 0.09, p < .05) and preventable loss (B = 0.08, p < .05) on opportunity exploitation. We found marginal significant moderation effects of perceived social class for the effects of desirability (B = 0.05, p = .06) and feasibility (B = 0.06, p = .05), tentatively supporting H2a and H2b. The two-way simple slope tests suggest that those from higher social classes are generally more willing to exploit opportunities when the uncertainty is high compared to their lower social class counterparts, and that this effect is significant across low, medium, and high levels of social class perception (see Table 2-3).

Table 2-2: Regression models for direct and interaction effects

	Model 1: Exploitation (direct effects)			**Model 2: Exploitation (interaction effects)**		
Variable	*B*	*SE*	*p*	*B*	*SE*	*p*
Direct Effects						
Desirability	-1.08	0.04	< .001***	-1.31	0.16	< .001***
Feasibility	-1.16	0.05	< .001***	-1.43	0.17	< .001***
Achievable Gain	-1.26	0.05	< .001***	-1.73	0.20	< .001***
Preventable Loss	-1.10	0.05	< .001***	-1.44	0.17	< .001***
Perceived Social Class	0.05	0.03	.054	-0.05	0.06	.431
Controls						
Country ID	-	-	-	-0.86	0.50	.087
Age	0.00	0.00	.144	-0.01	0.00	< .05*
Gender	-0.17	0.12	.157	-0.14	0.12	.250
Education	0.00	0.05	.857	0.02	0.05	.676
Firm age	0.00	0.00	.428	0.00	0.00	.478

Firm size	0.31	0.09	< .001***	0.28	0.10	< .01**
Entrepreneurial experience	0.00	0.00	.852	-	-	-
2- way Interaction Effects						
Desirability X Social Class				0.05	0.03	.069†
Feasibility X Social Class				0.06	0.06	.058†
Achievable Gain X Social Class				0.09	0.03	< .05*
Preventable Loss X Social Class				0.08	0.03	< .05*
Desirability X Country ID				0.94	0.30	< .01**
Feasibility X Country ID				0.14	0.38	.715
Achievable Gain X Country ID				1.08	0.30	< .01**
Preventable Loss X Country ID				0.28	0.35	.423
Perceived Social Class X Country ID				0.18	0.09	< .05*
3- way Interaction Effects						
(Desirability X Social Class) X Country ID				-0.19	0.05	< .001***
(Feasibility X Social Class) X Country ID				-0.05	0.06	.464
(Achievable Gain X Social Class) X Country ID				-0.19	0.06	< .001***
(Preventable Loss X Social Class) X Country ID				-0.08	0.06	.204
Conditional R^2	0.60			0.61		

***Note*: N = 226; 3616 observations, B = unstandardized regression coefficients; SE = standard errors. * B is significant at the $p < .05$ level, ** B is significant at the $p < .01$ level, *** B is significant at the $p < .001$ level, and † B is (marginally) significant at the $p < .10$ level. For all models we use hierarchical mixed regression models employing the lme4 package in R.

Consistent with our three-way moderation hypotheses H3a and H3c, we found that the perceived social class of the entrepreneur moderated the negative effect of uncertainty in terms of a) desirability (B = -0.19, $p < .001$) and c) achievable gain (B = -0.19, $p < .001$) on opportunity exploitation depending on the economic system in the country of operation. We

found no significant three-way moderation effects of perceived social class for feasibility (B = -0.05, p = ns) and preventable loss (B = -0.08, p = ns), thus rejecting H3b and H3d. As shown in Table 2-4, simple slope difference tests indicate significant differences in slopes between liberal and coordinated market economies, suggesting that the role of social class perceptions significantly varies depending of the country-specific economic system. Specifically, in nations with coordinated market economy (such as Germany), entrepreneurs with lower perceived social class were more willing to exploit opportunities when there was high uncertainty, while entrepreneurs with higher perceived social classes were more willing to exploit opportunities when the uncertainty is lower – indicating opposite results compared to entrepreneurs operating in countries with liberal market economies (such as the USA). Visualizing our findings for our (three-way) interaction effects, we also conducted simple slope analyses for all significant moderation effects (see Table 2-3, Table 2-4, and Figure 2-2 for an overview).

Table 2-3: Simple slope analyses (two-way interactions)

Variable	Moderator (Social Class Perception)	*B*	*SE*	*T*	*p*
Desirability	- 1 SD (3.583277)	-1.12	0.06	-18.19	<.001***
Desirability	Mean (5.316372)	-1.03	0.05	-21.82	<.001***
Desirability	+ 1 SD (7.049466)	-0.94	0.07	-13.50	<.001***
Feasibility	- 1 SD (3.583277)	-1.22	0.06	-19.75	<.001***
Feasibility	Mean (5.316372)	-1.11	0.05	-23.59	<.001***
Feasibility	+ 1 SD (7.049466)	-1.01	0.07	-14.52	<.001***
Achievable Gain	- 1 SD (3.583277)	-1.41	0.06	-22.87	<.001***
Achievable Gain	Mean (5.316372)	-1.25	0.05	-26.54	<.001***
Achievable Gain	+ 1 SD (7.049466)	-1.09	0.07	-15.75	<.001***

Preventable Loss	- 1 SD (3.583277)	-1.17	0.06	-18.92	<.001***
Preventable Loss	Mean (5.316372)	-1.03	0.05	-21.93	<.001***
Preventable Loss	+ 1 SD (7.049466)	-0.90	0.07	-13.00	<.001***

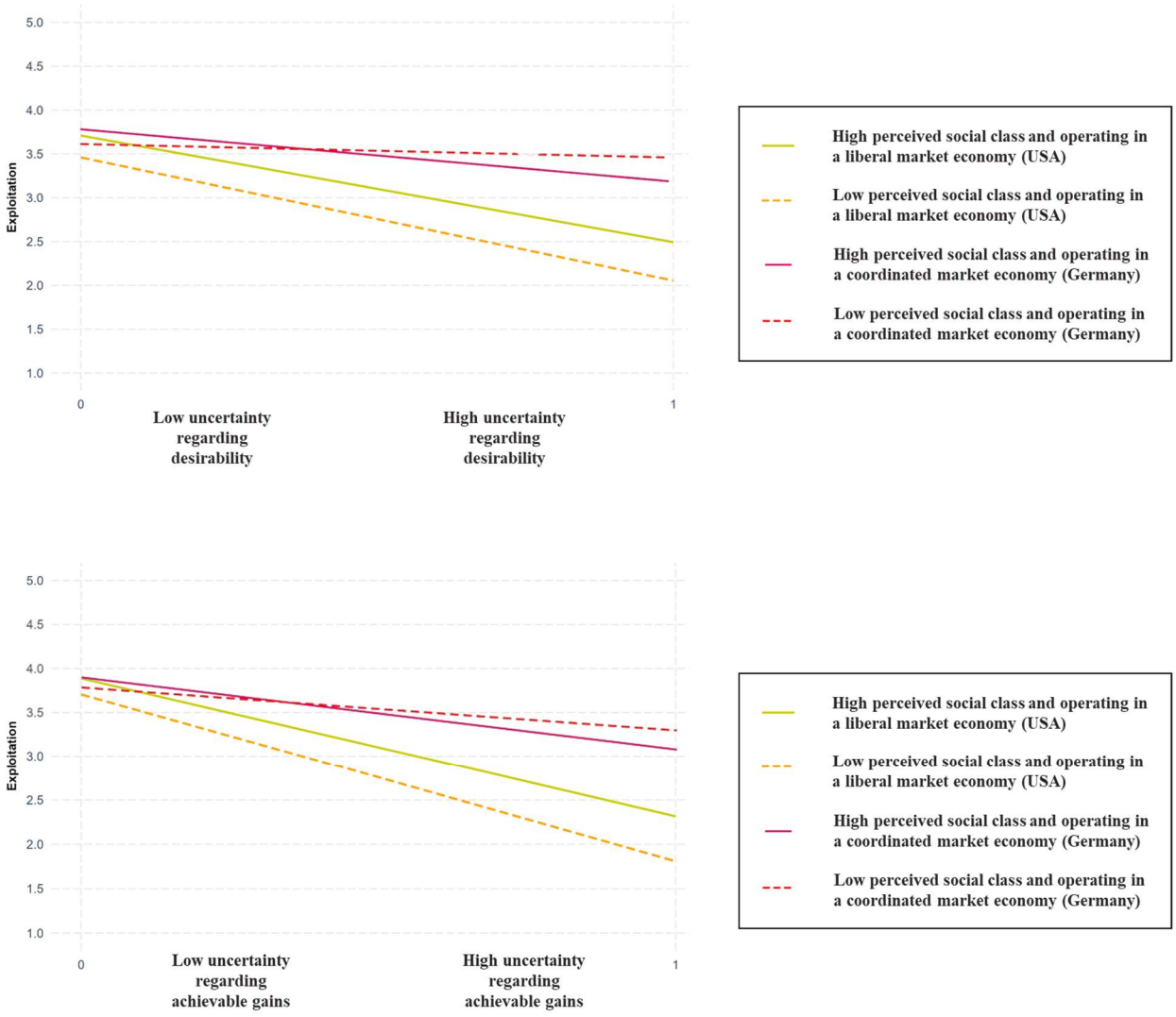
***Note*: *B* = unstandardized regression coefficients; *SE* = standard errors. * *B* is significant at the $p < .05$ level, ** *B* is significant at the $p < .01$ level, *** *B* is significant at the $p < .001$ level.

Table 2-4: Pairwise simple slope difference tests (three-way interactions)

Variable	**Moderator 1: (Social Class Perception)**	**Moderator 2: (Country ID: 1= USA; 2 = Germany)**	***B***	***SE***	***z-ratio***	***p***
Desirability	Mean (5.316372)	1	1.03	0.0472	21.808	<.001***
Desirability	Mean (5.316372)	2	1.10	0.0585	18.769	<.001***
Achievable Gain	Mean (5.316372)	1	1.25	0.0472	26.522	<.001***
Achievable Gain	Mean (5.316372)	2	1.20	0.0585	20.592	<.001***

***Note*: *B* = unstandardized regression coefficients; *SE* = standard errors. * *B* is significant at the $p < .05$ level, ** *B* is significant at the $p < .01$ level, *** *B* is significant at the $p < .001$ level.

Figure 2-2: Simple slope analyses for three-way interaction effects



2.6 DISCUSSION

Our research offers new insights into the role of social class perceptions as a boundary condition in entrepreneurial decision-making, indicating that social class effects may vary dependent on nation-specific economic systems. Drawing on literature on entrepreneurial decision-making (Davidsson, 2015; McMullen & Shepherd, 2006) and social cognitive theory of social class (Kraus et al., 2012), we developed and tested a model of social class in entrepreneurial decision-making in two developed countries. The analysis of metric conjoint experiments showed that uncertainty about the desirability, feasibility, achievable gain, and

preventable loss of an opportunity generally reduces the willingness of entrepreneurs to take advantage of opportunities. In our study, we observed that, entrepreneurs who perceive themselves as belonging to a lower social class generally were more likely to be deterred by uncertainty associated with opportunities compared to those who perceive themselves as belonging to a higher social class, with this effect being dependent on the country of operation. Specifically, we found that in nations with a liberal market economy, entrepreneurs who perceive themselves as belonging to a lower social class were more likely to be deterred by uncertainty associated with opportunities, probably due to the risk of ending up in an even more precarious situation. In such nations, entrepreneurship may offer entrepreneurs from a higher social class in particular an attractive path to improve their privileged situation, so that they are less likely to shy away from uncertain opportunities. The opposite was observed in countries with a coordinated market economy. Our findings suggest that in countries with a coordinated market economy, entrepreneurs who believed to belong to a lower social class were more incentivized to exploit uncertain opportunities, while their higher-class counterparts appeared to be more reserved to them. This indicates that in coordinated market economies, entrepreneurship may serve as an attractive pathway of social advancement for members of lower social classes, while existing privileges of members of higher social classes may lead to lower incentives for them to face the uncertainty inherent of entrepreneurial opportunities. In the following, we discuss how our findings contribute to research on entrepreneurial decision-making under uncertainty.

2.6.1 How Social Class Impacts Entrepreneurs' Decision-Making

Entrepreneurship literature is unclear about whether a low (perceived) social class is an undesirable impediment to entrepreneurial action (Baker et al., 2005; Lim et al., 2016) or driving force behind enacting uncertain opportunities since having less to lose than entrepreneurs of higher social classes (Kish-Gephart, 2017; Kish-Gephart et al., 2022; Kish-

Gephart & Campbell, 2015). Our findings support our theorizing by showing that entrepreneurs believing to belong to a low social class may exhibit less reservation towards uncertain opportunities compared to their higher social class counterparts in nations with coordinated market economy (such as Germany). This challenges the prevailing social inequality perspective in research on social class in entrepreneurship, which has so far mainly focused on emerging economies and the adverse effects of belonging to lower social classes and associated resource deficiencies on opportunity discovery and enactment (e.g., Lim et al., 2016).

Illuminating perceived social class as contingency, we found evidence that entrepreneurs with different social class perceptions processed uncertainty in different ways with implications for their decision-making. Our study illustrates that entrepreneurs with a low perceived social class need not necessarily view uncertainty as a greater obstacle compared to entrepreneurs with a high perceived social class, and paves the way for a more holistic view on the role of social class perceptions in entrepreneurial decision-making. This way, our study underscores that social class should not be positioned only as a beneficial or harming resource-based (dis-)advantage, but is a more complex phenomenon, which can come with different effects depending on the contextual frame of reference. To provide a comprehensive understanding of social class in entrepreneurial decision-making, future research needs to acknowledge that differences in social class perceptions can diminish, but also incentivize the willingness to pursue uncertain entrepreneurial opportunities.

2.6.2 The Role of National Economic Systems for Effects of Social Class

Our study indicates that the national frame of reference, in which entrepreneurs' operate, determines how their perceived social class shapes their entrepreneurial decision-making under uncertainty. More specifically, entrepreneurs from a lower social class may perceive greater potential downsides and exhibit a lower preference for uncertainties in

countries with liberal market economies (like the USA), whereas they are less reserved towards uncertainties in nations with coordinated market economies and fewer potential downsides, as seen in the case of Germany. These findings indicate that the mixed findings on the role of social class in opportunity exploitation may be attributable to nation-specific differences in socio-economic policies and anticipated returns from bearing uncertainty (Dilli, 2021; Hall & Soskice, 2001; Hessels et al., 2007; Hessels et al., 2008). While in countries with coordinated market economy, uncertainty related to opportunities may make venturing into the unknown less attractive for entrepreneurs who perceive themselves as belonging to a higher social class, in countries with liberal market economy, uncertainty may lead entrepreneurs who perceive to belong to a lower social class to shy away from the potential of ending up in even more precarious situations.

Previous literature often has conceptualized social class primarily from social inequality perspective, which is too simplistic since entrepreneurs are likely to take into account their national frame of reference, including the socio-economic policies, when making decisions about opportunities (Baker et al., 2005; Kraus et al., 2012). Our consideration of national economic systems helps to appease contradictory views the role of social class in the relationship between uncertainty and opportunity exploitation, and points to the importance of considering national differences in future research on how entrepreneurs with different social class perceptions enact uncertain opportunities.

2.6.3 Practical Implications

Developing inclusive and fair entrepreneurship conditions requires recognizing the diverse perspectives and motivations of entrepreneurs from various social classes in different nations. By fostering a supportive environment that values diversity and provides equal access to resources and opportunities, stakeholders can promote entrepreneurship as a viable path for individuals regardless of their social background. Understanding the influence of perceived

social class on entrepreneurial decision-making provides a stronger awareness for policy-makers, and supporting institutions to design effective policies that address the particular challenges faced by different social classes in different nations. In nations with liberal market economies, targeted support structures are of utter importance to mitigate the potential negative consequences of business failure for vulnerable entrepreneurs. Access to financial assistance or incentives, skill development initiatives, and mentoring can provide safety nets and encourage entrepreneurship among individuals from a lower social class. In contrast, in countries with coordinated market economies, where uncertain gains may prevent entrepreneurs perceiving higher social class from pursuing opportunities, policy-makers can incentivize risk-taking and innovation. Support-structures such as grants, tax incentives, and reputation-enhancing campaigns could mitigate perceived uncertainty and encourage entrepreneurial action, especially among individuals who perceive themselves as belonging to a high social class.

2.6.4 Limitations and Future Directions

Although our design has several methodological advantages, some limitations exist. First, while our conjoint experiments offer solid internal validity and stable results across various robustness checks and model specifications, common limitations of conjoint experiments include reduced external validity and restrictions in the number of attributes (Karren & Barringer, 2002). In our study, we used written descriptions for different sources of uncertainty related to business opportunities. While the relevant criteria for opportunity evaluation become more directly accessible, this approach may affect the external validity of our findings. However, we conducted several interviews with entrepreneurs of different social classes before collecting the data to enhance external validity and secure their understanding of the opportunity descriptions. We encourage scholars to replicate and adapt our study by employing other research designs to further enhance our findings' external validity.

Second, since we conducted the experiment only in the USA and Germany for economic reasons, our initial results are still not clearly generalizable to other national contexts, although these two countries were selected by design. Further cross-country comparative studies are essential to validate our hypothesis regarding the influence of national economic systems as a frame of reference in entrepreneurial decision-making under uncertainty, particularly in relation to varying social class perceptions. To date, there is very little literature on how perceived social class affects entrepreneurs' micro-level information processing and decision-making (cf. Brändle & Kuckertz, 2023, and Ge et al., 2022 for recent exceptions). Therefore, in our study we focused on exploring how much the effects of perceived social class might depend on the national context and initially conducted robustness checks with individual-level variables in particular.

Further research should replicate our design in different national contexts to enhance the external validity of our findings. Additionally, we recommend scholars to investigate the role of national contexts in shaping the effects of social class and to consider additional country-level variables that, beyond the economic system, which may influence the effects of social class. Cultural variables would be particularly suitable for this purpose as the meaning of social class can also vary within and across cultures (Domhoff, 1998; Hacker & Pierson, 2010; Kraus et al., 2012; Phillips, 2002). For example, cultures vary in their endorsement of egalitarian (vs. meritocratic) or independence (vs. interdependence) social values, which may influence the impact of social class perceptions in entrepreneurship (Hofstede, 2001; House et al., 2004; Shane, 1993; Storr, 2012; Wennekers et al., 2007). In order to improve our understanding on how social class affects entrepreneurial decision-making, it will be crucial for future research and theorizing to incorporate ideas about culture, inequality, and attitudes toward social class and equality.

Lastly, our study limits our ability to detect underlying mechanisms, which cause the effects of perceived social class. While we found that differences in entrepreneurs' perceived class affects their decision-making in different national settings, our research design does not suffice to investigate the psychological mechanisms driving this social class effects in different countries. We encourage future research to look into how entrepreneurs with different social class perceptions process opportunity-related uncertainties, while taking into account that these mechanisms may differ depending on the country of operation. Investigating the effects of social class perceptions and potential mediating processes in different nations can provide valuable insights in the general psychological mechanisms underlying the impact of entrepreneurs' perceived social class in entrepreneurial decision-making across various national contexts.

2.7 CONCLUSION

In sum, our findings suggest that social class perceptions have an important impact on entrepreneurs' evaluation of uncertain opportunities and subsequent decision-making. Entrepreneurs' perceptions of belonging to a low (or high) social class can both represent an advantage and a disadvantage for coming into action, contingent on the specific nation in which they operate. Therefore, distinguishing between different national contexts has important implications for the impact of perceived social class as a boundary condition in entrepreneurs' opportunity pursuit. Thus, we encourage future researchers and policy-makers to consider national differences and to expand their focus beyond a solely resource-centric perspective, which includes entrepreneurs' social reality in their country of operation when investigating the role of social class in entrepreneurial decision-making under uncertainty.

CHAPTER 3[4]

DRIVEN BY PASSION - HOW DO ENTREPRENEURS' PASSION SIGNALS INFLUENCE EMPLOYEES' DECISION MAKING UNDER UNCERTAINTY?

Abstract

Entrepreneurs' passion is generally portrayed as a helpful tool for convincing external stakeholders. However, towards their employees, the entrepreneur's passion can convey ambiguous signals that potentially complicate employees' decision-making during opportunity pursuit. To disentangle the effects of entrepreneurial leaders' passion signals on employees' behavior, we conducted two conjoint experiments (Study 1: 1440 decisions nested within 90 start-up employees; Study 2: 1472 decisions nested within 92 start-up employees). By distinguishing leaders' passion signals (passion type and strength), we observe that signals of leaders' passion influence employees' uncertainty perception, which determines their decision to exploit or explore business opportunities for the venture. Further, our study demonstrates the moderating role of employees' dualistic passion in dealing with uncertainty during decision-making. We provide theoretical contributions to research on passion and leadership in entrepreneurship, as well as practical implications for entrepreneurial leaders.

[4] Chapter three is co-authored by Dr. Andreas Schunk, Dr. Jens Schüler and Prof. Dr. Matthias Baum.

3.1 INTRODUCTION

Passion is often viewed as one of the most important and defining characteristics of entrepreneurs for coping with the uncertain challenges of entrepreneurship (Baum & Locke, 2004; Pollack et al., 2020). For instance, previous research shows that entrepreneurs' passion can function as an important signal for external audiences to cope with uncertainty, e.g., for investors evaluating start-ups (Oo et al., 2019; Warnick et al., 2018) or when joining a start-up team as a co-founder (Fu et al., 2022). However, the success of a start-up depends not only on the passionate entrepreneurs but also on the start-up employees, who are indispensable for driving growth and business development (Van Lancker et al., 2022). Previous studies have drawn a somewhat ambiguous picture regarding the influence of entrepreneurial leaders' passion on their employees. Whereas some studies find that leaders' passion can foster positive employee outcomes, such as affective commitment (Breugst et al., 2012) or creativity and effort (Hubner et al., 2020), others indicate potential negative implications of too passionate, obsessive entrepreneurial leaders (e.g., Piva & Stroe, 2022; Sirén et al., 2016).

Considering that start-up employees are highly reliant on their entrepreneurial leaders for guidance in their jobs (Stephan et al., 2024), such ambiguous signals may impose a threat to employees' understanding of how to effectively contribute to the pursuit of business opportunities that may be important for venture success. So, does entrepreneurs' passion inform employees' behavioral reactions towards exploration or exploitation? Our research aims to solve this puzzle by developing a conceptual model of signaling theory (Spence, 1973) and the dualistic model of passion (Vallerand et al., 2003), and by testing our predictions with the help of two complementary metric conjoint experiments.

We theorize and test how leaders' passion signals – depending on type and strength – influence employees' perceived uncertainty, which governs their readiness to support the pursuit of new business opportunities through exploitative or exploratory start-up efforts (Griffin & Grote, 2020; Mom et al., 2015). We hereby focus on employees' contributions to

the exploitation and exploration of business opportunities as they are vital for venture success (Choi & Shepherd, 2004; Hmieleski & Baron, 2008b; Schnellbächer et al., 2019; Sirén et al., 2012). Such decisions usually take place under uncertainty, as employees are not able to predict the consequences of their decision for their future work situation, the effects on themselves, and their response alternatives (McKelvie et al., 2011; Milliken, 1987; Townsend et al., 2018). Hence, we argue that employees cognitively process their entrepreneurial leaders' passion signals when making these decisions and that employees' perceived uncertainty plays a mediating role.

Our study makes two contributions to research on entrepreneurial passion and leadership. First, our model deciphers the ambivalent signaling effects of leaders' passion on employees' decision-making. Specifically, we show that leaders' passion signals (passion type and strength) invoke different effects on employees' perceived uncertainty and employees' subsequent decisions to contribute to the exploitation and exploration of opportunities. Hence, our results indicate a potentially damaging effect of leaders' passion for the leader-employee relationship due to the increased uncertainty induced by perceived obsessive passion signals.

Second, we further contribute to understanding uncertainty elaboration by integrating employees' own (harmonious and obsessive) passion into the picture. We demonstrate the ambivalent role of passion in employee decision-making, which makes harmoniously passionate employees more susceptible to (signal-based) uncertainty, whereas their obsessive passion shields these effects. We theorize that harmonious passion enables employees to cognitively process uncertainty (and associated threats), whereas obsessive passion renders them less attentive because of the rigid persistence and narrow focus with this form of passion (Vallerand et al., 2023). By showcasing the role of employee passion in regulating their behavior under uncertainty, we complement previous research on the role of passion in leader-employee relationships (Breugst et al., 2012; Hubner et al., 2020; Newman et al., 2021) and

contribute to the recent discourse on contingencies in employees' behavioral responses to uncertainty (Griffin & Grote, 2020).

3.2 THEORETICAL BACKGROUND

3.2.1 Entrepreneurial Passion as a Signal

Passion encourages entrepreneurs to go the extra mile (Cardon et al., 2013; Cardon & Kirk, 2015), helps them convince investors (Mitteness et al., 2012; Murnieks et al., 2016; Warnick et al., 2018), motivates employees (Hubner et al., 2020) and – ultimately – improves firm performance (Drnovsek et al., 2016). Several studies highlight entrepreneurial passion's capacity to signal entrepreneurs' characteristics to various receivers, such as investors or employees. However, among the few studies that emphasize the effects of entrepreneurs' passion for their employees (Breugst et al., 2012; Hubner et al., 2020), the main focus resides on how the different positive emotions and salient identity cues influence employee outcomes. These studies provide an important stepping stone for understanding entrepreneur-employee interactions but also limit their perspective towards a rather positive connotation of entrepreneurial passion. More recently, entrepreneurship scholars have begun to integrate a more nuanced picture of passion by emphasizing not only different roles (Cardon et al., 2009), but by putting a potentially damaging side of passion on the plate – obsessive passion (Fu et al., 2022; Pollack et al., 2020; Stroe et al., 2018).

We build on these recent advancements in the field and separate passion in terms of its displayed strength and its type (harmonious vs. obsessive). This approach is grounded in the dualistic passion model, which differentiates between harmonious and obsessive passion based on how passion is internalized into one's identity (Vallerand et al., 2003). We argue that how entrepreneurs have internalized and how strongly they display their passion can signal additional insights to employees.

Consistent with the dualistic passion model (Vallerand et al., 2003), passion is defined as an individual's inclination for meaningful activities which one loves to spend time with.

One's passion reflects what is important to them and highlights the activities that are important for them to engage in. Depending on how strongly individuals enact and display their passion, others can derive valuable information about passionate individuals from such signals. Further, the dualistic passion model's (Vallerand et al., 2003) differentiation of harmonious and obsessive provides additional information about passionate individuals.

Harmonious passion is autonomously internalized into one's identity, fostering high intrinsic motivation and enabling individuals to fully immerse themselves in their work without guilt or distraction (Pollack et al., 2020; Vallerand et al., 2003). This autonomous internalization allows individuals to flexibly balance their passion with emerging work and life demands (Curran et al., 2015). Moreover, harmoniously passionate individuals typically exhibit a strong mastery goal orientation, associated with intrinsic motivation for skill development and task mastery (Vallerand et al., 2007). Existing research on leaders' (harmonious) passion suggests its positive impact on passion contagion (Ho & Astakhova, 2020; Ho et al., 2021). Similarly, employees' harmonious passion is linked to many positive outcomes, including job and career satisfaction, job performance, flow, intrinsic motivation, and attention (Burke et al., 2015; Ho et al., 2011; Houlfort et al., 2014).

Unlike harmonious passion, obsessive passion is characterized by a controlled form of internalization, where individuals feel pressured to engage in an activity. Obsessively passionate individuals may encounter conflicts with other areas of their lives due to their passion's constrained and compulsive nature, despite their love for the activity. This can diminish positive affect and increase negative affect, such as guilt, pressure, and anxiety, both during the activity and when prevented from engaging in the activity (Vallerand et al., 2003; Vallerand et al., 2010). Additionally, those with higher levels of obsessive passion tend to exhibit cognitive rigidity, making it challenging to shift their focus to other responsibilities (Kakarika et al., 2022). Previous research on leaders' obsessive passion yields mixed results. While it can undermine the positive impact of change-oriented leadership on firm

performance (Sirén et al., 2016), it may also convince potential co-founders to join a venture (Fu et al., 2022). In the case of employees, obsessive passion negatively impacts attention, leads to depression and turnover intentions, and triggers rumination, resulting in emotional exhaustion (Burke et al., 2015; Donahue et al., 2012; Ho et al., 2011; Houlfort et al., 2014).

3.2.2 Challenges for Start-Up Employees during Decision-Making

Start-up employees rely heavily on their entrepreneurial leaders for guidance in their jobs (Stephan et al., 2024) and face the challenge of acting in line with leadership while effectively contributing to the exploration and exploitation of business opportunities in a constantly changing work environment (Griffin & Grote, 2020; Hitt et al., 2012; March, 1991). To this end, they can engage in both advantage-seeking (exploitation) and opportunity-seeking (exploration) efforts, both of which aim to navigate companies through uncertainty and contribute to venture success (Griffin & Grote, 2020; Griffin et al., 2007; Hitt et al., 2012; March, 1991). Exploitation requires the investment of resources to take advantage of opportunities – usually by leveraging knowledge and mapped means-end assumptions (Choi et al., 2008; Shane & Venkataraman, 2000). At the same time, exploration involves seeking (further) opportunities with highly uncertain but potentially higher rewards in the long run (Hitt et al., 2012; Schmitt et al., 2017; Sirén et al., 2012).

Employees rely on leader signals to guide such behavior under uncertainty (Connelly et al., 2011) because employees typically do not have as much knowledge as their leaders about the current situation and the firm's strategic goals. When employees must make autonomous decisions that align with leaders' interests, they perceive uncertainty. This uncertainty stems from their perceived inability to predict the consequences of their decisions on their future work situation, the effects on themselves, and how best to proceed (McKelvie et al., 2011; Milliken, 1987). Perceptions of uncertainty potentially pose a threat to achieving both personal and business objectives (Hirsh et al., 2012; McMullen & Shepherd, 2006), motivating individuals to mitigate it by interpreting signals from their leader.

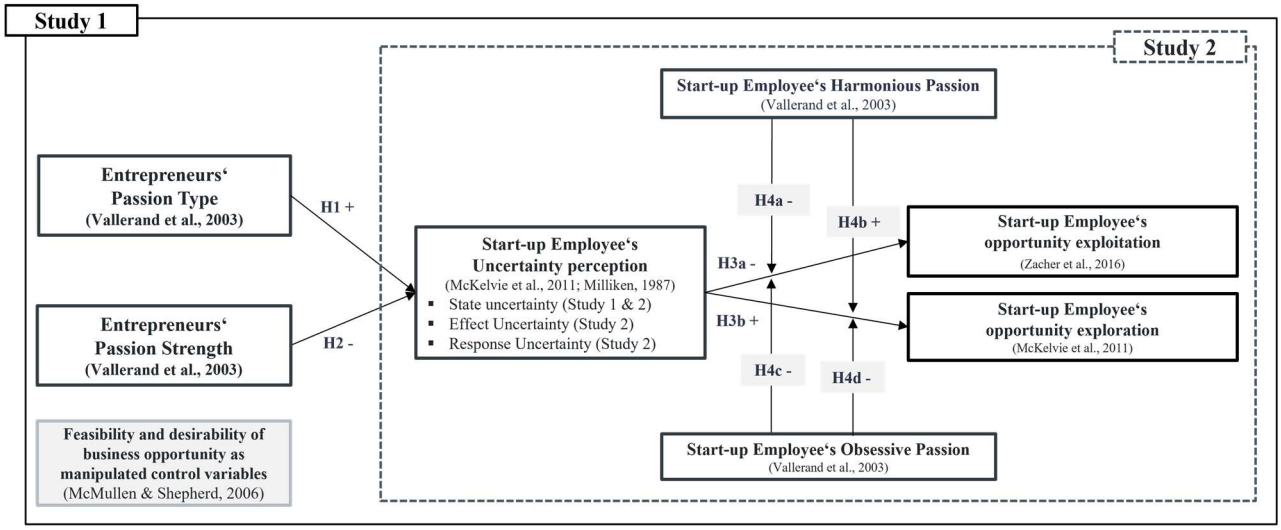
The signaling process between leader and employee reduces information asymmetries between the two parties (Connelly et al., 2011; Spence, 1973). While initially used to predict a party's unobservable qualities, signaling theory has more recently been applied in the organizational behavior and leadership context to study how employees make assumptions about wanted (or unwanted) behaviors based on supervisor signals (Ramaswami et al., 2010; Xu et al., 2019). In this vein, (entrepreneurial) leaders use their behaviors to signal their preferences and opinions to employees. These signals can help employees better understand what is important to their leader and adjust their decision-making accordingly.

In this way, start-up employees become active participants (rather than passive recipients) in receiving and responding to signals from their entrepreneurial leaders. As a result of processing these signals (Drover et al., 2018), employees determine how to respond to these signals in the pursuit of opportunities. For instance, with high levels of uncertainty triggering anxiety and doubts (Hirsh et al., 2012), employees may be prompted to explore additional information to reduce these negative affective states instead of immediately exploiting an opportunity (Carver, 2004; Cervone et al., 1994).

An individual's characteristics affect how uncertainty perceptions translate into exploitation and exploration tendencies (Griffin & Grote, 2020; McKelvie et al., 2011; Schmitt et al., 2017), and we argue that an employee's passion for work could be one such trait. Harmonious passion is associated with positive affective experiences and provides features (e.g., goal mastery orientation, cognitive flexibility) (Vallerand et al., 2007) that potentially enhance exploratory behaviors, making employees react more strongly to uncertainty by refraining from exploitation while cherishing exploration (Avnet & Higgins, 2003; Fredrickson, 2001). Conversely, with its cognitive rigidity, the externally controlled internalization of obsessive passion should limit the effects of uncertainty perception. Obsessively passionate employees find it more challenging to disconnect from an opportunity and open up for exploration, even when the uncertainty of the opportunity is high (Vallerand

et al., 2008; Vallerand et al., 2007). Therefore, we argue that the role of perceived uncertainty for start-up employees' decisions on exploring or exploiting a given opportunity is contingent upon employees' individual dualistic passion inclination (see Figure 3-1).

Figure 3-1: Theoretical model



3.3 HYPOTHESES DEVELOPMENT

3.3.1 Entrepreneurial Leaders' Passion as a Signal for Employees' Decision-Making

Entrepreneurial leaders' passion type (harmonious or obsessive passion) conveys valuable information about how entrepreneurs internalized their passion and likely behave while pursuing opportunities. Entrepreneurs with a high harmonious passion can deliberately direct their passion toward their chosen path rather than solely being motivated by external incentives, such as achieving performance targets (Vallerand et al., 2007). As a result, entrepreneurs can balance their passion with new obligations and challenges that typically arise when running a business is unpredictable. This can result in experiencing greater enjoyment and fun while simultaneously reducing negative emotions, such as guilt and anxiety, when engaging in entrepreneurial activities (Burke et al., 2015; Ho et al., 2011; Vallerand et al., 2003). We argue that these positive characteristics of harmonious leader passion are also received by employees, signaling a sense of security when making uncertain decisions about a particular opportunity. When employees receive signals of harmonious

passion, they are more likely to expect entrepreneurial leaders to respond more positively and flexibly to their decisions, even if they lead to undesirable outcomes.

On the contrary, obsessively passionate leaders are controlled by their passion and feel pressured to engage in entrepreneurial activities. A greater focus on external incentives such as achieving performance objectives is associated with this and generally results in less positive affect (e.g., enjoyment) and more negative affect (e.g., guilt and anxiety) when engaging in and being prevented from engaging in an activity (Vallerand et al., 2003; Vallerand et al., 2010; Vallerand et al., 2007). Further, due to their obsessive passion, leaders may seek to focus only on their passion and, if necessary, perform self-serving actions (Camps et al., 2012). Therefore, we expect that employees will also perceive these adverse effects of obsessive leader passion through signaling, which will further pressure and unsettle them during decision-making. When employees perceive signals of obsessive passion from their leaders, they anticipate that they are more likely to react negatively and rigidly to decisions that deviate from their obsessive intentions. Due to the uncertain reactions of their obsessive leaders, the consequences of employees' decisions heavily impact their ability to make their decisions, leading to an increased perception of uncertainty.

Hypothesis 1:	*Signals of leaders' obsessive (harmonious) passion for an opportunity increases (decreases) employees' uncertainty perception.*

Whereas previous research on leaders' role-based entrepreneurial passion attests to the capacity to signal entrepreneurs' underlying clear motivation for pursuing their venture (Murnieks et al., 2016; Oo et al., 2019; Warnick et al., 2018), we argue that signals of entrepreneurial passion can generally emit how important entrepreneurial activities are for the entrepreneur. This reasoning is in line with Vallerand et al. (2003), who define passion as a

strong inclination for activities that are important for individuals and that they seek to invest time in. Therefore, leaders expressing entrepreneurial passion for pursuing specific business opportunities can convey clear information about the importance for the leader and thus guide employees' decision-making.

We argue that entrepreneurs' signals of passion strength, how strongly they display their passion for particular business opportunities, will influence employees' perceived uncertainty when making decisions. A stronger display of entrepreneurs' passion will emphasize the significance of activities and showcase to employees that the entrepreneur intends to further engage in this business opportunity. Hence, employees will perceive less uncertainty with stronger signals of passion strength, whereas displaying only moderate passion strength may lead to employees feeling less clear about the importance of specific business opportunities to the leader.

Hypothesis 2:	*Leaders' passion strength reduces employees' uncertainty perception.*

3.3.2 Uncertainty Perception as a Mediating Mechanism for Employees' Exploitation and Exploration

As receivers of entrepreneurs' (passion) signals, employees interpret the resulting uncertainty that shapes their tendency to contribute to specific entrepreneurial actions (Choi et al., 2008; Griffin & Grote, 2020; Schmitt et al., 2017; Sirén et al., 2012). The decision-making literature in entrepreneurship research distinguishes between advantage-seeking (exploitation) and opportunity-seeking (exploration) behaviors that are both beneficial for businesses to overcome inherent uncertainty and achieve venture success (Griffin & Grote, 2020; Hitt et al., 2012; March, 1991).

Uncertainty is generally seen as detrimental to choosing and exploiting entrepreneurial opportunities (McMullen & Shepherd, 2006) because exploiting opportunities can increase the potential for downside risk if they do not turn out to be profitable. When employees perceive higher levels of uncertainty, they lack the required information to predict the outcomes of pursuing opportunities in their future work situation and potential response alternatives (McMullen & Shepherd, 2006; Milliken, 1987; Townsend et al., 2018). Thus, uncertainty prevents employees from using known means-end connections to make a clear call on whether an activity will lead to a desired outcome, which inhibits their exploitation behavior (McKelvie et al., 2011). Therefore, we assert that employees avoid exploiting opportunities with increased levels of perceived uncertainty to steer clear of potentially adverse outcomes, including negative feedback from supervisors due to committing to an uncertain opportunity (Anseel et al., 2015).

Hypothesis 3a:	*With increasing uncertainty perception, employees are less likely to exploit opportunities.*

On the other hand, we expect employees to pursue exploratory behaviors to obtain more information to reduce potential threats resulting from uncertainty. Exploratory actions focus on gathering information on further opportunities and postponing commitment to a specific opportunity, reducing perceived uncertainties in entrepreneurial environments (Choi et al., 2008; McKelvie et al., 2011). Several studies show that increased perceived uncertainty can activate people's alertness and perseverance in making sense of the uncertain situation (E. C. Anderson et al., 2019; Baas et al., 2011). The uncertainty-induced anxiety can prompt entrepreneurial exploration and create an awareness that people engaged in entrepreneurship need to take exploratory actions to gradually develop their business by incorporating new information, which helps to reduce uncertainty (Fisher, 2012; Griffin & Grote, 2020;

McKelvie et al., 2011; Schmitt et al., 2017). Hence, we argue that employees decide to reduce undesirable uncertainty by exploring further opportunities (Baumeister et al., 2007).

Hypothesis 3b:	*With increasing uncertainty perception, employees are more likely to explore further opportunities.*

3.3.3 Employees' Dualistic Passion as a Boundary Condition in Dealing with Uncertainty

According to signaling theory, the signaling process and outcome co-depend on the employee since the receiver interprets the sender's signals based on their own individual characteristics (Connelly et al., 2011; Ho & Astakhova, 2020; Ho et al., 2021). Recent studies on employees' behavior under uncertainty suggest that goal-related traits like passion, particularly in entrepreneurship, may influence how individuals regulate perceived uncertainty and make decisions (Griffin & Grote, 2020; Griffin et al., 2007). For example, Ho & Astakhova (2020) find that employees' perceived importance of performance to self-esteem is a critical boundary condition in the signaling process from leader to employee.

We therefore argue that employees' behavioral response to perceived uncertainty depends on their harmonious or obsessive passion. Harmoniously passionate employees experience positive feelings of deep absorption and cognitive engagement in their tasks and strive to learn as much as possible about them to pursue their personal mastery goals (Ho et al., 2011; Vallerand et al., 2007). Moreover, while passionate activities occupy an important place in their lives, harmoniously passionate people can move more flexibly between activities (Fredrickson, 2001, 2013; Pollack et al., 2020). These features stand against opportunity exploitation in highly uncertain situations.

Harmoniously passionate employees are more likely to disengage from uncertain situations and turn to other activities they are also passionate about (Fredrickson, 2001; Vallerand et al., 2014), rather than relentlessly pursuing an opportunity with unclear

outcomes. Since they are in autonomous control of their passion (Vallerand et al., 2003), we argue that harmoniously passionate individuals are less likely to get entangled in highly uncertain opportunities, which entail risks that may dampen the positive experiences associated with harmonious passion. Instead of overcommitting to exploiting an uncertain opportunity, harmoniously passionate individuals may prefer to explore alternative opportunities, allowing them to maintain their harmonious passion. Hence, we hypothesize that harmoniously passionate employees are even less motivated to exploit opportunities under high uncertainty.

Hypothesis 4a:	*Employees' harmonious passion moderates the relationship between perceived uncertainty and exploitation behavior such that higher harmonious passion enhances the negative effect of perceived uncertainty on employees' tendency to exploit opportunities.*

The same mechanisms that cause harmonious passion to increase the negative effect of uncertainty on exploitation should also increase the positive effect of uncertainty perception on exploration. Based on their enhanced mastery goal orientation (Vallerand et al., 2007), harmoniously passionate employees should strive to overcome uncertainty through further exploration, given that exploration enhances the relevant knowledge and improves related skills. Moreover, harmonious passion accompanies enhanced cognitive flexibility, lowering exploration costs (Isen, 2000). Furthermore, as harmonious passion enables individuals to disengage from a singular activity, exposure to multiple stimuli can expand an individual's potential opportunity space (Fredrickson, 2013). Accordingly, exploration of uncertain opportunities resonates with harmoniously passionate employees' motivation for mastery goal orientation (Vallerand et al., 2007), and the prospective outcome of exploration becomes more

valuable to them. When the burden of an activity is reduced and the value augmented, it becomes more likely that an individual will pursue this activity (Vroom, 1964; Wigfield & Cambria, 2010). Consequently, we argue that harmonious passion will enhance the positive effect of uncertainty perception on employees' exploration behavior.

Hypothesis 4b:	*Employees' harmonious passion moderates the relationship between perceived uncertainty and exploration behavior, such that higher harmonious passion enhances the positive effect of perceived uncertainty on employees' tendency to explore opportunities.*

Obsessively passionate employees have an externally controlled internalization of passion, enhancing feelings of pressure to engage in the underlying activity (Vallerand et al., 2003). They are rather controlled by their passion rather than in control of it. While the intense drive to engage in passionate activities can reduce positive affect and increase negative affect (Vallerand et al., 2010), it should also reduce the impact of uncertainty perceptions in the decision to exploit an opportunity. Obsessively passionate employees are more persistent in taking advantage of opportunities, even if it involves a high degree of uncertainty (Bélanger et al., 2013; Vallerand et al., 2010). They want to pursue an opportunity no matter the costs or consequences. Accordingly, employees may perceive (signal-based) uncertainty but disregard it because it does not fit their obsessive inclinations. Their cognitive elaboration of uncertainty becomes more superficial, and they even tend to downplay the potential negative consequences associated with pursuing a highly uncertain opportunity (Bélanger et al., 2019). For this reason, the adverse effects of uncertainty on opportunity exploitation should be less prevalent among obsessively passionate employees.

Hypothesis 4c:	*Employees' obsessive passion moderates the relationship between perceived uncertainty and exploitation behavior such that higher obsessive passion reduces the negative effect of perceived uncertainty on employees' tendency to exploit opportunities.*

We argue that the same mechanisms of obsessive passion to reduce the negative effect of uncertainty on exploitation should also reduce the positive effect of uncertainty perception on opportunity exploration. Since individuals with obsessive passion are controlled by their passion, the associated compulsive experience of anxiety, pressure, and guilt (Pollack et al., 2020; Vallerand et al., 2014) should outweigh the anxiety inherent in uncertainty and reduce employees' urge to mitigate their perceived uncertainty inherent in opportunities through exploratory behavior. Further, obsessively passionate employees are less alert to the anxiety associated with uncertainty because their obsessive passion narrows their cognitive attention and pushes them to think about and rigidly pursue their passion (Donahue et al., 2012; Vallerand et al., 2007). This cognitive rigidity makes them less able and willing to explore other opportunities – even when uncertainty is perceived as high. Moreover, their obsessive passion monopolizes their thinking and thus makes it hard for them to shift their attention (Ho et al., 2011) and embrace novel opportunities. Obsessively passionate individuals will more likely disregard the possibility of engaging in information searches associated with opportunity exploration as they are less open to external feedback (Kakarika et al., 2022). For these reasons, the positive effects of uncertainty on opportunity exploration should be less prevalent among obsessively passionate employees.

Hypothesis 4d:	*Employees' obsessive passion moderates the relationship between perceived uncertainty and exploration behavior, such that higher obsessive passion reduces the positive effect of perceived uncertainty on employees' tendency to explore opportunities.*

3.4 METHODOLOGY

We conducted two metric-conjoint experiments to assess the role of leaders' entrepreneurial passion as a signal in employees' decision-making under uncertainty. Entrepreneurship research has widely used conjoint studies (Moser et al., 2017; Scheaf et al., 2018; Zhu & Newman, 2022) as they are particularly suitable for investigating decision-making processes and resistant to potential biases associated with survey data, e.g., self-reporting biases (Choi & Shepherd, 2004; Lohrke et al., 2010; Shepherd & Zacharakis, 2018).

In our first conjoint experiment (Study 1), we manipulated signals of entrepreneurial leaders' passion type and strength and tested the effects on employees' perceived uncertainty and the decision to exploit or explore business opportunities. While Study 1 suggests that leaders' passion signals affect employees' uncertainty perception and subsequent decision-making, we did not manipulate them; rather, we assessed employees' uncertainty perception and decision for exploitation and exploration. Considering the theorized mediating effect of leaders' passion signals on the decision to exploit or explore business opportunities, we chose to conduct a complementary conjoint experiment. Therefore, within the second conjoint experiment (Study 2), we examine how employees' uncertainty perception (manipulated independent variable) affects the decision to support leaders' exploitative or explorative actions. We followed the recent recommendations of Hsu et al. (2023) to observe mediating effects with the help of multiple experiments. Thus, we decided to not only measure the mediating variable of uncertainty perception in Study 1 but also to manipulate perceived

uncertainty in Study 2. This allows us to replicate, validate, and expand our empirical setup and avoid endogeneity issues arising from the simultaneous measurement of multiple dependent variables (B. S. Anderson et al., 2019).

3.5 STUDY 1

3.5.1 Design and Sample

For the first conjoint experiment, we sampled data from start-up employees with the help of a professional German panel provider (Cint). We asked participants to self-validate their current company as a start-up. In addition, we controlled for start-ups that have been operating for less than ten years and have under 250 employees. All respondents who have completed the questionnaire received a small compensation for participating in this experiment.

We instructed participants to imagine that they are working for a start-up and that their CEO has assigned them to assess new business opportunities. Evaluating these business opportunities may help the start-up choose the best opportunity to scale the company. For each business opportunity, we provided participants with manipulated information about the leader's passion type and strength of this passion signal. Additionally, we provided information on the feasibility and desirability of the business opportunity in each scenario as manipulated control variables, thus enhancing the credibility of our conjoint experiment consistent with previous studies (Volkmer et al., 2024; Warnick et al., 2018). After reading each scenario, employees indicated their level of perceived uncertainty. They stated whether to suggest to their entrepreneurial leaders to either exploit the presented business opportunity or explore other business opportunities. Before the experiment, all participants read definitions for all four manipulated attributes and received a practice scenario to familiarize themselves with the decision situation at hand. The final conjoint experiment comprises 16 conjoint scenarios (four attributes with two levels each), which we chose to partially replicate to minimize participants' response fatigue by randomly picking four scenarios (Aiman-Smith

et al., 2002; Karren & Barringer, 2002), similar to prior studies (Fu et al., 2022; Kier & McMullen, 2018). Altogether, participants thus evaluated 21 conjoint scenarios.

In total, we obtained 169 complete responses, of which 90 remained after controlling for sample criteria, response duration, and carelessness (Meade & Craig, 2012). Thus, we have 1440 decisions nested within 90 individuals, which should provide robust results for our analyses (Scherbaum & Ferreter, 2009). On average, participants were 36.81 years old, 64.0% were female and had been working for 3.51 years at their current company, which is 5.11 years old (mean firm age) and has 23 employees (mean firm size). With 30% each, most participants have completed vocational training or received a university degree.

3.5.2 Measures

Manipulated Independent and Control Variables (Level 1). We carefully manipulated our independent variables based on prior research (Fu et al., 2022; Scheaf et al., 2018). All attributes differed in two dimensions. Entrepreneurial leaders' passion type was either "harmonious" (coded 0) or "obsessive" (coded 1), while passion strength was set to "moderate" (coded 0) or "strong" (coded 1) (Fu et al., 2022; Vallerand et al., 2003). We derived both passion strength and type descriptions based on Vallerand et al.'s (2003) conceptualization and measurement of dualistic passion. The feasibility and desirability of business opportunities were presented as "high" or "low" (see Appendix A-3). We thoroughly pre-tested our conjoint experiment by conducting six interviews with start-up employees using a think-aloud approach to ensure that the scenarios and manipulated variables are well understood (Volkmer et al., 2024). Furthermore, they validated the relevance of our manipulated attributes, pointing out that the perception of their leader's passion plays a vital role in their uncertainty perception in everyday work. Lastly, interviewees articulated their understanding of our experiment and indicated any issues.

In addition to the conjoint experiment, participants responded to a post-experiment questionnaire. All items in Study 1 were translated from English into German using a double

back-translation procedure (Brislin, 1980), supported by researchers in our network (Schaffer & Riordan, 2003). All items were assessed using a 7-point Likert scale.

Dependent Variable - Uncertainty Perception. After reading each profile, participants indicated their level of perceived uncertainty when evaluating the displayed business opportunity, responding to the statement, "I am very uncertain about this business opportunity.". We created this measure based on the conceptualization of state uncertainty associated with the perceived unpredictability of the environment during decision-making (Milliken, 1987). This follows prior studies on uncertainty perception in entrepreneurship (McKelvie et al., 2011; McMullen & Shepherd, 2006; Schmitt et al., 2017). The scale ranged from 1 (not at all) to 7 (fully agree).

Willingness for Exploitation and Exploration of Business Opportunities. After assessing employees' perceived uncertainty, we asked participants to rate their tendencies regarding exploiting the business opportunity and exploring further business opportunities. To measure employees' willingness to exploit business opportunities, we adopted the measurement of willingness to exploit given opportunities by McKelvie et al. (2011) from the employee perspective. Thus, participants indicated if they would actively propose the displayed business opportunity to their leader for exploitation, answering to a single item: "It is very likely that I would actively propose to exploit this business opportunity". Turning to employees' willingness to explore business opportunities, we adapted an item for explorative behavior by (Zacher et al., 2016), i.e., "Searching for new possibilities with respect to my work" (p. 16), shifting its focus from an organizational to an entrepreneurial setting. Hence, participants were asked to indicate their willingness to explore other opportunities, i.e., "It is very likely that I would prefer to explore other business opportunities". Both variables were measured on 7-point Likert scales.

Moderator Variables – Employee Harmonious and Obsessive Passion (Level 2). We measured employees' entrepreneurial passion by adapting the dualistic passion scale (Marsh

et al., 2013). We adjusted the wording of the original items from "activity" to "job" to be more relevant to employees' work situations. Example items include "My job is in harmony with the other activities in my life" for harmonious employee passion and "I have almost an obsessive feeling for my job" for obsessive employee passion. Both employee obsessive and harmonious passion scales showed good internal consistency (Cronbach's α for harmonious passion = 0.83; for obsessive passion = 0.86).

Control Variables (Level 2). Besides employees' age and gender (coded 0 = male, 1 = female), we assessed several control variables that may potentially affect employees' uncertainty perception such as an employee's prior working experience, experience as a leader, and entrepreneurial experience (McMullen & Shepherd, 2006; Shane & Venkataraman, 2000). In addition, we controlled for respondents' firm size and firm age.

3.5.3 Results Study 1

To evaluate the test-retest reliability, we followed best practice recommendations by Schüler et al. (2023). First, we calculated ICCs (ICC 3k) for all dependent variables, which range from 0.56 to 0.58 on average. Further, we examined slope differences between rounds, which indicate no significant differences. Considering these parameters, we conclude that the findings in this study yield acceptable reliability.

Table 3-1 presents the means, SDs, and correlations for all dependent variables and level 2 variables for Study 1. We calculated variance inflation factors (VIFs) to control for multicollinearity. All VIFs were below 1.8, thus we inferred that multicollinearity was not a problem for our analysis (O'Brien, 2007)

Table 3-1: Means, standard deviations, and correlations (Study 1)

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
1. Uncertainty Perception	3.88	1.63										
2. Exploration	4.56	1.58	0.30**									
3. Exploitation	4.29	1.58	-0.23**	-0.08**								
4. Gender	0.64	0.48	0.00	0.04	-0.02							
5. Working Experience	12.87	10.01	-0.01	0.02	-0.01	0.02						
6. Firm size	23.84	33.75	0.06*	0.04	-0.02	0.08**	-0.19**					
7. Firm age	5.11	3.05	-0.06**	-0.03	-0.05	-0.14**	0.18**	-0.06**				
8. Entrepreneurial Experience	0.22	0.42	-0.00	0.05*	-0.03	-0.05*	0.03	-0.21**	-0.11**			
9. Leader Experience	3.94	3.94	-0.01	0.06*	-0.04	-0.23**	0.39**	-0.07**	0.25**	0.09**		
10. Employee Harmonious Passion	5.03	0.98	-0.00	0.02	0.07**	0.13**	0.11**	0.05*	-0.11**	0.05*	0.13**	
11. Employee Obsessive Passion	3.03	1.30	0.04	0.01	0.16**	-0.08**	-0.23**	0.12**	-0.22**	0.13**	-0.04	0.00

***Note*: *M* and *SD* represent mean and standard deviation, respectively. We only report correlations between dependent variables and individual-level measured variables on Level 2, as Level 1 correlations are zero due to our conjoint experiment design employing an orthogonal design. * Correlation is significant at the $p < .05$ level (2-tailed), ** Correlation is significant at the $p < .01$ level (2-tailed).

We employed multilevel structural equation models using the lavaan package in R (Rosseel, 2012) to match the data structure of conjoint experiments. All non-binary control and moderator variables were z-standardized to ease interpretation. Table 3-2 presents our model testing the effects of leaders' passion signals on uncertainty perception (Model 1). We find significant effects for leaders' passion type increasing employees' perceived uncertainty ($B = 0.11$, $p < .05$). In addition, we find that passion strength reduces employees' uncertainty perception ($B = - 0.15$, $p < .01$). Therefore, both hypotheses H1 and H2 are supported. Considering our manipulated controls, we find that feasibility and desirability reduce uncertainty perception (feasibility: $B = - 0.38$, $p < .001$; desirability: $B = - 0.41$, $p < .001$).

Table 3-2: Regression models for direct and indirect effects (Study 1)

	Model 1: Uncertainty Perception			**Model 2: Exploration**			**Model 3: Exploitation**		
Variable	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
Direct Effects									
Passion Type	0.11	0.051	.027*	-0.04	0.079	.573	-0.12	0.079	.124
Passion Strength	-0.15	0.053	.004***	-0.20	0.093	.036*	0.17	0.076	.031*
Feasibility	-0.38	0.069	<.001***	-0.18	0.123	.139	0.36	0.148	.015*
Desirability	-0.41	0.069	<.001***	-0.20	0.121	.098	0.36	0.134	.007**
Uncertainty Perception				0.30	0.098	.002**	-0.32	0.123	.009**
Interaction Effects									
Obsessive Passion X Uncertainty Perception				-0.00	0.09	.969	0.29	0.115	.012*
Harmonious Passion X Uncertainty Perception				0.17	0.107	.122	-0.28	0.126	.027*
Controls									
Working experience [a]	0.01	0.057	.842	-0.03	0.069	.653	0.02	0066	.72
Gender	0.00	0.105	.969	0.20	0.137	.153	-0.03	0.15	.82
Firm age [a]	-0.06	0.05	.209	-0.00	0.057	.939	0.02	0.054	.732
Firm size [a]	0.07	0.029	.017*	-0.07	0.058	.26	-0.12	0.077	.127
Entrepreneurial experience	0.01	0.1	.894	0.25	0.136	.068	-0.18	0.137	.196
Leader experience [a]	0.01	0.045	.787	0.1	0.072	.169	-0.09	0.069	.178
Model coefficients									

Robust CFI	0.993
Robust TLI	0.979
RMSEA	0.012
Number of observations	1440
Number of Clusters (id)	90

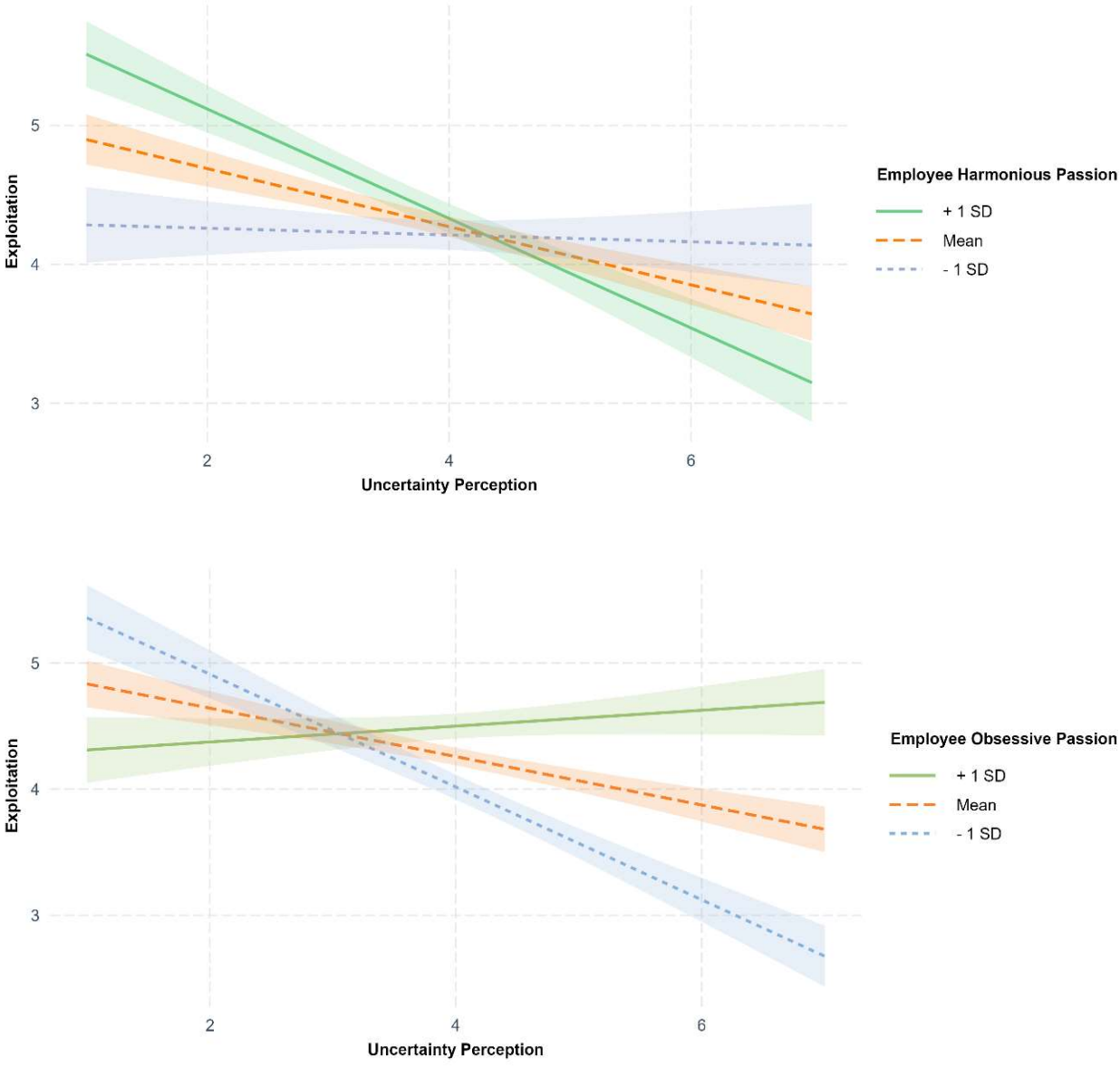
***Note*:** *B* = unstandardized regression coefficients; SE = cluster robust standard errors. * *B* is significant at the $p < .05$ level, ** *B* is significant at the $p < .01$ level, *** *B* is significant at the $p < .001$ level. For passion strength, 0 = low, 1 = high; For passion Type, 0 = harmonious, 1 = obsessive; For feasibility and desirability, 0 = low, 1 = high. For gender, 0 = male, 1 = female. [a] z-standardized controls and moderator variables.

We further specified models regarding the effects of uncertainty perception on subsequent employees' willingness to exploit and explore business opportunities (see Table 3-2). Our results indicate that uncertainty perception reduces exploitation ($B = - 0.32$, $p < .01$), and increases exploration ($B = 0.30$, $p < .01$), supporting hypotheses H3a and H3b.

We investigated the function of employees' dualistic passion as a moderator in dealing with uncertainty perception. Table 3-2 presents our models for all interaction effects. In support of hypotheses H4a and H4c, we find significant moderations of employees' harmonious ($B = - 0.28$, $p < .05$) and obsessive passion ($B = 0.29$, $p < .05$) on the relationship between uncertainty perception and exploitation. High levels of harmonious passion strengthen the negative effect of uncertainty perception on exploitation, while obsessive passion increases the negative effect of uncertainty perception on exploitation. More precisely, employees' harmonious passion negatively moderates the effect of uncertainty perception on exploitation when employees' harmonious passion is around the mean level ($B = - 0.21$, $SE = 0.02$, $p < .001$) and + 1 SD above the mean ($B = - 0.39$, $SE = 0.03$, $p < .001$). In addition, the positive moderation effect of obsessive passion on the relationship between employees' perceived uncertainty and exploitation is significant - 1 SD below the mean ($B = - 0.45$, SE = 0.03, $p < .001$) and around the mean level ($B = - 0.19$, $SE = 0.02$, $p < .001$). Turning to exploration, we do not find significant interactions of employees' dualistic passion

on the relationship between uncertainty perception and exploration (Table 3-2, harmonious passion: $B = 0.17$, p = ns; obsessive passion: $B = -0.00$, p = ns), hence rejecting hypotheses H4b and H4d. Visualizing our findings for interaction effects, we further conducted simple slope analyses for all significant moderation effects (see Figure 3-2).

Figure 3-2: Simple slope analyses for interaction effects (Study 1)



3.5.3 Additional Analyses

We further assessed employees' uncertainty perception as a mediator between leaders' passion signals (passion strength and passion type) and our independent variables, i.e., exploitation and exploration. We find that uncertainty perception fully mediates the effects of leaders' passion type on employees' exploitation and exploration tendency, but only partially mediates the effects of passion strength on exploitation and exploration.

Furthermore, we implemented a series of robustness checks. First, we additionally controlled for participants' positive and negative affect during the decision-making procedure, which may affect their perceived uncertainty (E. C. Anderson et al., 2019). Second, we controlled for outliers based on respondents' mean deviations and compared outlier-eliminated data with our findings. Overall, all our findings remained stable and consistent for all robustness checks.

3.6 STUDY 2

3.6.1 Design and Sample

Similar to Study 1, we sampled start-up employees via a new panel provider (Consumerfieldwork), limiting potential biases from recurring respondents. We informed participants that they were working for a start-up, and the CEO tasked them with evaluating potential business opportunities for scaling. Further, we provided information on the feasibility and desirability of the business opportunities by assigning them as constant values in the scenario description (Shepherd & Zacharakis, 2018). In Study 2, we manipulated employees' perceived uncertainty levels after reading each business opportunity, i.e., their perceived state, effect, and response uncertainty (Milliken, 1987), to test their effect on exploitation and exploration. We manipulated each dimension of perceived uncertainty at two levels – high and low. Employing an orthogonal full design, we eliminated potential multicollinearity between types of perceived uncertainty and reduced the number of scenarios

to eight (Hahn & Shapiro, 1966). We fully replicated our conjoint experiment to increase estimation power; thus, respondents evaluated 16 scenarios in total.

We created two versions of our conjoint experiment to capture the nuances of environmental uncertainty (Milliken, 1987). We, therefore, differentiated between descriptions of perceived (Version 1) and objective uncertainty, i.e., uncertainty exists for each respondent (Version 2). Hence, versions marginally differed in the manipulation of perceived uncertainty. After data collection, we conducted a slope difference test, which did not indicate significant differences between versions. We therefore combined both versions into a full data set.

In total, 176 start-up employees participated in the conjoint experiment of Study 2. After filtering for careless responses, sample criteria, and response duration, our final data set consists of 92 participants (yielding 1472 observations; 53 participants in Version 1, 39 respondents in Version 2). On average, participants are 44.61 years old, 50% female, and 27.7% received a university degree. The start-ups they work for are, on average, 6.41 years old and employ 65 people. On average, they have been working for 4.43 years at their current company.

3.6.2 Measures

Manipulated Independent Variables (Level 1). We manipulated participants' uncertainty perception, i.e., state, effect, and response uncertainty, based on prior conceptualizations (McMullen & Shepherd, 2006; Milliken, 1987), distinguishing all attributes in "low" (coded 0) or "high" (coded 1) (see Appendix B-3).

Dependent Variables – Exploitation and Exploration. Identical to Study 1, respondents indicated if they would actively propose the displayed business opportunity to their leader for implementation (exploitation) or prefer to explore additional business opportunities (exploration). Both constructs were measured on a 7-point Likert scale using our adopted measures (McKelvie et al., 2011; Zacher et al., 2016).

Moderator Variables: Employee Harmonious and Obsessive Passion (Level 2). We replicated our measurement of employees' dualistic passion from Study 1 (Marsh et al., 2013; Vallerand et al., 2003). The scales for employees' dualistic passion showed good internal consistency (Cronbach's α for harmonious passion = 0.92; obsessive passion = 0.89).

Control Variables (Level 2). We employed identical control variables as in Study 1, thus controlling for respondents' age, gender (coded 0 = male, 1 = female), prior working experience, experience as a leader, and entrepreneurial experience.

3.6.3 Results Study 2

To test the test-retest reliability of our study, we calculated ICCs (ICC 3k) for both dependent variables, which exceeded 0.64 (on average). In addition, following recommendations by Schüler et al. (2023), we conducted simple slope differences for all dependent variables, which showed no significant differences. We therefore conclude that the findings yield reliable results. Table 3-3 shows means, SDs, and correlations for all Level 2 variables. We calculated variance inflation factors (VIFs) to control for multicollinearity. All VIFs are below 1.6, indicating no sign of severe multicollinearity (O'Brien, 2007).

Table 3-3: Means, standard deviations, and correlations (Study 2)

Variable	*M*	*SD*	1	2	3	4	5	6
1. Exploitation	4.02	1.59						
2. Exploration	4.76	1.44	-0.19**					
3. Gender	0.50	0.50	-0.04	-0.02				
4. Working Experience	20.02	10.58	-0.00	0.08*	-0.15**			
5. Leader Experience	6.52	6.94	0.04	0.04	-0.34**	0.49**		
6. Employee Harmonious Passion	5.00	1.20	0.18**	0.09*	-0.13**	0.13**	0.20**	
7. Employee Obsessive Passion	3.02	1.38	0.21**	-0.07	-0.26**	0.02	0.22**	0.21**

***Note*:** *M* and *SD* are used to represent mean and standard deviation, respectively. We only report correlations between dependent variables and individual-level measured variables on Level 2, as Level 1 correlations are zero due to our conjoint experiment design employing an orthogonal design. * Correlation is significant at the $p < .05$ level (2-tailed), ** Correlation is significant at the $p < .01$ level (2-tailed), *** Correlation is significant at the $p < .001$ level (2-tailed).

We fit hierarchical regression models employing the lme4 package in R (Bates et al., 2015) to test hypotheses H3 and H4. Table 3-4 presents all models testing the direct effects of uncertainty perception on exploitation and exploration.

Table 3-4: Regression models for direct and indirect effects (Study 2)

	Model 4: Exploration			**Model 5: Exploitation**		
Variable	*B (β)*	*SE*	*p*	*B (β)*	*SE*	*p*
Directs Effects						
State Uncertainty	0.29 (0.10)	0.066	<.001***	-0.77 (-0.24)	0.067	<.001***
Effect Uncertainty	0.33 (0.11)	0.067	<.001***	-0.83 (-0.26)	0.067	<.001***
Response Uncertainty	0.24 (0.08)	0.064	<.001***	-0.51 (-0.16)	0.066	<.001***
Interaction Effects						
Obsessive Passion X State Uncertainty	-0.30 (-0.14)	0.065	<.001***	0.28 (0.13)	0.068	<.001***
Obsessive Passion X Effect Uncertainty	-0.30 (-0.11)	0.065	<.001***	0.31 (0.14)	0.068	<.001***
Obsessive Passion X Response Uncertainty	-0.23 (-0.11)	0.064	<.001***	0.20 (0.09)	0.067	.003**
Harmonious Passion X State Uncertainty	0.32 (0.15)	0.065	<.001***	-0.12 (-0.05)	0.068	.087
Harmonious Passion X Effect Uncertainty	0.31 (0.15)	0.065	<.001***	-0.17 (-0.07)	0.069	.015*
Harmonious Passion X Response Uncertainty	0.20 (0.09)	0.065	.003**	0.05 (0.02)	0.068	.425
Controls						
Gender	0.02 (0.01)	0.189	.896	0.15 (0.05)	0.157	.337
Working experience	0.00 (0.03)	0.010	.675	0.00 (-0.02)	0.008	.679
Firm age	0.03 (0.05)	0.034	.459	0.02 (0.03)	0.028	.544
Firm size	0.00 (0.04)	0.001	.492	0.00 (0.06)	0.001	.172
Entrepreneurial experience	0.45 (0.11)	0.261	.084	0.33 (-0.07)	0.217	.126
Leader experience	0.01 (0.03)	0.016	.675	-0.01 (-0.03)	0.013	.563
Model coefficients						
R conditional		0.39			0.41	
R2 marginal		0.13			0.27	
RMSE		1.16			1.22	

Number of observations	1456	1456
Number of Clusters (id)	91	91

***Note*: B** = unstandardized regression coefficients; β = standardized regression coefficients; SE = cluster robust standard errors. * B is significant at the $p < .05$ level, ** B is significant at the $p < .01$ level, *** B is significant at the $p < .001$ level. For state, effect, and response uncertainty, 0 = low, 1 = high. For Gender, 0 = Male, 1 = Female. We use hierarchical regression models employing the lme4 package in R for all models.

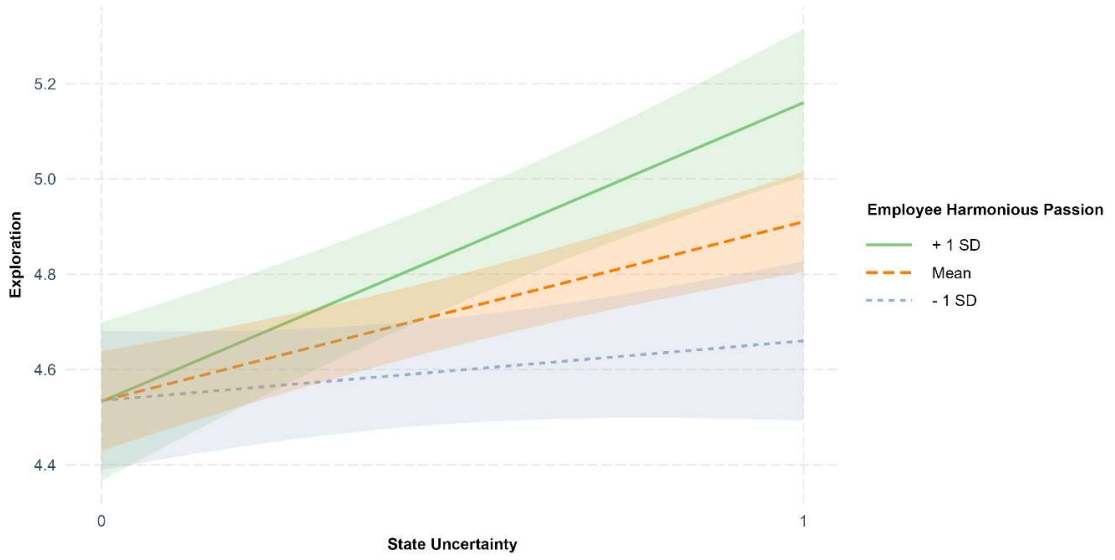
Our results show that state, effect, and response uncertainty negatively affect employees' tendency to exploit business opportunities (state uncertainty: $B = - 0.77$, $p < .001$; effect uncertainty: $B = - 0.83$, $p < .001$; response uncertainty: $B = -0.51$, $p < .001$). Further, we find that all dimensions of uncertainty perception are significantly and positively related to exploration (state uncertainty: $B = 0.29$, $p < .001$; effect uncertainty: $B = 0.33$, $p < .001$; response uncertainty: $B = 0.24$, $p < .001$), yielding support for hypotheses H3a and H3b.

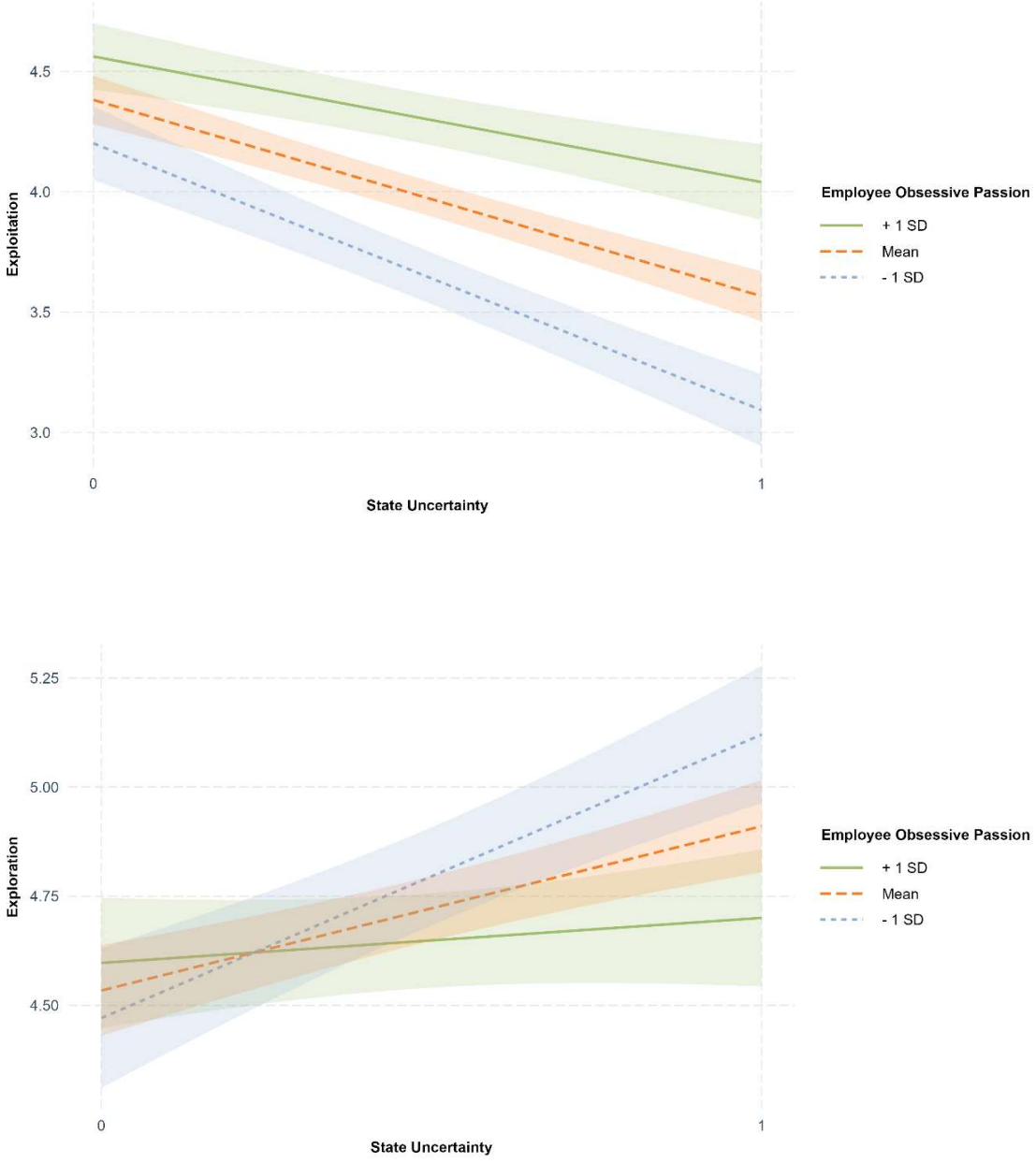
Considering hypothesis H4a suggesting a moderation effect of harmonious passion on state uncertainty and exploitation, we only find marginal support on the 0.1 level ($B = - 0.12$, $p = .087$). While the moderating effect of employees' harmonious passion on response uncertainty and exploitation is non-significant ($B = 0.05$, p = ns), our data indicates a significant moderation on effect uncertainty and exploitation ($B = - 0.17$, $p < .05$). Further, we find full support for hypothesis H4c, suggesting that employees' obsessive passion moderates the relationship between uncertainty perception and exploitation. In addition to state uncertainty ($B = 0.28$, $p < .001$), we find significant moderation effects for effect uncertainty ($B = 0.31$, $p < .001$), and response uncertainty ($B = 0.20$, $p < .01$) and exploitation. Furthermore, we find that employees' obsessive passion moderates the effect of state uncertainty on exploitation when obsessive passion is – 1 SD below ($B = - 1.11$, $SE = 0.10$, $p < .001$), around ($B = - 0.82$, $SE = 0.07$, $p < .001$), and + 1 SD above the mean level ($B = - 0.52$, $SE = 0.10$, $p < .001$).

Turning to exploration, our results indicate significant moderation effects for employees' harmonious passion for all dimensions of uncertainty perception and exploration (on state uncertainty: $B = 0.32$, $p < .001$, on effect uncertainty: $B = 0.31$, $p < .001$, on response uncertainty: $B = 0.20$, $p < .001$). Interaction plots indicate that employees' harmonious passion moderates the relationship between state uncertainty and exploration when harmonious passion is around the mean level ($B = 0.38$, $SE = 0.08$, $p < .001$) and + 1 SD above the mean level ($B = 0.63$, $SE = 0.11$, $p < .001$).

Lastly, our results indicate significant moderation effects for employees' obsessive passion on all dimensions of uncertainty perception and exploration (obsessive passion on state uncertainty: $B = -0.30$, $p < .001$; on effect uncertainty: $B = -0.30$, $p < .001$; on response uncertainty: $B = -0.23$, $p < .001$). Moreover, we find that employees' obsessive passion moderates the effect of state uncertainty on exploration when obsessive passion is – 1 SD below the mean level ($B = 0.65$, $SE = 0.11$, $p < .001$) and around the mean level ($B = 0.38$, SE = 0.08, $p < .001$). Hence, hypotheses H4b and H4d are supported. All simple slope analyses for significant moderation effects on state uncertainty are depicted in Figure 3-3.

Figure 3-3: Simple slope analyses for interaction effects (Study 2)





3.7.1 Additional Analyses

We conducted various robustness checks to enhance the reliability and credibility of our findings. Congruent with our analytical procedure in Study 1, we controlled for participants' positive and negative affect. Furthermore, we computed error outliers based on participants' responses' mean deviations and compared model results with our initial findings. Overall, all results remain stable for all robustness checks.

3.8 DISCUSSION

Our study provides novel insights into how and under which circumstances entrepreneurial leaders' passion signals stimulate employees' entrepreneurial decision-making at the uncertain start-up workplace, acknowledging that entrepreneurs' passion can have ambivalent effects on employee outcomes. Drawing on signaling theory (Connelly et al., 2011; Spence, 2002) and the dualistic passion model (Vallerand et al., 2003), we develop a theoretical model on the influence of entrepreneurs' passion signals on employees' uncertainty perception that determines their tendency to support the exploitation and exploration of business opportunities. We test our hypotheses in two complementary experimental studies and show that (a) signals of entrepreneurial leaders' passion type (harmonious and obsessive) can decrease or increase employees' uncertainty perception, b) signals of leaders' passion strength reduce employees' uncertainty perception, (c) employees' uncertainty perception is a causal mechanism linking entrepreneurial leaders' passion signals with employees' decision-making, and (d) the signaling and interpretation process is moderated by employees' dualistic passion. While we find strong empirical support for most of our hypotheses in both studies, the results pertaining to the moderation effects of employees' dualistic passion are mixed. We will discuss these findings and their contributions to research on passion and leadership in entrepreneurship.

3.8.1 Entrepreneurs' Passion Signals and Employee Behavior under Uncertainty

The examination of our model suggests that employees' cognitive elaboration of entrepreneurs' passion signals (passion type and passion strength) can either reduce or promote their uncertainty perception, which informs their decisions to support to exploit and explore opportunities in the uncertain work environment of entrepreneurship (Griffin & Grote, 2020; McMullen & Shepherd, 2006). This is of particular importance because employees essentially contribute to business success and competitive advantage through their

innovative behaviors, even if they did not co-found the company (Breugst et al., 2012; Wallace et al., 2013). So far, research has predominantly focused on role-based entrepreneurial passion signals and their effect on employee-level outcomes (e.g., Breugst et al., 2012; Hubner et al., 2020), while the limited studies on dualistic passion signals of leaders have mainly examined passion contagion (Ho & Astakhova, 2020; Ho et al., 2021). Therefore, overall, we have limited insights into how leaders' (dualistic) passion signals affect employees' decision-making.

Our results suggest that while signals of leaders' passion strength generally reduce employees' perceptions of uncertainty during decision-making, employees' perceived uncertainty also depends on leaders' passion type, signaling that passion is harmoniously or obsessively internalized. Consistent with our theoretical underpinnings, we observe that entrepreneurs' passion can serve as an uncertainty-reducing signal by indicating the entrepreneur's motivation by strongly displaying a passion for activities they seek to engage in but enhancing uncertainty perception when entrepreneurs signal an obsessive form of passion.

Moreover, our research enhances current theoretical considerations by presenting an integrative perspective that elucidates how and when entrepreneurial leaders' passion type and passion strength influence employees' perceptions and subsequent entrepreneurial behaviors. Considering the limited attention to the potential ambivalent effects of leader passion on employees' cognitions and work behaviors (Newman et al., 2021), we conclude that more research is needed on how entrepreneurs can harness the potential of their employees (Cardon & Stevens, 2004) and under which conditions they (unintentionally) mislead their employees through their passion signals. Moreover, entrepreneurs' passion signals could not only impact how employees process uncertainty regarding the execution of entrepreneurial tasks but also social uncertainty (FeldmanHall & Shenhav, 2019; Hogg, 2007), which could be the subject

of future studies, for example, in the context of employees' fairness perceptions (Van den Bos & Lind, 2002).

Investigating the consequences of leaders' dualistic passion signals and employee responses seems a fruitful avenue for future studies and has important practical implications for entrepreneurial leaders. Motivating their employees to behave in the interest of their business is a central task for entrepreneurial leaders (Vidyarthi et al., 2014), which is why entrepreneurial leaders need to send the appropriate signals to foster entrepreneurial thinking and acting in the face of uncertainty (Brundin et al., 2008).

3.8.2 The Mediating Role of Uncertainty Perception and Employees' Passion Inclination as a Boundary Condition in Employees' Decision-Making

Our results indicate that employees' uncertainty perception (partially) mediates how leaders' harmonious and obsessive passion signals affect employees' decision-making, and this effect is contingent on employees' passion inclination. Specifically, we show that while harmonious passion can enable employees to reduce perceived uncertainty, its obsessive form offers ambivalence, which counteractively increases perceptions of uncertainty and produces corresponding behavioral outcomes.

Thereby, our study contributes to the predominantly conceptual literature on employee work behavior under uncertainty (Griffin & Grote, 2020; Griffin et al., 2007) and provides empirical evidence on entrepreneurial leader passion as an antecedent of uncertainty perception, which is a key mechanism driving employee behavior in uncertain organizational contexts such as entrepreneurial firms. While we find that employees' uncertainty perception only partially mediates the effects of leaders' passion type and passion strength on employee outcomes, we encourage scholars to look further into these explanatory mechanisms for leaders' passion. Future studies should also consider the reverse effects of employees' uncertainty perception and subsequent actions on leaders' passion and uncertainty

perceptions. This would broaden our understanding of how receivers' feedback reciprocally affects the signaler (Connelly et al., 2011)

Moreover, we showcase how employees' passion inclinations alter the behavioral responses of employees under uncertainty in such that harmonious passion makes employees more receptive to signal-based uncertainty, while obsessive passion shields these effects. By demonstrating that employees interpret their leaders' passion signals according to their dualistic passion disposition, we add to the literature on passion as a signal (Ho & Astakhova, 2020; Mitteness et al., 2012) and contribute to the current discourse on cognitions in signaling (e.g., Drover et al., 2018). Previous research on employee passion (Breugst et al., 2012; Hubner et al., 2020) highlights that employees' lived passion can diverge from leaders' passion and alter their decisions to act entrepreneurially, potentially threatening venture growth and success. For example, Hubner et al. (2020) show that, among workers with high levels of passion at baseline, entrepreneurs' perceptions of passion do not alter their evaluation of entrepreneurial pursuits and conclude that a leader's expression of passion appears to be less influential for employees who are already passionate. Our results challenge this, as the adoption of the dualistic passion model shows that it is not only the presence of passion that matters but particularly its harmonious or obsessive nature. However, considering our mixed findings across both studies, more research is needed that considers employees' dualistic passion as a moderating factor in employees' decision-making under uncertainty.

3.8.3 Limitations and Future Research Directions

Although our multi-study design has several methodological advantages, some limitations exist. First, while both conjoint experiments offer solid internal validity and stable results across various robustness checks and model specifications, common limitations of conjoint experiments include reduced external validity and restrictions in the number of attributes (Karren & Barringer, 2002). In our study, we employ written descriptions for signals

of leaders' passion type and passion strength. While these signals become more directly accessible, this approach may affect the external validity of our findings. Prior studies have employed more observable forms of signals that refer to signalers' underlying qualities, e.g., leadership style (Connelly et al., 2011; Ho & Astakhova, 2020). However, we conducted several interviews with start-up employees before data collection to enhance external validity and secure their understanding of the signals' descriptions. We encourage scholars to replicate and adapt our study by employing other research designs to enhance our findings' external validity further.

Second, as we manipulated the signals of leaders' passion type and passion strength, we neglected additional facets of producing the signals for leaders, such as signal cost (Connelly et al., 2011). In addition, effective signaling processes depend on efficacious signals from signaler to receiver (Connelly et al., 2011). However, while obsessive passion is linked to emotional exhaustion and rumination (Burke et al., 2015), producing signals of obsessive passion may negatively affect entrepreneurial leaders and the signaling process overall. When obsessively passionate leaders constantly think about their passion and feel the urge to pursue it, the clarity of leaders' signals can become tarnished. While producing such signals is costly for the entrepreneurial leaders' well-being, we contend that leaders' passion type signals are signaled unintentionally as they represent their leaders' stable self-identity. Future research is needed to investigate how signal cost affects leaders' choice to produce signals. Further, leaders may be willing to produce intentional signals to cover and distort unintentionally produced signals, such as their representation of self-identity, to improve employee and firm outcomes. We deem this an exciting pathway for future research on signaling in entrepreneurship.

Lastly, our experimental setting limits our ability to detect dynamic relationships between passion and uncertainty. While we find that signals of leaders' passion type and

passion strength affect employees' uncertainty perception, our research design does not suffice to investigate reciprocal relationships of passion and uncertainty among employees and their leaders. We encourage future research to conduct longitudinal studies over more extended periods of time to gain a better understanding of the interplay of passion and uncertainty in entrepreneurial firms and test potential recursive effects. Considering the burgeoning research on team entrepreneurial passion (Cardon et al., 2017; Santos & Cardon, 2018), we conclude that a multilevel perspective may be even more fruitful in which mixed passion signals, a team's passion diversity (Cardon et al., 2017), and a team's adaptive coordination under uncertainty (Grote et al., 2018) could be examined. This would further contribute to our understanding of both team entrepreneurial passion and dealing with uncertainty, particularly when addressing the dualistic nature of passion (Vallerand et al., 2003).

3.9 CONCLUSION

Our findings suggest that signals of leaders' passion can influence employees' behavior when making decisions under uncertainty. Distinguishing leaders' passion signals into passion type and passion strength has severe implications for employees' perceived uncertainty and subsequent entrepreneurial action. Further, employees' passion disposition is a critical boundary condition for dealing with their perceived uncertainty. Thus, we introduce a more nuanced perspective of passion in dealing with uncertainty as both leaders' and employees' passion significantly shape the fortune of a start-up.

CHAPTER 4[5]

ANTECEDENTS AND BOUNDARY CONDITIONS OF EMPLOYEE UNCERTAINTY REGULATION PROCESSES: A REVIEW AND ORGANIZING FRAMEWORK

Abstract

Organizations navigate increasingly uncertain environments and must take risks to survive and improve their performance. However, while this has become an organizational reality, much remains to be uncovered about how employees perceive and respond to uncertainty in the workplace and the role their uncertainty regulation plays in this process. To identify the drivers, mechanisms, and boundary conditions of employees' uncertainty perceptions and responses, this literature review examines how uncertainty emanating from the organizational environment shapes employees' responses. By developing an organizing framework and mapping out key individual and contextual antecedents and boundary conditions of employees' uncertainty regulation, our findings reveal how uncertainty may be handled as an opportunity rather than merely a threat. This way, we offer promising avenues for future research and practical insights for the effective management of uncertainty in organizations.

[5] Chapter four is co-authored by Dr. Jens Schüler and Prof. Dr. Matthias Baum.

4.1 INRODUCTION

Uncertainty, defined as the unpredictability of events, is a fundamental challenge organizations face in today's dynamic business environments (e.g., Arend, 2024a; Knight, 1921; Townsend et al., 2018; Yin et al., 2024). However, despite several calls for research attesting its growing relevance (e.g., Alvarez & Porac, 2020; Alvarez et al., 2018; Arikan et al., 2020; Davidsson et al., 2023; Foss, 2023), prevailing perspectives still predominantly take a downside loss stance and view uncertainty as something to be avoided or mitigated rather than as a source of opportunity to be embraced (e.g., Bromiley et al., 2015; Crawford & Jabbour, 2024; Jauch & Kraft, 1986; McMullen & Shepherd, 2006). That is, the upside potential of uncertainty, such as stimulating innovation through positive and proactive responses of organizations and their employees (Alquist & Baumeister, 2022; Carpini et al., 2017; Kaul et al., 2024) remains largely overlooked (Bridge, 2021; Griffin & Grote, 2020; Griffin & Grote, 2022).

While organizations are confronted with increasing levels of uncertainty in both their strategic and operational activities (e.g., Dutt & John, 2019; Powell, 1992; Tung, 1979), the existing literature presents a mixed picture with diverse and sometimes conflicting views on how organizations and their employees actually perceive and respond to uncertainty (Griffin & Grote, 2020; McMullen & Shepherd, 2006; Shen et al., 2015; Smith & Lewis, 2011). This highlights the importance of consolidating the different perspectives on employee uncertainty regulation in order to create a coherent understanding and guide future research and practice. With the present study, we aim to bring clarity into these complexities by exploring the drivers and boundary conditions of the uncertainty perception and responses of employees, forming the backbone of organizations' venturing activities and strategic re-orientation efforts in uncertain environments (e.g., Griffin et al., 2007; Liu et al., 2024; Yin et al., 2024). Specifically, we look into the circumstances under which employees respond to uncertainty as

either a threat or an opportunity, offering indications on how it can be actively managed to achieve positive outcomes. To this end, we conduct a systematic literature review on the antecedents, mechanisms, and boundary conditions of employees' uncertainty perception and responses to develop an organizing framework for understanding employees' uncertainty regulation processes (see Figure 4-1).

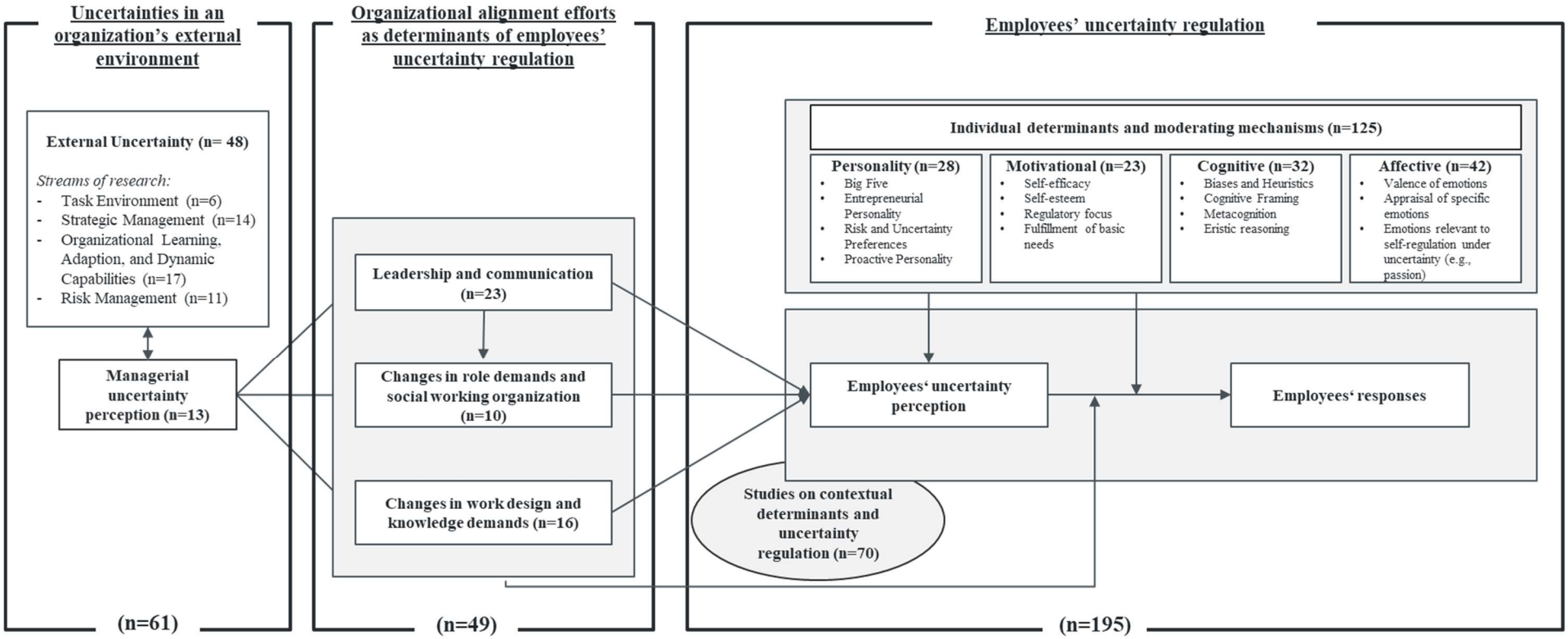
In this framework, we conceptualize uncertainty as originating from changes in the organizations' external environment, which are beyond the control of organizational actors and can present both threatening challenges and enabling opportunities (Covin & Slevin, 1989; Davidsson, 2015; Dess & Beard, 1984; Miller & Friesen, 1983; Rosenbusch et al., 2013). Taking an outside-in perspective (cf. Hambrick, 2007; Hambrick, 1975), these external changes are the primary sources of exogenous uncertainty perceived by top-level managers within organizations (Downey & Slocum, 1975; Downey et al., 1975; Duncan, 1972; Duncan, 1973; Milliken, 1987; Packard et al., 2017). Organizations respond to these uncertainties with various (re-)alignment efforts regarding their leadership and communication, changing role demands and social work organization, and work design and knowledge demands (Anderson & Paine, 1975; Fløvik et al., 2019; Powell, 1992; Slocum & Sims, 1980), which in turn, create further uncertainties for employees (Bordia et al., 2004a; Miller & Shamsie, 1999; O'Driscoll & Beehr, 1994). Given that employees' contributions are decisive for business development and strategic (re-)alignment efforts of ventures (Griffin et al., 2007; Liu et al., 2024; Yin et al., 2024), we focus on how employees perceive and respond to uncertainties, examining the antecedents and boundary conditions that determine whether they handle uncertainty as a threat or an opportunity (Griffin & Grote, 2020; Lipshitz & Strauss, 1997; Rafferty & Griffin, 2006).

We contribute to research on organizational behavior under uncertainty in two ways. First, we provide an organizing framework on employees' uncertainty regulation within

organizational environments by mapping out the relevant individual- and contextual determinants that illuminate how and under which boundary conditions employees handle uncertainty as either a threat or opportunity for proactive bottom-up change. By acknowledging the dual nature of uncertainty and identifying the conditions that enable the recognition of its upside potential, our framework transcends the prevailing 'downside loss' perspective and contributes to a broader theoretical understanding of how organizations can navigate uncertainty in a positive and opportunity-driven way.

Second, by offering an organizing framework of employee uncertainty regulation, our review lays the groundwork for future research. It encourages the investigation of the nuanced interactions between the uncertainties in employees' operational environments, their individual characteristics - such as personality traits, motivational, cognitive and affective aspects, and the structural and social factors in their operational environment. Understanding these interactions will illuminate how these aspects jointly shape employees' uncertainty regulation and enable organizational decision-makers to develop effective strategies to respond to uncertainty. In an overall effort to advance the uncertainty conversation, we aim to towards a new perspective on handling uncertainty, that is, to focus more extensively on the variety of opportunities in the concept of uncertainty that arise in dynamic contexts of organizational change and entrepreneurial venturing activities, rather than dwelling on the avoidance of the potential downsides of uncertain events.

Figure 4-1: Organizing framework of employees' uncertainty regulation



Note: The review included n=10 general calls for research on uncertainty and its effective management, which are not covered in the figure. For a more granular categorization of the studies refer to Appendix B.

4.2 METHOD AND SCOPE OF THE REVIEW

In conducting our systematic literature review, we followed the guidelines of Aguinis et al. (2018). We employed a two-pronged retrieval procedure to identify relevant studies on employees' uncertainty perception and responses across different levels of analysis.

First, we systematically searched for peer-reviewed, English-language articles in Business Source Premier (EBSCOHost) and Web of Science (Thompson Reuters) without time constraints (up until August 2024). To narrow our focus on management and entrepreneurship research, we initially limited our scope to peer-reviewed journals in the categories: general management (e.g., *Academy of Management Review*, *Academy of Management Journal*), entrepreneurship (e.g., *Entrepreneurship Theory and Practice*, *Journal of Business Venturing*), and applied psychology (e.g., *Journal of Applied Psychology*, *Frontiers in Psychology*). Given our interest in a comprehensive and multidimensional review, we also expanded our search beyond top-tier journals to include articles from leading European management journals (e.g., *European Management Journal*, *European Management Review*) and psychology-related fields such as cognitive and behavioral sciences (e.g., *Frontiers in Human Neuroscience*, *Cognition*). In total, we included 101 journals (a complete list of included journals and respective paper counts can be found in Appendix A-4). We performed a title, abstract, and subject search on our list of keywords (Nofal et al., 2018). We used "uncertainty" as the main keyword and connected it with "perception", "regulation", "management", "coping", "assessment," and "evaluation". We selected these keywords to capture the literature on various aspects of uncertainty regulation. Recognizing the interchangeable use of "uncertainty" and "risk" in the literature (Miller, 2009), we also aimed to include perspectives on risk perception and management. To ensure comprehensive coverage across different levels of analysis, we further connected these keywords with "employee", "manager", and "leader", as well as with terms related to various organizational

contexts like “work*”, “work environment”, “work design”, “job*”, “job design”, “orga*”, “orga* design”, “orga* environment”, “firm”, “firm environment”.

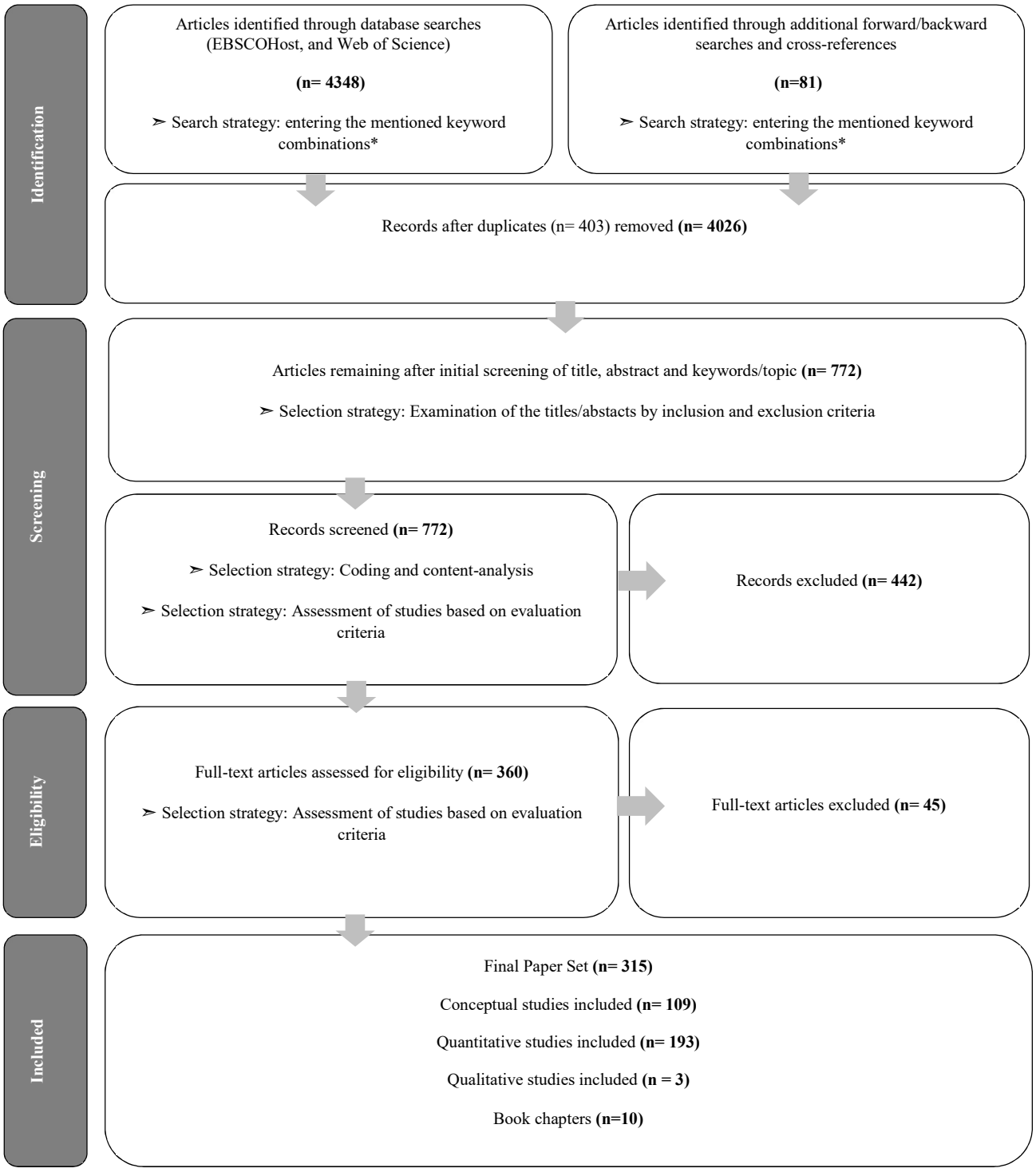
Second, we purposefully selected a set of peer-reviewed journals (Short, 2009), which had published the most relevant articles (e.g., *Academy of Management Journal*, *Journal of Applied Psychology*, *Journal of Management*), and conducted a systematic issue-by-issue to double-check our results. In addition, we executed forward and backward searches to include all relevant contributions, tracing papers citing key articles and those cited within them.

This preliminary search initially yielded 4026 potentially relevant papers (including articles and chapters). Next, we reviewed the abstract, and as necessary, the full text of the articles (Gao et al., 2016) to identify those that aligned with the scope of our review (Rietveld & Schilling, 2021). This initial screening yielded 772 potentially relevant papers, which were then subjected to the following exclusion criteria: (1) unclear or inappropriate definition of uncertainty; (2) narrow focus on risk conceptualization or measurement; (3) narrow focus on research methods or scale development; (4) research question not addressing external conditions affecting embedded organizational actors; (5) research question not centered on uncertainty perception and responses to uncertainty; and (6) articles specifically addressing entrepreneurial or intrapreneurial processes that are not applicable to general organizational contexts. After applying these criteria, 315 articles remained for further review, comprising 109 conceptual articles, 193 quantitative articles, 3 qualitative articles, and 10 chapters (see Figure 4-2 for an overview of the search and literature selection procedure). Lastly, we coded each paper according to article type (conceptual, quantitative, qualitative, or book chapter), level of analysis (e.g., uncertainties in an organization’s external environment (organizational level), organizational alignment efforts as determinants of employees’ uncertainty regulation (work-unit level), and employees’ uncertainty regulation (individual level)), and the focal topic and perspective related to antecedents and boundary conditions in employees’

uncertainty regulation (e.g., leadership and communication, personality). This coding process allowed us to take stock of the proposed antecedents, mechanisms, and boundary conditions of employees' uncertainty regulation on different levels of analysis.

Predicated upon the conceptual heterogeneity among the articles in our database, we chose an inductive approach to synthesize our findings. This narrative approach is the method of choice to develop new theoretical models, provide multi-theoretical perspectives on controversial issues, and present novel views on emerging issues in a field (cf. Baumeister & Leary, 1997). Drawing on our insights, we adopted an outside-in perspective (cf. Hambrick, 2007) as the organizing theme of our systematic review (cf. Figure 4-1) and mapped out individual and contextual determinants that illuminate how and under which conditions employees perceive and respond to uncertainty as a threat or an opportunity. In this process, we identified major categories and subcategories of the search results around three main content areas (see Appendix 4-B for a more granular sub-categorization of the papers): *Uncertainties in the organizational environment* (n = 61), *Organizational alignment efforts as sources of uncertainty* (n =49), *Employees' uncertainty regulation* (n = 195). Due to space constraints, we aimed to provide a representative rather than exhaustive review of the articles in each area. Consistent with prior work (e.g., Busenbark et al., 2016; Kish-Gephardt et al., 2022), our review directly references over 50% of the relevant articles identified. While we cite the over 92.5% of the studies in the main text, we refer to 23 additional potentially relevant articles in footnotes, representing the remaining 7.5%. We also complemented sections of our review by directing readers to additional relevant articles that look deeper into specific topics, including recent meta-analyses, articles recommended by subject experts, or cited in the sources identified during our search (Gao et al., 2016).

Figure 4-2: Complete search and literature selection procedure



4.3 RESULTS

In the following section, we present the theoretical perspectives of our organizing framework (see Figure 4-1) and identify key antecedents and boundary conditions of employees' uncertainty regulation. First, we start with a broad overview of research efforts to conceptualize and measure uncertainties in external organizational environments, and how the perception of these uncertainties by top-level managers prompt them to adjust strategies and introduce organizational alignment efforts that may, in turn, introduce further internal uncertainties. Second, we summarize these organizational alignment efforts that may influence employees' uncertainty regulation as antecedents and boundary conditions. Third, we organize how individual employees' characteristics may shape their responses to uncertainty. This analysis clarifies the current understanding of how individual and contextual factors may interact and influence employees' responses to uncertainty.

4.3.1 Uncertainties in the External Organizational Environment

Unpredictable changes and events in an organization's external environment are beyond the control of business leaders and lead to managerial perceptions of uncertainty (Knight, 1921; Milliken, 1987; McKelvie et al., 2011; Packard et al., 2017). Current research has made considerable progress in conceptualizing and measuring such (external) uncertainties (e.g., Covin & Slevin, 1989; Dess & Beard, 1984; Miller, 1992; Miller, 1993; Miller & Friesen, 1982)[6] and in understanding how top-managers perceive them (e.g., Downey et al., 1975; Downey & Slocum, 1975; Duncan, 1972; Duncan, 1973; Milliken, 1987)[7]. While uncertainty provides various strategic opportunities to redesign processes

[6] Additional studies on the conceptualization and measurement of (external) uncertainties: Arend, 2024b; Harris, 2002; Hrebiniak et al., 1980; Priem et al., 2002; Sharfman, 1991.

[7] Additional studies on the conceptualization and measurement of managerial uncertainty perceptions: Ashill & Jobber, 2010; Buchko, 1994.

(Berglund et al., 2020; Koberg, 1987; Miller et al., 1988), experiment and learn (Ehrig & Schmidt, 2022; March, 1991; Zellweger & Zenger, 2023), and capitalize on innovative opportunities (Davidsson, 2015; Yestrepsky et al., 2023), it is still primarily framed as a threat to business performance and survival (e.g., Bourgeois, 1985; Bromiley et al., 2015; Crawford & Jabbour, 2024; Furr & Eisenhardt, 2021; Jauch & Kraft, 1986)[8].

A long tradition of strategic and risk management research has focused on systematically predicting and reducing uncertainties (Drew & Terry, 2005; Miller, 1992; Hardy et al., 2020; Hagigi & Sivakumar, 2009; Schiller & Prpich, 2014). However, recent discourse suggests that concentrating solely on control- and prediction-focused approaches is no longer adequate for navigating today's dynamic business environments (e.g., Packard & Clark, 2020a; Packard & Clark, 2020b, Rindova & Courtney, 2020). This had led to calls for increased managerial risk-taking (Hoskisson et al., 2017), a stronger entrepreneurial orientation (Cowden et al., 2024, Liu et al., 2024; Lumpkin & Dess, 1996; Rauch et al., 2009; Rosenbusch et al., 2013; Simpson & Sariol, 2022), and the development of dynamic capabilities within organizations (Irwin et al., 2022; Teece & Leih, 2016; Teece et al., 2016) to handle uncertainty more proactively (Bridge, 2021; Clampitt et al., 2001; Griffin & Grote, 2020).

While adopting a proactive stance toward uncertainty and leveraging it as a catalyst for strategic change and innovation can be a promising strategy, it requires organizational (re-)alignment efforts (Lengnick-Hall & Beck, 2005; Powell, 1992; Slocum & Sims, 1980; Tung, 1979)[9]. These efforts lead to changes in employees' operational environment (Anderson & Paine, 1975; Hambrick, 2005; Hambrick, 2007; Hambrick & Crozier, 1985), which in turn,

[8] Additional studies on the conceptualization of uncertainty as risk or stressful threat to be avoided and mitigated: Cullen et al., 2013; Shrader et al., 1989; Slagmulder & Devoldere, 2018; Soltanizadeh et al., 2018.

[9] Additional studies on organizational re-alignment efforts in response to uncertainty: Argote, 1982; Argote et al., 1989; Ellis & Sphielberg, 2003; Leifer & Huber, 1977; Liao et al., 2011; McDonough & Leifer, 1983.

generate uncertainty among employees (e.g., Fløvik et al., 2019; Kim et al., 2013; O'Driscoll & Beehr, 1994; Rafferty & Griffin, 2009). Since employees' contributions are crucial for realizing positive and opportunistic approaches to uncertainty (Griffin et al., 2007; Liu et al., 2024; Yin et al., 2024), their ability to effectively regulate these uncertainties (Griffin & Grote, 2020; Rafferty & Griffin, 2009) is a critical prerequisite to exploit the potential of uncertainty-embracing strategic agendas.

4.3.2 Organizational Alignment Efforts as Determinants of Employees' Uncertainty Regulation

In our review, we identified three categories of organizational alignment efforts and corresponding change processes that can influence employees' uncertainty regulation (i.e., their perception and responses to uncertainty) as antecedents and boundary conditions: (a) leadership and communication, (b) role demands and the social organization of work, and (c) work design and knowledge demands.

Leadership and Communication. Leadership and communication of organizational change is a central determinant of employees' perceptions and responses to uncertainty throughout the organization (Allen et al., 2007; Bordia et al., 2004a; Bordia et al., 2004b). To align their employees with new organizational objectives, managers face the challenge to cultivate an awareness of uncertainty among employees and to effectively communicate a clear direction and catalyze effective action during uncertain times (Allen et al., 2007; Clampitt et al., 2001; Weed & Mitchell, 1980). Direct supervisors can manage employees' uncertainty perceptions and openness to changes by communicating implementation- and job-related information, while senior managers typically provide an engaging vision and strategic agenda, which helps employees to make sense of the unpredictability associated with changes (Allen et al., 2007; Hill & Levenhagen, 1995; Kraft et al., 2018; Schulz, 2011). A strand of research highlights the vital role of leaders in mitigating uncertainties by empowering

employees and fostering a sense of agency (e.g., Lang-Lehmann et al., 2024; Potosky & Azan, 2023; Sousa & Van Dierendonck, 2014), while also employing benevolent and supportive leadership styles, such as improved leader-member-exchange (LMX) (van Dam et al., 2021), ethical leadership (Sun et al., 2024), authentic leadership (Zhu et al., 2023), transformational leadership (Leuteritz et al., 2017), and visionary or servant leadership (Bernards, 2024; Sousa & Van Dierendonck, 2014). The findings illustrate the high impact of different leadership behaviors in managing employees' uncertainty regulation and driving positive organizational outcomes. Ethical leadership reduces uncertainty, leading to increased organizational citizenship behavior (OCBO), though this advantages can be diminished by close monitoring (Sun et al., 2024). In highly uncertain environments such as mergers and acquisitions (M&A), servant leadership appears to be a driver of work engagement, reducing (cognitive) uncertainty by fostering organizational identification and psychological empowerment (Sousa & Van Dierendonck, 2014). Authentic leadership effectively reduces employees' resistance to change by lowering their uncertainty perceptions. This effect is even more pronounced among employees with higher uncertainty avoidance, where the direct and indirect effects of authentic leadership turned out to be stronger (Zhu et al., 2023). Transformational leadership was also shown to reduce task uncertainties, which reflect unstable external demands, and this uncertainty reduction partially mediated the effect of transformational leadership on team effectiveness in R&D organizations (Leuteritz et al., 2017). Similarly, visionary leadership can reduce (change-related) uncertainty through an improved team cohesion, while servant leadership can reduce uncertainty via improved learning among employees (Bernards, 2023). In addition, research on leader-member-exchanges highlights how managers can facilitate uncertainty-embracing tendencies among employees by providing clear change-related information, and actively involving them in change processes, thereby addressing their emotional reactions and reducing uncertainty (Van

Dam et al., 2021). Research on social exchange shows that employees' general felt trust and trust in supervisors interact to reduce turnover intentions and improve job performance by decreasing work uncertainty (Colquitt et al., 2012; Skiba & Wildman, 2019), which emphasizes the critical responsibility of leaders to establish a climate of trust and psychological safety as a means to manage employees' responses to uncertainty (Allen et al., 2007; Edmondson, 1999).

In contrast to the research emphasizing the positive role of leadership and communication in managing uncertainty, there is also evidence that leadership and communication can lead to detrimental or ambivalent responses to uncertainty among employees. For instance, O'Driscoll and Beehr (1994) show that poor supervisory behavior can create role conflict and role ambiguity, increasing employees' uncertainty perceptions and leading to (dis-)satisfaction, strain, and turnover intentions. Similarly, authoritarian leadership similarly exacerbates feelings of uncertainty among employees, which suppresses their willingness to voice ethical concerns (Zheng et al., 2021). This negative effect can be somewhat mitigated when authoritarian leaders also demonstrate benevolence, reducing uncertainty and encouraging voice. Supervisors who express emotional ambivalence create an unpredictable work environment, which can diminish employees' task engagement, especially when the ambivalence is directed towards specific subordinates (Lim et al., 2021). This unpredictability, coupled with anticipated stress, further weakens engagement. Moreover, research on CEO narcissism illustrates another form of ambivalent leadership, where middle managers experiencing high levels of narcissism in their leaders perceive increased uncertainty during crises such as COVID-19 (Kim et al., 2021). This increased uncertainty drives them toward counterproductive coping strategies such as laissez-faire leadership and impression management, which can have negative implications for the management of operational changes. However, while some ambivalent leader behaviors can lead to negative

outcomes, others, such as ambidextrous leadership (Rosing et al., 2011), can have positive implications. For instance, Bernards (2024) demonstrates that while (cognitive) uncertainty can translate into innovative work behavior, this effect is dependent of the presence of ambidextrous leadership (Rosing et al., 2011), which effectively fosters closing and opening behaviors among employees to harness the creative potential inherent in uncertainty.

Changes in Role Demands and Social Work Organization. Strategic initiatives to regulate external uncertainties prompt changes in job roles (i.e., role ambiguity, role conflict, role over-/underload; Gilboa et al., 2008; Griffin et al., 2007; Kahn et al., 1964) and the social work organization (Fløvik et al., 2019; Grant & Parker, 2009; Hamman et al., 2023; Raveendran et al., 2020). These factors can serve as antecedents or boundary conditions in employees' uncertainty regulation (e.g., O'Driscoll & Beehr, 1994; Wu et al., 2019; Zettna et al., 2024). Research in these domains often draws on role stress theory (Kahn et al., 1964; Peterson et al., 1995), which views uncertainty as a negative stressor resulting from role-related changes (e.g., Keeley, 1977; O'Driscoll & Beehr, 1994; Schmidt et al., 2014) rather than as a potential opportunity for job design and enriching structural change (Ben-Ner et al., 2012; Griffin et al., 2007; Parker et al., 2017; Slocum & Sims, 1980). However, to meet emerging customer demands and technological opportunities, advances in work design research and increasing job uncertainty have shifted the focus from formalized job descriptions, roles and tasks to more dynamic conceptualizations (Griffin et al., 2007; Ilgen & Hollenbeck, 1991; Larsson & Bowen, 1989; Parker & Grote, 2022). Therefore, while prevailing research has largely focused on role stress theories to conceptualize uncertainty (Kahn et al., 1964), recent studies are increasingly recognizing the need to examine not only these traditional sources of uncertainty but also the expanding array of factors influencing employees' perception and responses to uncertainty on the operational level (Grant & Parker, 2009; Leach et al., 2013; Wall et al., 2002).

Since employees in modern organizations typically work in teams and need to manage uncertainty collaboratively, relational aspects between employees must also be considered to make sense of employees' uncertainty regulation (Diduc, 2022; FeldmanHall & Shenhav, 2019; Grant & Parker, 2009; Grote et al., 2018). One stream of research in this domain focuses on the social characteristics of employees' operational environment (e.g., social support, interdependence, and feedback), which are potentially relevant antecedents and boundary conditions in uncertainty regulation at the workplace (Humphrey et al., 2007; Morgeson & Humphrey, 2006). A supportive social work environment can be a critical resource for successful re-orientation processes among employees during uncertain changes in work routines. Support from supervisors and constructive feedback from co-workers can create a state of psychological safety (Edmondson, 1999) in a work group, which is assumed to be an important determinant in on individuals' willingness to seek out uncertainty for themselves and others by voicing new ideas, concerns and criticism (Carpini et al., 2017). Moreover, results of Zettna et al. (2024) show that co-worker instrumental support enhances role clarity, which is linked to reduced psychological distress and change fatigue, and increased job satisfaction. These positive effects amplified when employees worked with leaders exhibiting high role clarity.

As research continues to evolve, there is growing recognition that the increasing emphasis on individual employee contributions is also making social relationships more complex (Grant & Parker, 2009). This complexity is evident in highly political organizational environments, where complicated social relationships can increase psychological uncertainty, which in turn can negatively affect both promotive and prohibitive voice, even when psychological safety and felt obligation are accounted for (Li et al., 2020). However, job autonomy and job security can be resources in this context and play mitigating roles, reducing potential adverse effects of uncertainty on voice behavior. Different types of interdependence

between employees may also represent an antecedent and critical boundary condition in their uncertainty regulation, influencing how employees respond to uncertainty and how uncertainty can stretch out in work groups (Grant & Parker, 2009; Raveendran et al., 2018). For instance, task interdependence and emotion sharing, along with resilience were found to dampen the negative effects of uncertainty (measured as role ambiguities) on employees' creative behaviors (Clercq, 2019). On the contrary, group studies reveal that social uncertainty about the behavior of interdependent group members can also have negative implications and lead employees to prioritize self-interests over team interests, which can reduce the quality of team decisions (Sniezek et al., 1990; Sniezek, 1992). However, when team members receive feedback on each other's contributions, particularly on an individual level, resource allocations to the group increase significantly. This positive effect of feedback can be diminished if members express expectations about others' future contributions. Thus, in managing employee uncertainty, providing specific and individualized feedback can enhance cooperation and commitment under uncertainty, whereas setting clear social expectations may reduce the influence of feedback within working teams. However, although feedback is widely recognized as an effective tool to adapt to uncertainties (Ashford, 1986), evidence suggests that employees tend to seek feedback primarily when they are most in need of it (Anseel et al. 2015, Ashford et al., 2016). Additionally, several social preconditions such as interpersonal certainty must be met to encourage employees to actively seek out and make constructive use of feedback (Niemann et al., 2015). For instance, studies of Niemann et al. (2015) show that employees are less likely to seek feedback when they perceive high interpersonal uncertainty, especially if they feel powerful. This behavior is attributed to stronger ego-protective motives and weaker image-enhancement motives among powerful employees who feel uncertain about their interpersonal interactions.

Another strand of research focuses on the management of social uncertainties (FeldmanHall & Shenhav, 2019) through the lens of self-uncertainty management (Bradac, 2001; Cremer & Sedikides, 2009; Van den Bos, 2009a, Van den Bos, 2009b). While most studies in this area use proxies to imply uncertainty without directly measuring it (e.g., Rosen et al., 2011), we found a smaller number studies that explicitly investigate the uncertainty-reducing effects of group-identification (Hogg, 2009; Lian et al., 2022) or the role of uncertainty perceptions as a boundary condition in fairness perceptions (e.g., Lind & Van den Bos, 2002; Van den Bos & Lind, 2002; Wu et al., 2019)[10]. For example, Sun et al. (2023) studied 218 supervisor-subordinate pairs across 40 teams and found that distributive, procedural, and interactional justice climates interact with employees' psychological safety and creative self-efficacy, with justice climate affecting employee creativity through creative self-efficacy. Notably, these positive effects of on employee creativity were more pronounced in teams perceiving higher work uncertainty. In addition, a longitudinal study of Rodell & Colquitt (2009) found that employees' uncertainty perceptions moderated the impact of anticipatory justice and supervisory fairness regarding a policy ban. When employees perceived higher levels of uncertainty, the relationship between these factors and their support for the ban was stronger.

Changes in Work Design and Knowledge Demands. Internal change processes expose employees to new work designs (i.e., through changes in task variety, autonomy, feedback, task significance and task identity; Grant & Parker, 2009; Hackman & Lawler, 1971; Hackman & Oldham, 1976) and concomitant knowledge demands (i.e., job complexity, information processing, problem-solving, skill variety; Morgeson & Humphrey, 2006). These changes can lead to increased perceptions of uncertainty as employees must process new

[10] Additional studies on uncertainty management theory: Katsaros et al. 2014.

information and solve emerging problems (Humphrey et al., 2007; Morgeson & Humphrey, 2006; Tushman et al., 1978).

The Job Characteristics Model (JCM) of Hackman and colleagues has long been considered the gold standard for describing the structural composition of jobs (Fried & Ferris, 1987; Grant & Parker, 2009) and has been supplemented over time with additional characteristics like knowledge demands to reflect changes in the work environment (Humphrey et al., 2007; Morgeson & Humphrey, 2006). The baseline model emphasizes five structural characteristics of jobs (task variety, autonomy, feedback, task significance, and task identity) that are supposed to enhance internal work motivation, satisfaction and performance by increasing the experience of meaningfulness, responsibility, and knowledge of results (Hackman & Lawler, 1971; Hackman & Oldham, 1976). Although work design is often conceptually highlighted as key factor in managing uncertainty (Ben-Ner et al., 2012; Grant & Parker, 2007; Parker & Grote, 2022; Parker et al., 2017), our review indicates that the influence of these structural influences as antecedents or boundary conditions for employees' uncertainty regulation are not extensively explored. One of the few exceptions is a study by De Jong et al. (2015), which shows that job autonomy and job variety impact employees' entrepreneurial behavior, which involves a proactive approach to uncertainty. While job autonomy is positively related with entrepreneurial behavior, job variety is not. Additionally, structural characteristics like task identity and task significance contribute to the perceived meaningfulness of a job (Hackman & Oldham, 1976), which may help employees to make sense of uncertainty and uncover its positive value (Van den Bos et al., 2009a). Similarly, a longitudinal study of Cordery et al. (2010) suggests that interventions increasing team autonomy can transform the negative effect of task uncertainty on team performance into a positive one, where task uncertainty enhances performance post-intervention.

4.3.3 Individual Uncertainty Regulation of Employees

To organize the identified relevant antecedents and boundary conditions at the individual level that influence employees' uncertainty perception and responses, we categorize the results in broader (a) personality-based, and narrower (b) motivational, (c) cognitive, and (d) affective approaches to employees' uncertainty regulation.

Personality-Based Determinants of Uncertainty Regulation. Personality traits are enduring dispositions to exhibit certain responses across various situations (Paunonen & Aston, 2001). They are distal to behavior and are likely to affect behavior under uncertainty through more proximal cognitive, affective and motivational mechanisms (e.g., Downey et al., 1977; Frese & Gielnik, 2023; Frese & Gielnik, 2014; Johnson et al., 2012)[11]. The Big Five taxonomy (Costa & McCrae, 1988) is the most widely known personality taxonomy, proposing five broad dimensions (extraversion, openness for new experiences, conscientiousness, agreeableness, and neuroticism) that are used to describe human personality. Newer developments in personality neuroscience (Belkaid & Krichmar, 2020; DeYoung, 2013; 2015; DeYoung et al., 2007) explore the relationship between personality facets and relatively stable behavioral tendencies to seek out vs. avoid uncertainty. Their results indicate that the Big Five personality traits can be divided into two inter-correlated aspects – plasticity and stability – each with distinct biological substrates influencing uncertainty behavior (DeYoung et al., 2007; DeYoung, 2015). While extraversion and openness are associated with the plasticity factor and drive uncertainty seeking behavior, conscientiousness, agreeableness, and neuroticism are linked to the stability factor and drive uncertainty-avoiding/stability-seeking behavior (Gray & McNaughton, 2000; Quilty et al., 2014). In addition, this line of research underscores the importance to examine not just broad personality dimensions, but also their sub-facets (e.g., industriousness and orderliness within

[11] Additional studies on personality traits and psychological characteristics: Frese & Zapf, 1994.

conscientiousness, DeYoung et al., 2007). Studying these sub-facets provides a more accurate understanding of personality effects, as they can have distinct effects on outcomes and may show low (or even negative) inter-correlations, despite loading on the same broader personality dimension (DeYoung et al., 2007; DeYoung, 2015). These views are also supported by a management study of Lepine et al. (2006), which found that both conscientiousness and openness, along with experience influence decision-making performance before introducing unexpected rule changes in a task context. Before the changes, cognitive ability was the only predictor of decision accuracy. After the change, both conscientiousness and openness became significant, with high openness and low conscientiousness leading to better decisions. Notably, an examination of the personality effects at the facet level has revealed that the advantage of low conscientiousness was linked to orderliness traits, rather than traits related to industriousness and volition. Moreover, research shows that personality can affect employees' responses to uncertainty through more proximal affective and cognitive mechanisms (Johnson et al., 2012). Johnson et al. (2012) show across three studies that employees' personality determines how they engage in group-identification to manage uncertainty and enhance self-esteem. Neurotic employees tend to identify with groups cognitively to reduce uncertainty, while extraverted individuals engage in affective identification to improve their self-esteem. The studies show that neuroticism is linked to cognitive identification, whereas extraversion is associated with affective identification. In this regard, affective identification turned out to be a stronger predictor of positive outcomes such as organizational commitment, involvement, and citizenship behavior compared to cognitive identification. While research on broad personality traits as boundary condition in employees' uncertainty regulation is limited, Grant and Ashford (2008) suggest uncertainty reduction motivation as a mediator between ambiguity and proactive behaviors. They propose that neuroticism and openness to experience serve as key moderators in this

relationship, suggesting that employees who are more neurotic and highly open to experiences are more likely to engage in proactive behaviors compared to those who exhibit lower levels of these traits.

Moreover, Judge et al.'s (1999) study underscores the relevance of more specific personality traits, as they identify not only openness experience, but also more specific traits – such as locus of control, generalized self-efficacy, self-esteem, positive affectivity, tolerance for ambiguity, and risk aversion - as key antecedents of coping with change. Thus, to gain a comprehensive understanding of how personality influences employees' uncertainty regulation, it is essential to take a look on more specific individual characteristics. In this regard, we identified uncertainty or risk preferences (often also referred to as orientations, aversions, or tolerances) and proactive personality as main uncertainty-related personality traits in our review (e.g., Bateman & Crant, 1993; Desai et al., 2011; Shin & Kim, 2022; Sorrentino et al., 2009) [12], which potentially affect employees' uncertainty regulation as antecedent or boundary condition. For example, Desai et al. (2011) found that job satisfaction and performance are influenced by procedural justice, but these effects depend on employees' risk aversion. Risk-averse employees tend to react positively to fair procedures as they reduce uncertainty, while risk-seeking employees may not respond as positively, making risk aversion a key boundary condition in how employees respond to (social) uncertainty. In addition, a study of Shin and Kim (2022) indicates that employees' with proactive personalities were more likely to engage in advice-seeking and task crafting under uncertainty (measured via role ambiguity). These results suggest that uncertainty may serve as an

[12] Studies on potential further specific personality traits and psychological characteristics relevant to employees' uncertainty regulation: Locus of control and tolerance for ambiguity (Ashill & Jobber, 2013), (Organization-based) self-esteem (Hui & Lee, 2000), Risk-taking propensity (Sitkin & Pablo, 1992; Sitkin & Weingart, 1995), Self-construal (Wisse & Sleebos, 2016).

opportunity for proactive employees to take initiative and actively contribute to their work environment.

Understanding how personality affects employees' uncertainty regulation can be deepened by examining the link between personality and entrepreneurship, as being entrepreneurial is closely related with how individuals perceive and respond to uncertainty (Frese, 2009). This is important given that research suggests employees and entrepreneurs may not differ as much in personality traits associated with uncertainty as often presumed (Holm et al., 2013; Koudstaal et al., 2016). Meta-analyses have shown that the Big Five personality traits (except for neuroticism) are linked to business creation, an activity that implies bearing uncertainty (Rauch & Frese, 2007; Zhao & Seibert, 2006; Zhao et al., 2010). A central concept in this regard is the entrepreneurial orientation or personality of individuals (Howard & Boudreaux, 2014; Krauss et al., 2005), which includes traits such as learning orientation, achievement orientation, autonomy orientation, competitive aggressiveness, innovative orientation, risk-taking orientation, and personal initiative (Krauss et al., 2005). However, applied research also points to the importance of not only analyzing broad personality dimensions, but also taking a closer look at the facet level (Dijkstra et al., 2023; Lumpkin & Dess, 1996). For instance, Dijkstra et al. (2023) found an overall negative relationship between individuals' entrepreneurial orientation and decision-making under uncertainty, while these effects varied by subscale (risk-taking, innovativeness, and proactivity). While innovativeness and proactivity were negatively related to decision-making under uncertainty, risk-taking was positively related, which was attributed to differences in the sensitivity to potential gains and losses.

Motivational Determinants of Uncertainty Regulation. Motivational determinants of uncertainty regulation are grounded in the principles of psychological self-regulation (Carver & Scheier, 1998; Diefendorff & Lord, 2008; Griffin & Grote, 2020). They reflect self-

regulatory goal preferences or “standards”. These standards include beliefs about one's own competencies and are activated in uncertain situations to anticipate the future and guide further actions (Griffin & Grote, 2020; Karoly, 1993). Research on how motivational aspects shape uncertainty processing in general organizational contexts is in its nascent stages and still focuses mainly on very specific contexts such as retirement (e.g., Cabib et al., 2024; Harris et al., 2024; Rudolph & Zacher, 2024; Taneva & Peng, 2024) and responses to COVID-19 (Grote & Pfrombeck, 2020; Li & Griffin, 2022). This is particularly apparent as the notion of positively managing uncertainty and the broader concept of uncertainty regulation have only recently emerged in the academic discourse (Griffin & Grote, 2020; Griffin & Grote, 2022). However, the concept of uncertainty regulation (Griffin & Grote, 2020) suggests that motivational influences on uncertainty regulation are informed by well-established self-regulation theories such as self-efficacy (Hmieleski & Baron, 2008a), regulatory focus (Hmieleski & Baron, 2008b) and self-determination theory (Ryan & Deci, 2000). These well-researched theories provide a solid foundation in organizational and entrepreneurship studies, which we refer to in reviewing potential motivational determinants in employees’ uncertainty regulation.

Self-efficacy (Bandura, 1997; Bandura, 1982) reflects the confidence in one’s capabilities to handle various (and often unanticipated) tasks in uncertain situations, including both entrepreneurial venturing and organizational changes (e.g., Jimmieson et al., 2004; Schmitt et al., 2017). For instance, a longitudinal study of Jimmieson et al. (2004) showed that change-related information positively influenced employees’ well-being, job satisfaction, and client engagement through self-efficacy. Self-efficacy was also shown to play a stress buffering role, further enhancing client engagement and job satisfaction. In addition, entrepreneurship research suggests a positive impact of self-efficacy on various entrepreneurial behaviors such as the intention to start a business (Zhao et al., 2005) and

venturing behavior (Chen et al., 1998). Self-efficacy can buffer negative appraisals of perceived uncertainty and increase entrepreneurs' explorative behaviors (Schmitt et al., 2017). In this regard, self-efficacy is also a main component of composite self-appraisal measures like core self-evaluations (Judge et al., 2002) and psychological capital (Loghman et al., 2023; Luthans et al., 2007), which are considered as important antecedents and boundary conditions in effective responses to uncertainty in change contexts (Haynie et al., 2016; Hmieleski et al., 2015; Judge et al., 2002).

Regulatory focus theory (Higgins, 1998) examines how promotion-focused (seeking to align actual with ideal selves) and prevention-focused (seeking to minimize differences between actual and ought selves) goal frames impact self-regulation under uncertainty (Diefendorff & Lord, 2008). Halamish et al. (2008) show across three studies that individuals with a prevention focus reduced the perceived importance of negative outcomes much more significantly under uncertainty compared to participants with a promotion focus. In other words, individuals who are focused on security and obligations tend to downplay potential losses more strongly than those who focus on aspirations and advancement. This suggests that prevention-focused individuals are more sensitive to uncertainty regarding potential losses. Similarly, Kammerlander et al. (2015) found that CEOs with a promotion focus were more likely to engage in both exploitative and exploratory activities, especially under intense competition. In contrast, prevention-focused CEOs tended to limit their engagement in risky exploitative activities and were less involved in exploration. This view is supported by Hmieleski & Baron (2008b), who showed that in uncertain environments, entrepreneurs with a promotion-focus positively influenced venture performance, while those with prevention focus negatively impacted it (Hmielieski & Baron, 2008b). These effects where fully mediated by entrepreneurs' deviance from original business concepts. In stable environments,

however, no significant relationship was observed between regulatory focus and venture performance.

Self-determination theory (Ryan & Deci, 2000) posits that work behavior is driven by the fulfillment of basic psychological needs: competence, autonomy, and relatedness. The theory distinguishes between intrinsic motivation (i.e., behaviors that are inherently enjoyable and interesting), extrinsic motivation (i.e., behaviors linked to some external reward), and amotivation (i.e., behaviors that lack intention and motivation). Employees facing uncertainty due to changes in their operational environment could initially interpret emerging uncertainties as potential threats to their needs, but could also discover opportunities for need fulfillment. In this regard, Boudrias et al. (2020) found that the satisfaction of the need for autonomy moderated the relationship between uncertainty (measured via role ambiguity and role conflict) with turnover intentions, reducing turnover intentions in uncertain situations. In addition, the need for competence moderated the impact of role conflict on turnover intentions, while the need for relatedness showed no significant effect.

Cognitive Determinants of Uncertainty Regulation. Cognitive influences play a crucial role in uncertainty processing and decision-making (Beesley et al., 2015; Laureiro-Martinez, 2014; Laureiro-Martinez et al., 2019; Starbuck, 2009). Management and entrepreneurship scholars highlight the impact of cognitive processes in entrepreneurs' and managers' adaptive responses under uncertainty (Busenitz & Barney, 1997; Hodgkinson et al., 2023; Shepherd et al., 2015). A significant portion of this research focuses on cognitive biases and heuristics (e.g., Das & Teng, 1999; Gigerenzer & Luan, 2022; Grandori, 2023; Tversky & Kahneman, 1992). While early research primarily focused on the negative aspects of heuristics (Tversky & Kahneman, 1992), contemporary research recognize that heuristics can have both detrimental and beneficial implications for decision-making under uncertainty (for a review of cognitive heuristics and biases in entrepreneurship and management, refer to

Hodgkinson et al., 2023, and Zhang & Cueto, 2017). One the one hand, heuristics and biases are short-cuts that can lead to systematic errors and flawed decisions (Mitchell et al., 2011; Tversky & Kahneman, 1992). These cognitive shortcuts can result in oversimplified solutions or skewed perceptions, which can lead decision-makers to overlook critical information. On the other hand, heuristics can serve as an efficient way to update mental models (Feduzi et al., 2022; Kozyreva & Hartwig, 2021) and to make reasonable decisions without extensive analysis, which can be crucial in uncertain environments (e.g., Artinger et al., 2015; Gigerenzer & Luan, 2022; Luan et al., 2019; Mousavi et al., 2014). Commonly discussed heuristics include overconfidence (e.g., Burkhard et al., 2022), representativeness (e.g., Busenitz & Barney, 1997), and illusions of control (e.g., Keh et al., 2002; Schwenk, 1985). However, the field is constantly evolving, and there is also research on more niche heuristics such as hindsight bias (e.g., Werth et al., 2002) and superstitious thinking (Liu et al., 2023). Moreover, research on adaptive decision-making and risk-taking agrees that framing can significantly alter the outcomes of decision-making under uncertainty by shaping the perception of uncertainty and associated cognitive processes (e.g., Hodgkinson, 1999; Sitkin & Pablo, 1992; Sitkin & Weingart, 1995; Smit, 2023). For example, positive framing might encourage risk-averse behavior, while negative framing could lead to risk-seeking actions under uncertainty (Kahneman & Tversky, 1992). A new and notable concept in this area is eristic reasoning (Kurdoglu et al., 2023a; Kurdoglu et al., 2023b), which describes how decision-makers respond to uncertainty by blindly following their own desires based on self-serving illusory beliefs. The core idea of the eristic approach to uncertainty is that it can be more adaptive for decision-makers, especially under extreme uncertainty, to shift from rational to irrational and highly self-centered approaches. Thus, eristic in contrast to heuristic approaches to uncertainty, aim to achieve purely hedonistic goals without considering heuristic cues in the environment. Research on cognitive biases and heuristics in employees'

regulation of uncertainty remains limited, even though, like managers, employees are influenced by cognitive biases in their responses to uncertainty.

This is problematic as the findings in managerial and entrepreneurial contexts may be not fully applicable to the uncertainty experiences of employees within organizations. Unlike entrepreneurs and top-level managers, who can utilize their decision-making authority to manage uncertainties in the external organizational environment, most employees lower in the hierarchy are more focused on their immediate work environment and are likely primarily concerned about their influence within their own work group (Covin & Slevin 1989; Hambrick & Crozier, 1985; Ireland et al., 1987; Milliken, 1987). This disparity leaves a significant gap in understanding how cognitive biases and heuristics affect employees' navigation of uncertainty, despite their crucial role in organizational uncertainty management (Griffin & Grote, 2020).

While much research focuses on cognitive biases that inhibit adaptive cognitions under uncertainty, there is also significant work on controlled meta-cognitive processing of uncertainty (e.g., Haynie et al., 2010; Haynie et al., 2012). Anomalies such as unpredicted errors or uncertain novelties in the working environment can extend attention and inform ongoing decisions about how to act (Hirsh et al., 2012). In this complex cognitive process, uncertainty can either be evaluated as a threat or an opportunity (Griffin & Grote, 2020; Yestrepsky et al., 2023). Notably, Haynie et al. (2010) developed a framework detailing the adaptive metacognitive processes that enable entrepreneurs to reorganize existing knowledge structures and heuristics, promoting adaptability in the face of novel and uncertain decision contexts. Metacognitive adaptability, as defined in entrepreneurship and self-regulation literatures, is the ability to be dynamic, flexible, and self-regulating in one's cognitions in dynamic and uncertain environments (Karoly, 1993; Haynie et al., 2010; Haynie & Shepherd, 2009). Notably, metacognition is not seen as a stable trait, but rather as a learned skill that can

be developed through experience and training. As this line of research has only recently gained attention in entrepreneurship and management studies, employee perspectives remain largely unexplored.

Affective Determinants of Uncertainty Regulation. Research on affective determinants in uncertainty regulation can be categorized under the "valence-based" approach or the "appraisal tendency" approach (see Lerner et al., 2015 for a review). The valence-based approach suggests that positive affect, i.e., the tendency to generate positive emotions (e.g., joy, happiness) lowers risk perception, while negative affect (e.g., fear) increases risk perception under uncertainty (Forgas, 1995; Lerner et al., 2015). Positive affect also tends to foster creative and opportunistic responses to uncertainty, while negative affect tends to lead to controlled cognitive processing and conservative responses among managers and entrepreneurs (Bachkirov, 2015; Welpe et al. 2012). In contrast, the appraisal tendency approach explores how specific emotions - regardless of their valence - affect responses in uncertain environments differently, as each emotion is associated with different types of information and decision-making goals (Smith et al., 1985; Smith & Ellsworth, 1987; Lerner & Keltner, 2000; Lerner & Keltner, 2001). For example, fear typically drives risk-averse choices, whereas anger, despite being a negative emotion, can promote risk-seeking behavior under uncertainty (Lerner et al. 2015; Lerner & Tiedens, 2006). In this regard, Foo (2009) found that the risk perception of angry entrepreneurs resembles that of happy more than fearful ones, and that hope shares more similarities with fear than with happiness. However, while anger can motivate proactive responses to uncertainty, research suggests it can also diminish decision quality (Meissner et al., 2021). Further research on specific emotional influences indicates that sad individuals are more inclined to favor high-risk/high-reward options, while anxiety nudges them toward low-risk/low-reward options (Raghunathan et al., 1999).

Similar to research on cognitive influences, there is extensive research investigating the role of affect in uncertain entrepreneurial and managerial decision-making situations (e.g., Peters et al., 2006; Van Gelderen et al., 2015). The bulk this research links uncertainty with negative emotional reactions such as anxiety and doubt, which lead to avoidant responses (e.g., Carleton, 2016; Carleton et al., 2007; Hirsh et al., 2012; McMullen & Shepherd, 2006; Van Gelderen et al., 2015). However, our review reveals a more complex picture, indicating that negative emotional reactions to uncertainty can also drive positive outcomes such as increased motivation during reward pursuit (Shen et al., 2015), performance standards (Cervone et al., 1994), and the willingness to act – given that individuals critically evaluate potential pros and cons of self-threat (Reich et al., 2022).

Additionally, existing research often neglects that individuals regulate themselves in the pursuit of uncertain outcomes (Sansone & Smith, 2000a; Sansone & Smith, 2000b; Sansone & Thoman, 2005; Sansone, 1986) and can experience or even seek out positive affective reactions to uncertainty (Alquist & Baumeister, 2022; Anderson et al., 2019; Bar-Anan et al., 2009; Clark, 2018; Wilson et al., 2005). For example, Mayiwar et al. (2024) found that individuals can regulate their negative affective responses to uncertainty like anger and fear through self-distancing. Moreover, a few studies suggest that employees may embrace uncertainties inherent in novel situations, when they perceive tasks as intrinsically interesting and engage with them because they "want" to, rather than because they "should" (Milkman, 2012; Silvia, 2008). In this context, we identified employees' (dualistic) passion for work (Pollack et al., 2020; Vallerand, 2007) as a particularly important feature. Passion not only has action-guiding self-regulatory properties such as sustaining interest and curiosity (e.g., Lievens et al., 2022; Vallerand et al., 2023), but may serve as a motivational compass, guiding employees towards tasks they find stimulating and meaningful.

4.4 DISCUSSION AND AVENUES FOR FUTURE RESEARCH

Uncertainty is a pervasive challenge for organizations in today's dynamic business environments, often viewed primarily as a potential threat rather than an opportunity for innovation and growth (Bromiley et al., 2015; McMullen & Shepherd, 2006; Townsend et al., 2018). While existing literature offers diverse perspectives on how organizations and their employees regulate uncertainty, a coherent understanding is lacking (Griffin & Grote, 2020; McMullen & Shepherd, 2006; Shen et al., 2015; Smith & Lewis, 2011). Our study aims to bring clarity into these complexities by exploring the antecedents and boundary conditions of uncertainty perception and responses among employees. Specifically, we investigate when employees may handle uncertainty as a threat or an opportunity, which is crucial for implementing strategic responses and managing it effectively (Griffin & Grote, 2020; Yestrepsky et al., 2023). By conducting a systematic literature review, we develop an organizing framework that integrates individual and contextual factors influencing employees' uncertainty regulation processes. Thereby, our framework supports scholars to develop a more comprehensive perspective on uncertainty and offers business leaders a practical rationale to deal with strategic (re-)alignment activities and organizational change (see Table 4-1).

Table 4-1: Future research avenues

Analytical focus	Theoretical perspectives	Research avenues
Uncertainties in an organization's external environment	- Task Environment (e.g., Covin & Slevin, 1989) - Strategic Management (e.g., Bourgeois, 1985) - Organizational Learning, Adaption, and Dynamic Capabilities (e.g., Koberg, 1987; March, 1991; Teece & Leih, 2016) - Risk Management (e.g., Bromiley et al., 2015) - Managerial uncertainty perception (e.g., Milliken, 1987)	**Overall research questions** - How do organizations and top-managers respond to external uncertainties? - Which concrete alignment efforts and strategic changes do they initiate in the operational work environment to respond to uncertainty (e.g., work design interventions)? - Which (unexpected) effects and uncertainties on employee level emerge as a result of these changes?
Organizational alignment efforts as determinants of employee uncertainty regulation	- Leadership and communication (e.g., Lim et al., 2021)	**Research questions with regard to leadership and communication** - How do ambivalent leadership styles such as ambidextrous leadership, paradoxical leadership, and potential ambiguous emotional cues conveyed by leaders affect the uncertainty regulation of employees?
	- Changes in role demands and social working organization (e.g., Fløvik et al., 2019; Grant & Parker, 2009; Kahn et al., 1964)	**Research questions with regard to changes in role demands and social working organization** - How do role stress and uncertainty perception differ and interact as antecedents and boundary conditions in employees' uncertainty regulation? - How do interdependencies in the social work environment interact with individual characteristics in the prediction of employees' uncertainty regulation processes on individual and team levels (e.g., with regard to divergent individual interests)? - How do complex feedback processes shape uncertainty regulation on individual and team levels?
	- Changes in work design and knowledge demands (e.g., Hackman & Lawler, 1971; Humphrey et al., 2007; Slocum & Sims, 1980)	**Research questions with regard to changes in work design and knowledge demands** - How do changes in knowledge demands influence employees' uncertainty perceptions and subsequent (positive) responses? - Which role play structural work characteristics and associated outcomes (e.g., autonomy, and experienced meaningfulness) in employees' uncertainty regulation? - How can organizational decision-makers facilitate effective uncertainty regulation among employees through work design interventions?
Individual determinants and moderating mechanisms		

Personality and uncertainty	- Broad personality traits (e.g., Costa & McCrae, 1988; DeYoung et al., 2007) - Specific uncertainty-related traits (e.g., Sorrentino et al., 2009) - Entrepreneurial personality/orientation (e.g., Krauss et al., 2005)	**Overall research questions** - How do broad and more specific personality traits shape employees' perceptions and responses to uncertainty? - How do employees' entrepreneurial traits and orientations affect employees' uncertainty regulation?
Motivation and uncertainty	- Self-efficacy (e.g., Bandura, 1997) - Regulatory focus (e.g., Higgins, 1998) - Self-determination they (e.g., Ryan & Deci, 2000)	**Overall research questions** - Which roles play self-efficacy, regulatory goal preferences and the fulfilment of basic needs in the regulation of uncertainties associated with new and uncertain tasks? - How can work design interventions (e.g., facilitating the satisfaction of basic needs) positively influence motivational factors relevant to employees' uncertainty regulation?
Cognition and uncertainty	- Cognitive biases and heuristics (e.g., Hodgkinson et al., 2023) - Framing (e.g., Hodgkinson et al., 1999) - Eristic reasoning (e.g., Kurdoglu et al., 2023a) - Metacognition (e.g., Haynie et al., 2009)	**Overall research questions** - How do cognitive biases, heuristics and eristic reasoning affect employees' uncertainty regulation and decision-making within their operational environments? - How do metacognitive processes affect employees' uncertainty regulation? - How can interventions aimed at developing metacognitive skills help prepare employees for navigating uncertain work environments?
Affect and uncertainty	- Valence of emotions (e.g., Forgas, 1995) - Appraisal of specific emotions (e.g., Lerner & Keltner, 2000; 2001) - Complex affective processes/mixed emotions (e.g., Podoynitsyna et al., 2012) - Interplay of emotions and cognitions (e.g., Li et al., 2014; Luo & Yu, 2015) - Emotions relevant to self-regulation under uncertainty (e.g., passion) (e.g., Lim et al., 2021; Vallerand et al., 2023)	**Overall research questions** - Which role play specific emotions and their appraisal in employees' uncertainty regulation? - Under which circumstances can negative affective appraisals of uncertainty lead to desirable behavioral responses among employees? - When do employees perceive uncertainty as something positive and respond beneficially to it? - How can interventions enhance employees' positive appraisals and responses to uncertainty? - How do complex affective processes, such as the simultaneous processing of positive and negative emotions and the interplay of cognitions and emotions influence employees' regulation of uncertainty?

4.4.1 The External Environment of Organizations as Source of Uncertainty

Our organizing framework posits that uncertainties in an organizations' external environment foster managerial perceptions of uncertainty and strategic alignment efforts within organizations, which in turn influence the uncertainty regulation of employees. Future studies should illuminate how organizations and their top-managers respond to uncertainties by triggering alignment efforts and strategic changes in the operational work environment to respond to uncertainty. For instance, multi-level studies can explore the extent to which self-reported strategic orientations, such as entrepreneurial orientation (Lumpkin & Dess, 1996; Rauch et al., 2009), translate into actual changes in work design (e.g., increased autonomy; Boudrias et al., 2020; Cordery et al., 2010) and how these changes influence employees' uncertainty regulation throughout the organization. Strategic initiatives at the organizational level can have (unexpected) effects at the employee level, which are often overlooked in macro-analytical approaches (e.g., Ben-Ner et al., 2012). This presents a promising area for future research to identify individual and contextual conditions that facilitate the successful navigation of organizations in uncertain environments. Current approaches primarily focus on organization-level behaviors under varying levels of uncertainty (e.g., drawing from entrepreneurial orientation (Dess & Beard, 1984) and organizational learning literatures (March, 1991)), but leave unanswered questions about the specific processes activated at the operational level and the conditions that enable the effective implementation of strategic changes by the core workforce (e.g., Rafferty & Griffin, 2006). A deeper understanding of processes at operational levels enables managers to translate abstract top-down decisions in more effective measures at individual and work context levels, enhancing the management of uncertainty during strategic changes.

4.4.2 The Role of Organizational Alignment Efforts in Employees' Uncertainty Regulation

Organizational alignment efforts regarding (a) leadership and communication, (b) changes in role demands and the social working organization, and (c) work design and knowledge demands are central antecedents and boundary conditions in employees' uncertainty regulation. Our review highlights that leaders and their communication of anticipated changes are pivotal in facilitating effective uncertainty regulation among employees. High-quality communication, interpersonal trust, and benevolent leadership behaviors can enhance employees' awareness of the opportunities inherent in uncertainty, enabling them to perceive and respond more positively, while mitigating its negative side-effects. In contrary, darker leadership behaviors exacerbate (social) uncertainties and tend to hinder employees' uncertainty regulation. Given that leaders themselves also grapple with uncertainty and that positive leadership can be challenging to maintain during uncertain times, we see significant research potential in exploring the positive and negative effects of ambivalent leadership behavior on the regulation of uncertainty by employees and in dynamic team settings (e.g., Grote et al., 2018). In this context, ambivalent leadership styles such as ambidextrous leadership (Rosing et al., 2011), paradoxical leadership (Smith & Lewis, 2011), along with the potential ambiguous emotional cues conveyed by leaders (e.g., Lim et al., 2021; Vallerand et al., 2003) offer a promising starting point to delve deeper into the complexities of how leaders shape employees' uncertainty regulation.

Changes in role demands and the social working organization can also trigger uncertainty perceptions among employees and act as critical contingencies influencing employees' responses during organizational change and strategic re-alignment efforts. In the literature, role stress is often used interchangeably with uncertainty perception, but it is essential to differentiate between these two concepts. While uncertainty can also be the

starting point for job enrichment and design (e.g., Ben-Ner et al., 2012; Slocum & Sims, 1980), role stress is primarily viewed negatively (Kahn et al., 1964; Schmidt et al., 2014). Instead of conceptualizing uncertainty solely in negative terms alongside role stress, future research would benefit from investigating role stress as a potential (negative) antecedent or boundary condition of employees' regulation. Future studies are needed to differentiate these constructs more clearly and explore their relationships, especially with regard to employees' perceptions and responses.

Our review reveals that the social characteristics of employees' operational environment – such as social support, interdependence, and feedback – act as antecedents and boundary conditions in employees' uncertainty regulation. Intuitively, a supportive social environment is likely to positively impact employees' psychological safety and distress levels, as well as their engagement with uncertainty, including participation in change-related activities and voicing new ideas or criticism. Conversely, highly political environments with more complex social dynamics can heighten uncertainty perceptions among employees and have the opposite effect. However, job security and autonomy play a crucial role in mitigating negative effects of uncertainty perception on voice behavior. Therefore, we suggest organizational decision-makers to establish supportive social working conditions and structures to facilitate proactive responses to uncertainty (e.g., Li et al., 2020), while reducing negative responses such as distress and burnout (e.g., Bodensteiner et al., 1989). In this regard, various forms of interdependencies (e.g., Raveendran et al., 2018) turned out to be potentially relevant for the uncertainty regulation of individuals and working teams (e.g., Clerq, 2019; Sniezek et al., 1990; Sniezek, 1992). Research on how interdependencies interact with employees' individual characteristics presents another fruitful avenue for future research on employees' uncertainty regulation. Especially, it is important to explore how personal interests may diverge from those of others or the group, as this can significantly impact how

employees and working teams respond to uncertainty. For example, while uncertainty-avoidant employees may welcome greater dependencies in the social work environment, proactive employees may feel impaired in their autonomy to embrace uncertainty as an opportunity to organize themselves and make a change. Understanding these ambiguities, especially in complex team settings, can provide insights into how changes in the social work organization can shape employees' perceptions and responses to uncertainty, leading to a more targeted uncertainty management within organizations. Additionally, complex feedback processes and communication within work units play an important role in uncertain and interdependent work contexts (e.g., Anseel et al., 2015; Ashford et al., 2016). Investigating the conditions that foster employees' willingness to seek out and provide feedback, as well as how they utilize feedback effectively, can improve current understanding on effective uncertainty regulation on operational levels. In this regard, it may be beneficial to apply theories on self-uncertainty (e.g., Van den Bos, 2009a, Van den Bos, 2009b) and group-identification (Hogg, 2009) to complex team processes. Expanding these theories beyond their focus on justice perceptions in change contexts to study how these social processes influence broader aspects of employees' uncertainty regulation could yield valuable insights into their impact on general outcomes such as work performance under uncertainty (e.g., Carpini et al., 2017; Griffin et al., 2020; Griffin et al., 2007).

Lastly, we identified changes in work design (i.e., task variety, autonomy, feedback, task significance, and task identity) and associated knowledge demands (i.e., job complexity, information processing, problem-solving, and skill variety) as potential antecedents and contingencies in employees' uncertainty regulation. Knowledge demands and deficits are recognized sources of uncertainty, especially in entrepreneurial contexts (Townsend et al., 2018). However, these insights have been less frequently applied to employees, who also face increasing levels of uncertainty (e.g., Kaul et al., 2024). Therefore, we see significant

potential in exploring the conditions under which employees interpret change-related knowledge demands as either stressful burden or enriching opportunity to learn, experiment, and redesign work processes (e.g., Ehrig & Schmidt, 2022; Liao et al., 2011; Zellweger & Zenger, 2023). Similarly, despite work design is often conceptually highlighted as key factor in managing uncertainty (Ben-Ner et al., 2012; Grant & Parker, 2007; Parker & Grote, 2022; Parker et al., 2017), we identified only scarce empirical research on these structural influences on employees' uncertainty regulation. Research indicates that it could be useful to consider experienced meaningfulness, and autonomy as both potential antecedents and moderators in uncertainty regulation processes. Experienced meaningfulness provides coherence and orientation in uncertain endeavors (e.g., Van den Bos, 2009a) and may help to interpret uncertainty as a valuable opportunity for achieving higher-order personal or organizational goals. Additionally, to which extent work design can evoke feelings of autonomy and competence among employees may influence how they respond to uncertainty (Boudrias et al., 2020; Cordery et al., 2010). Therefore, we encourage scholars and managers to take a closer look the effects of work design interventions and employees' responses to uncertainty – especially with regard to recent insights on the psychological impact of work design (Gagné et al., 2022).

4.4.3 The Role of Individual Characteristics in Employees' Uncertainty Regulation

Our review highlights the value of developing and testing models that examine the interactions between employees' individual attributes and their uncertain work environments to better understand how they regulate uncertainty. We identified both distal personality traits and proximal factors, such as motivational, cognitive, and affective processes, that impact employees' perceptions and responses to uncertainty. The following insights provide important implications for scholars seeking to advance the field of uncertainty regulation and for HR managers responsible for work organization and people development under

uncertainty (e.g., Bhattacharya & Wright, 2005; Binyamin & Abraham, 2010; Chen et al., 2024; Kwong et al., 2021).

The transfer of research on personality neuroscience (DeYoung, 2013; DeYoung, 2015; DeYoung et al., 2007), specific uncertainty-related traits (e.g., risk and uncertainty preferences, and proactive personality; Sorrentino et al., 2009; Bateman & Crant, 1993), and entrepreneurial personality research (Howard & Boudreaux, 2014; Krauss et al., 2005) to the employee level offers a promising starting point for future research on individual differences as antecedents and boundary conditions in employees' uncertainty regulation. From a methodological point of view, it is very important in this regard to use comprehensive scales and to analyze personality factors at both (sub-) scale and facet level (DeYoung et al., 2007).

With regard to motivational aspects of uncertainty regulation, self-efficacy is pivotal for perceiving uncertainty as such, but also works as individual reference point for responses to uncertainties (e.g., Schmitt et al., 2017). In addition, theoretical frameworks such as regulatory focus (Higgins, 1998) and self-determination theory (Ryan & Deci, 2000) provide potential avenues to investigate employees' uncertainty regulation (Griffin & Grote, 2020). Future research should transfer the findings on the role of self-efficacy and regulatory focus in responding to uncertainty to employee contexts to examine whether these findings also apply to employees, who encounter unique challenges and opportunities related to uncertainty within their operational work environments. We assume that self-determination theory (Ryan & Deci, 2000) in particular provides a fertile ground for research on employees' uncertainty regulation processes. Self-determination theory describes (unmet) needs for autonomy, competence, and social relatedness as drivers of intrinsic work motivation, which can turn out to be crucial factors in the regulation of uncertainty (e.g., Boudrias et al., 2020). Employees can be intrinsically motivated by novel (and still uncertain) activities and evaluate them as interesting when these activities satisfy their basic needs. For example, employees lacking

social integration might paradoxically view uncertainty more positively when (social) changes are introduced in their work group, as these changes offer them the opportunity to recalibrate their workplace relationships. Similarly, poorly performing employees who struggle to satisfy their need for competence or feel bored in their current tasks might also view new and uncertain tasks as enriching opportunities. These challenges could offer a renewed experience of competence and foster a positive attitude towards these uncertainties. This perspective has significant practical implications, as fulfilling employees' motivational needs and influencing their responses to new and uncertain tasks can be achieved through targeted work design interventions (Boudrias et al., 2020; Gagné et al., 2022).

Investigating the role of various perspectives on (meta-) cognitive processes and adaptation strategies of employees during uncertainty regulation, offers a further fruitful avenue for future research. In this regard, future research should analyze whether the findings on cognitive biases and heuristics observed in entrepreneurial and managerial settings are also transferrable employees' regulation of uncertainty, and explore the unique characteristics specific to employee contexts. The concept of eristic reasoning (Kurdoglu et al., 2023a; Kurdoglu et al., 2023b) provides the opportunity to examine how employee might respond (seemingly) irrationally to uncertainty. It suggests scenarios where employees might take advantages of the uncertainties of organizational change to pursue self-serving goals, which could lead to both positive and negative consequences for the organization. For example, employees may leverage uncertainty to negotiate a better position or benefits for themselves. While this could result in personal advantages, it might also lead to unexpected organizational benefits, such as prompting management to re-evaluate and improve their organizational strategy. In contrast, such self-serving actions could lead to negative consequences, such as fostering tensions at the workplace and undermining team morale. In addition, research on adaptive metacognition (e.g., Haynie et al., 2009; Haynie et al., 2010) is instrumental to

specify the metacognitive processes, enabling employees to think beyond or reorganize existing knowledge structures in the face of novel and uncertain work contexts. As emphasized by Haynie et al. (2009; 2010), metacognition is not only a dispositional trait, but also represents a trainable skill, which facilitates the identification of risks and opportunities as well as effective behavior under uncertainty. Thus, adopting (meta-) cognitive perspectives not only enhance understanding of how employees regulate uncertainty, but also facilitates the development of actionable interventions to improve skills to manage uncertainty effectively in the workplace.

Furthermore, we recommend scholars to investigate affective aspects with regard to the regulation of uncertainty in operational environments. Understanding how affective factors shape employees' uncertainty regulation can provide valuable insights into the unique emotional challenges employees encounter in uncertain work environments. In this context, our review revealed that it might be not sufficient to examine only positive and negative affective valences, but that a closer look at emotion appraisals is necessary to predict responses with greater accuracy (e.g., Lerner et al., 2015). Such research would allow to detect potential paradoxical effects of negative emotions, which are often overlooked in favor of simplified explanations of valence-based explanations, particularly in studies exploring the link between uncertainty and negative affective reactions. For example, our review uncovered several studies suggesting that negative affective reactions to uncertainty can, under specific conditions, lead to desirable behavioral responses. We see significant potential for future research in this area and recommend researchers to look deeper into complex affective processes, such as the simultaneous processing of positive and negative emotions (e.g., Cowley, 2013; Podoynitsyna et al., 2012; Welsh et al., 2022) or the interplay of cognitions and emotions during employees' uncertainty regulation (e.g., Foo et al., 2015; Junça-Silva & Caetano, 2024; Li et al., 2014; Luo & Yu, 2015; Van Gelderen et al., 2015). Moreover, we

encourage scholars to recognize that individuals regulate themselves in the pursuit of uncertain outcomes and can interpret and respond to uncertainty positively (e.g., Anderson et al., 2019; Griffin et al., 2020; Shen et al., 2015). This seems to be particularly accurate when employees perceive their task as intrinsically interesting and engage with them because they want to rather than viewing it as necessary duty (Milkman, 2012; Silvia, 2008). Therefore, we recommend scholars to take a closer look at the regulatory role of self-set goals and employees passion inclinations, which may enhance interest and affective attraction to uncertain work tasks (e.g., Vallerand et al., 2023; Welsh et al., 2020). These findings are also crucial for HR managers in developing uncertainty management interventions. By encouraging employees to playfully discover their passions (e.g., Statler et al., 2009) and set their own interesting goals through job crafting interventions (Wrzesniewski & Dutton, 2001), HR managers can potentially motivate employees to handle uncertainty in an opportunity-driven manner.

4.4.4 Limitations

Since we applied a narrative approach, the strength of our approach lies in our systematic methods, including extensive searching and double-coding of a range of research, across varying research designs, variables and heterogeneous contexts. However, we do acknowledge a number of limitations. The heterogeneity of the studies in our database, made it necessary to determine meaningful theoretical boundaries and does not preclude the possibility that isolated and potentially relevant studies cannot be included in this review. Moreover, some articles in our review could have been classified to different levels of analysis. We applied double-coding of our results to ensure consistency. Although our study primarily reviews how employees perceive and respond to uncertainty, we encountered several studies suggesting potential dynamic relationships between uncertainty and leadership (e.g., Batool et al., 2023; Buss & Kearney, 2023; Junça-Silva & Caetano, 2024; Mom et al.,

2015; Rodell & Colquitt, 2009; Wall et al., 2002), work demands (Rubino et al., 2012), job crafting (Irfan et al., 2023), and emotions (e.g., Van Djik & Zeelenberg, 2006). In our review, we chose not to incorporate all reciprocal relations or focus extensively on studies treating uncertainty as contingency for several reasons. Our primary goal was to organize the antecedents and boundary conditions that influence employees' perceptions and responses to uncertainty. By focusing on these aspects, we aimed to clarify the foundational elements that affect how employees perceive and respond to uncertainties, rather than extensively exploring how these factors might evolve dynamically through reciprocal interactions. Therefore, reciprocal relations that focus on how employees' perceptions and responses to uncertainty may influence subsequent uncertainty perceptions or other work outcomes were beyond the scope of our current model. While these studies offer valuable insights, our focus was to improve understanding on the antecedents and boundary conditions of employees' uncertainty regulation, rather than how uncertainty itself might act as contingency in broader processes.

4.5 CONCLUSION

In conclusion, this study contributes to the ongoing discussion on the factors influencing uncertainty regulation within organizational environments. Through a systematic literature review focused on the phenomenon of employee uncertainty regulation, we have developed an organizing framework that integrates diverse theoretical perspectives. By shifting the prevailing view of uncertainty from mere avoidance to recognizing its potential, we aim to stimulate new insights. Our synthesis underscores the active regulation of uncertainty as a critical stimulus, drawing on a range of theoretical perspectives in organizational research. We have identified and mapped promising future research directions that can propel the field forward.

CONCLUSION

Findings on Entrepreneurs' and Employees' Navigation of Uncertainty

The aim of this dissertation was to address two research questions. The analyses, first, aimed to analyze how entrepreneurs perceive and respond to uncertainty, and second, to explore how employees handle uncertainty within entrepreneurial and organizational environments. The four chapters of this dissertation contribute to answering these questions as follows.

Chapters one and two analyzed entrepreneurs' perceptions and responses to uncertainty. Chapter one focused on entrepreneurs' psychological reactions to uncertainty and how these reactions, influenced by their uncertainty preferences, determine their entrepreneurial actions. The combination of a field study with a scenario-based vignette experiment allowed for an examination of entrepreneurs' action strategies when faced with uncertainty, along with the underlying causal effects and psychological mechanisms. The field study indicated that the derived entrepreneurial action strategies are empirically valid and have external validity. Additionally, the scenario-based experiment revealed that entrepreneurs' engagement in these action strategies is driven (and partially mediated) by their emotional and cognitive reactions to uncertainty, shaped by their uncertainty preferences. Inhibitory emotions promote analytical approaches to uncertainty, while activating cognitions prompt entrepreneurs to reduce uncertainty through both analytical and experimental strategies, preventing ignorant actions. The findings demonstrated that entrepreneurs' uncertainty preferences shape their cognitive reactions to uncertainty, leading them to engage in specific action strategies under uncertainty. When thinking about how to reduce uncertainty, entrepreneurs with a high uncertainty preference are more likely to engage in uncertainty-embracing experimental strategies, which emphasize learning by doing and are considered promising for long-term entrepreneurial success, compared to those with a lower preference for uncertainty. They are also less likely to ignore uncertainties than those with a

lower uncertainty preference, likely because they are better at keeping a cool head under uncertain conditions. Thus, the first chapter demonstrated that entrepreneurs do not automatically react negatively to uncertainty. Instead, they psychologically process it according to their uncertainty preference, which shapes their engagement in action strategies during business development.

Chapter two examined another boundary condition in entrepreneurial decision-making under (opportunity-related) uncertainty: the moderating effects of their perceptions of social class. A conjoint experiment conducted in the USA and Germany – two developed countries with different economic systems (liberal vs. coordinated market economy) – enabled an investigation of whether and how social class perceptions influence the effects of opportunity-related uncertainty on entrepreneurs' willingness to pursue opportunities. The comparative analysis indicated that entrepreneurs who perceived themselves as belonging to a low social class were generally more likely to be deterred by uncertainty associated with opportunities compared to those who perceived themselves to belong to a high social class, with this effect varying by a country's economic system. In nations with a liberal market economy, such as the USA, entrepreneurs from lower social classes were more likely to be deterred by uncertainty associated with opportunities, likely due to the risk of ending up in an even more precarious situation. In contrast, in countries with a coordinated market economy, such as Germany, entrepreneurs from lower social classes were more incentivized to exploit uncertain opportunities, while their higher-class counterparts were more reserved. Hence, the second chapter demonstrated that entrepreneurs evaluate uncertain opportunities in accordance with their social class perceptions, which shape their willingness to pursue such opportunities depending on the economic system in their country of operation.

The chapters three and four complemented these analyses on entrepreneurs and examined employees' perceptions and responses to uncertainty. Chapter three explored how

entrepreneurs' passion signals affect employee decision-making under uncertainty within start-ups. Using two conjoint experiments, we examined the effects of entrepreneurs' passion signals on employees' uncertainty perceptions and subsequent decision-making, considering their dualistic passion inclinations. Our analyses indicated that the type of entrepreneurs' passion signals – harmonious and obsessive – can either decrease or increase employees' uncertainty perception, while the strength of leaders' passion signals generally reduces employees' uncertainty perception. Moreover, employees' uncertainty perception serves as a causal mechanism linking entrepreneurial leaders' passion signals with employees' and exploitation and exploration behaviors, moderated by their dualistic passion. Specifically, our results indicated that harmonious passion makes employees more receptive to (signal-based) uncertainty, while obsessive passion mitigates these effects. Therefore, the third chapter showed that entrepreneurs' ambivalent passion signals can influence employees' uncertainty perception, which guides their decision-making in accordance with their own dualistic passion inclination.

Based on a systematic literature review, chapter four presented an organizing framework on the antecedents and boundary conditions of employees' uncertainty regulation processes within broader organizational settings. The review highlighted that uncertainty within organizations originates from external changes in the organizations' external environment, leading organizations and top-managers to respond with (re-)alignment efforts within the organization that can introduce further internal uncertainties for their employees. Employees' responses to uncertainty result from the interplay between their perception of these uncertainties in their operational environment, their individual characteristics (such as personality traits, motivational, cognitive, and affective aspects) and the characteristics of their operational environment. By acknowledging the dual nature of uncertainty and identifying the conditions that enable its upside potential, our framework moves beyond the

typical focus on the negative aspects of uncertainty and sets the stage for future research on opportunity-driven uncertainty management.

In summary, this dissertation indicated that both entrepreneurs and employees do not automatically perceive uncertainty as a negative feature but instead process and deliberately engage with it. In this process, individual and contextual boundary conditions play a crucial role in shaping their responses to uncertainty. For entrepreneurs, their uncertainty preferences and social class perceptions significantly co-determine their decision-making during business development and the evaluation of uncertain opportunities. Employees also process and respond to uncertainty consciously, but perceive it through different sources, such as ambivalent passion signals from their entrepreneurial leaders and changes in their operational environment. Their responses to uncertainty are also significantly shaped by individual and contextual boundary conditions, such as their dualistic passion inclinations and characteristics of their operational environment.

Implications of the Findings

These findings have several implications for future research. Several individual and contextual factors influence how entrepreneurs and employees perceive and respond to uncertainty. Firstly, entrepreneurs' decision-making regarding their chosen action strategies and entrepreneurial opportunities is highly concerned with their processing of uncertainty, which depends of both psychological and social boundary conditions. Secondly, while this also applies to employees in a similar way, they encounter different sources of uncertainty and contextual circumstances in start-up and organizational settings. Since uncertainty fundamentally challenges entrepreneurial and organizational renewal efforts, it is essential for entrepreneurs and employees to enhance their awareness on how uncertainty is processed and the individual and contextual aspects influencing this process. This knowledge enables them to make better decisions and take advantage of the potential of uncertainty, while reducing

associated threats. Accordingly, recent research points to the importance of not only considering uncertainty as a given and undesirable contextual element, as has been the case in the past, but to focus more on how decision-makers can leverage it as catalyst for innovation and to produce unconventional solutions. Thus, research should acknowledge the multifaceted nature of uncertainty and delve deeper into entrepreneurs' and employees' perceptions of uncertainty, which proximally determine effective action during business development and opportunity pursuit. Moreover, future research should aim to identify more individual and contextual influences, which co-determine this processing and help or hinder their attempts to capitalize on the potential inherent in uncertainty.

The findings of this dissertation also have several implications for decision-makers and stakeholders involved within entrepreneurial and organizational environments. First, entrepreneurs need to develop an awareness of how they process uncertainty and the individual and contextual influences that shape this process, as it is crucial for developing effective approaches to the various uncertainties in their environments. This insight is not only important for entrepreneurs, but also for entrepreneurship educators, who should not only teach the most effective actions under uncertainty, but also stimulate reflection on how individual and contextual influences shape uncertainty processing. This way, they can enable entrepreneurs to counteract potentially adverse tendencies and foster appropriate responses to uncertainty. Policy-makers and institutions in the entrepreneurial ecosystem should acknowledge the diverse perspectives and motivations of entrepreneurs from various social classes in different nations to develop inclusive and fair entrepreneurship conditions. A stronger awareness of policy-makers and supporting institutions of the influence of perceived social class on entrepreneurial decision-making can help them to design effective policies that address the particular challenges faced by different social classes in different nations. Second, the findings of this dissertation indicate that entrepreneurial leaders and organizations

substantially influence how employees perceive uncertainty and respond to it. Entrepreneurs benefit of a deeper awareness of how their ambivalent passion signals guide employee decision-making in uncertain start-up environments. By consciously sending specific passion signals, they can influence the extent to which start-up employees align with their envisioned strategy and contribute to venturing efforts. Business leaders and organizations can refer to our conceptual work to develop a practical rationale to deal with strategic (re-) orientation activities and organizational change in an opportunity-driven manner. By designing interventions that foster conducive individual skills and operational environments for dealing with uncertainty, organizations can encourage their employees to embrace uncertainty and its inherent opportunities.

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APPENDIX

Appendix A-1: Item factor loadings and reliabilities (Chapter 1)

Study 1	
Items	**Standardized Factor Loadings**
Uncertainty perception (*α* = *.69)*	
I perceive a lot of uncertainty at work in my company.	.86
I am very uncertain about how future changes in the market will affect my start-up project.	.61
Ignorant actions (*α* = *.75)*	
We (or I) prevent ourselves from being swayed by uncertainty and maintain the current course in order to implement the promising business idea.	.67
We (or I) do not allow ourselves to be distracted from the current course and continue to offer the originally conceived product/service.	.81
We (or I) put aside uncertainty and stick to our original concept, not allowing it to distract us from our original vision.	.65
Analytical strategy (*α* = *.68)*	
We (or I) analyzed long-term opportunities and selected what we believed would provide the best returns.	.70
We (or I) designed and planned business strategies.	.73
Experimental strategy (*α* = *.74)*	
We (or I) experimented with different products and/or business models.	.64
The product/service that we (or I) now provide is substantially different from what we first imagined.	.80
We (or I) tried several different approaches until we found a business model that worked.	.67
Perceived uncertainty reduction (*α* = *.89)*	
My approach (as described in the questions above) helps me to reduce the uncertainties in my business activities.	.96
My approach (as described in the questions above) helps me to gain more certainty.	.82
Note: We excluded one *analytical strategy* item from our subsequent analysis due to factor loadings below < .50 (Hair et al., 2019).	

Study 2

Items	Standardized Factor Loadings
Uncertainty preference (*α = .78*)	
Unforeseen surprises excite me greatly.	.47
It makes me curious not to have all the information I need.	.41
You should always leave options open to keep it exciting.	.43
One small, unforeseen event can improve everything at once, even if there was a plan previously.	.49
I find it exciting not to know yet what the future has in store for me.	.66
I really like to be surprised.	.69
Uncertainty energizes me to live a full life.	.63
When it's time to act, uncertainty energizes me.	.65
When I'm uncertain, I'm at peak form.	.55
Small doubts motivate me to act.	.40
Uncertain situations make life enjoyable.	.58
Inhibitory emotion (*α = .75*)	
Please indicate how you feel in this situation…	
Anxious	.81
Doubtful	.74
Activating cognition (*α = .87*)	
In this situation, my primary goal would be to reduce uncertainty.	.96
I would focus my actions in this situation on achieving more certainty.	.80
Uncertainty perception (manipulation check) (*α = .84*)	
I perceive a lot of uncertainty in this situation.	.87
I am very uncertain about the impact of potential market changes in this situation.	.87

Note: We executed additional robustness checks by specifying our model with original and purified scales (exclusion of scale items which had factor loadings below < .50 (Hair et al., 2019)). Our results remained consistent and stable across all specifications.

Appendix B-1: Vignette design (Chapter 1)

Introduction	Scenario 1: Demand	Action strategies (DV)
Imagine that you are in the process of starting a business. This company produces T-shirts with a novel and promising design. Your company uses a novel, sustainable, and cost saving production process.	**Low uncertainty:** A report on current trends in the market reaches you, showing which designs are in particular demand. This indicates that the current changes in the market are likely to change the demand for your T-shirts only to a moderate extent. Therefore, you can assume that there is comparatively low uncertainty regarding the development of your T-shirt sales. You'll be founding in the next few days, and then things can really take off. How would you allocate your resources? **High uncertainty:** A report on current trends in the market reaches you, showing which designs are in particular demand. This indicates that the current changes in the market will greatly change the demand for your T-shirts, so there is enormous uncertainty regarding the development of your T-shirt sales. Despite the enormous uncertainty, you will set up in the next few days, and try to make the company a success. How would you allocate your resources?	1. I am not distracted by the report and am launching the product on a large scale, regardless of design trends, in order to implement my promising business idea. (Ignorant action) 2. I am doing a comprehensive market analysis to take a closer look at how the design trend might be changing and how the competition is performing in the market. (Analytical strategy) 3. I continuously do small test runs with different designs to be able to adjust my product based on my observations. (Experimental strategy)
Introduction	**Scenario 2: Technology**	**Action strategies (DV)**
Now imagine you are about to start a technology	**Low uncertainty:** Shortly before you are about to launch your products, you receive a message about forecasts from proven technology experts. The forecasts show that current technology developments will bring new competition	1. I am launching the promising product on a large scale, regardless of the forecasts of technology experts, and I am not distracted by the forecasts. (Ignorant action)

company. The company sells novel beverages that can be produced in a cost-saving and sustainable way using a revolutionary technology.	to your technology. These could impact the competitiveness of your technology. Nevertheless, since your technology is superior in many components, your sales are likely to be only slightly affected. You can therefore assume that there is comparatively low uncertainty about the future competitiveness of your beverage technology. You now need to make a decision about how to proceed. How would you allocate your resources? **High uncertainty:** Shortly before you are about to launch your products, you receive a message about forecasts from proven technology experts. The forecasts show that current technology developments will bring new competition to your technology. These could impact the competitiveness of your technology. Although your technology is superior in some components, your sales are likely to be greatly affected. You must therefore assume that there is enormous uncertainty about the future competitiveness of your beverage technology. You now need to make a decision about how to proceed. How would you allocate your resources?	2. I carefully analyze the forecasts of technology experts to understand how the technology market might change and create a plan for the next steps. (Analytical strategy) 3. I continuously conduct small test runs and iteratively develop new ideas to improve my production process based on my observations. (Experimental strategy)

Introduction	**Scenario 3: Resources**	**Action strategies (DV)**
Please imagine now you are about to start a company specializing in the	**Low uncertainty:** In the early stages of your start-up, you learn in your network about the imminent entry of international competitors into the national packaging market. The new competitive situation could have an impact on your market position.	1. We should not allow ourselves to be overly distracted by the new competitive situation and launch the packaging products on the market as planned in order to benefit from our innovative process technology. (Ignorant action)

production of packaging. You have developed an innovative process technology that you use for your packaging production.	You assume that your resources are sufficient to be able to quickly achieve an advantage on the market. Thus, there is comparatively low uncertainty that your company will be able to establish itself in the future packaging market. You have a meeting with your business partners coming up soon to make a decision on how to proceed. What allocation of resources to the following courses of action do you propose?	2. We should closely analyze the approach of the new competition to get a better picture of which strategy is the most appropriate in dealing with the competition. (Analytical strategy)
	High uncertainty: In the early stages of your start-up, you learn in your network about the imminent entry of international competitors into the national packaging market. The new competitive situation could have an impact on your market position. You are not sure whether your resources are sufficient to be able to achieve a competitive advantage on the market quickly enough. Therefore, there is enormous uncertainty about whether your company can establish itself in the future packaging market. You have a meeting with your business partners coming up soon to make a decision on how to proceed. What allocation of resources to the following courses of action do you propose?	3. We should continuously monitor the market situation and develop new ideas to enhance our business model. (Experimental strategy)

Appendix C-1: Moderated mediation analyses (Chapter 1)

Table C-1-1: Moderated mediation analysis (ignorant actions as DV)

Effects	B (β)	SE	z-statistic	p-value	ci.lb	ci.ub
Direct Effects						
unc → act_cog_z	0.74 (0.39)***	0.168	4.39	0.000	0.41	1.06
unc → neg_emo	0.66 (0.42)***	0.173	3.81	0.000	0.32	1.00
unc → ignor	-8.59 (-0.16)*	3.937	-2.18	0.029	-16.31	-0.88
act_cog_z → ignor	-7.87 (-0.28)***	1.587	-4.96	0.000	-10.98	-4.75
unpref_z → ignor	0.74 (0.02)	2.432	0.31	0.760	-4.02	5.51
interaction_cog_z → ignor	-6.04 (-0.13)***	0.636	-9.50	0.000	-7.29	-4.80
neg_emo → ignor	-4.58 (-0.14)*	2.290	-2.00	0.046	-9.07	-0.09
age → act_cog_z	-0.01 (-0.07)	0.008	-1.01	0.313	-0.02	0.01
age → neg_emo	-0.01 (-0.08)	0.007	-1.20	0.231	-0.02	0.01
age → ignor	0.52 (0.16)***	0.100	5.24	0.000	0.33	0.72
gender → act_cog_z	0.17 (0.07)†	0.094	1.80	0.071	-0.01	0.35
gender → neg_emo	0.23 (0.12)**	0.076	3.09	0.002	0.09	0.38
gender → ignor	-6.06 (-0.09)**	1.122	-5.40	0.000	-8.26	-3.86
eship_exp → act_cog_z	0 (-0.07)†	0.002	-1.76	0.078	-0.01	0.00
eship_exp → neg_emo	0 (-0.03)	0.002	-0.54	0.586	-0.01	0.00
eship_exp → ignor	0.05 (0.05)***	0.013	4.18	0.000	0.03	0.08
eship_edu → act_cog_z	0.03 (0.02)	0.143	0.23	0.819	-0.25	0.31
eship_edu → neg_emo	0.03 (0.02)	0.151	0.20	0.843	-0.27	0.33
eship_edu → ignor	0.27 (0)	2.684	0.10	0.919	-4.99	5.53
Indirect Effects						
unc → cog → ignor	-5.79 (-0.11)***	0.373	-15.51	0.000	-6.52	-5.05
unc → negemo → ignor	-3.03 (-0.06)	2.211	-1.37	0.171	-7.36	1.31
unc → ignor	-10.16 (0.06)***	1.179	-8.61	0.000	-12.47	-7.85
total	-17.41 (-0.33)***	3.544	-4.91	0.000	-24.35	-10.46
Conditional Indirect Effects						
cog → ignor pp low	-1.82 (-0.15)	2.198	-0.83	0.408	-6.13	2.49
cog → ignor pp mid	-7.87 (-0.28)***	1.587	-4.96	0.000	-10.98	-4.75
cog → ignor pp high	-13.91 (-0.4)***	1.008	-13.80	0.000	-15.89	-11.93

Model fit: χ^2 (13) = 25.73, p = 0.018; RMSEA = 0.060 ; SRMR = 0.038 ; TLI = 0.830 ; CFI = 0.951; R^2 = 0.296

Note: N = 102; 306 observations. B = unstandardized coefficient; (β) = standardized coefficient; SE = standard error; ci.lb = 95% confidence interval lower bound; ci.ub = 95% confidence interval upper bound; RMSEA = root mean square error of approximation; SRMR = standardized root mean squared residual; TLI = Tucker Lewis index; CFI = comparative fit index; → = directional path. unc = uncertainty treatment; act_cog_z = activating cognitions; neg_emo = inhibitory emotions; ignor = ignorant actions; eship_exp = entrepreneurial experience; eship_edu = entrepreneurial education. † indicates p < .10; * indicates p < .05; ** indicates p < .01; *** indicates p < .001.

Table C-1-2: Moderated mediation analysis (analytical strategies as DV)

Effects	B (β)	SE	z-statistic	p-value	ci.lb	ci.ub
Direct Effects						
unc → act_cog_z	0.74 (0.39)***	0.168	4.39	0.000	0.41	1.06
unc → neg_emo	0.66 (0.42)***	0.173	3.81	0.000	0.32	1.00
unc → analy	3 (0.09)	2.173	1.38	0.167	-1.26	7.26
act_cog_z → analy	4.21 (0.22)***	0.593	7.10	0.000	3.05	5.37
unpref_z → analy	-4.91 (-0.17)*	2.235	-2.20	0.028	-9.29	-0.53
interaction_cog_z → analy	-0.81 (-0.03)	2.480	-0.33	0.743	-5.67	4.05
neg_emo → analy	5.43 (0.24)*	2.485	2.19	0.029	0.56	10.30
age → act_cog_z	-0.01 (-0.07)	0.008	-1.01	0.313	-0.02	0.01
age → neg_emo	-0.01 (-0.08)	0.007	-1.20	0.231	-0.02	0.01
age → analy	-0.18 (-0.08)	0.130	-1.39	0.164	-0.43	0.07
gender → act_cog_z	0.17 (0.07) †	0.094	1.80	0.071	-0.01	0.35
gender → neg_emo	0.23 (0.12)**	0.076	3.09	0.002	0.09	0.38
gender → analy	2.59 (0.06)	2.153	1.20	0.230	-1.64	6.81
eship_exp → act_cog_z	0 (-0.07) †	0.002	-1.76	0.078	-0.01	0.00
eship_exp → neg_emo	0 (-0.03)	0.002	-0.54	0.586	-0.01	0.00
eship_exp → analy	-0.15 (-0.2)***	0.037	-4.12	0.000	-0.22	-0.08
eship_edu → act_cog_z	0.03 (0.02)	0.143	0.23	0.819	-0.25	0.31
eship_edu → neg_emo	0.03 (0.02)	0.151	0.20	0.843	-0.27	0.33
eship_edu → analy	2.67 (0.07)	1.724	1.55	0.122	-0.71	6.05
Indirect Effects						
unc → cog → analy	3.09 (0.09)***	0.590	5.25	0.000	1.94	4.25
unc → negemo → analy	3.59 (0.1)	2.500	1.44	0.151	-1.31	8.49
unc → analy	8.53 (0.72)**	2.759	3.09	0.002	3.13	13.94
total	9.69 (0.27)**	3.440	2.82	0.005	2.95	16.43

Model fit: χ^2 (13) = 25.73, p = 0.018; RMSEA = 0.060 ; SRMR = 0.039 ; TLI = 0.833 ; CFI = 0.952; R^2 = 0.313

***Note*:** N = 102; 306 observations. B = unstandardized coefficient; (β) = standardized coefficient; SE = standard error; ci.lb = 95% confidence interval lower bound; ci.ub = 95% confidence interval upper bound; RMSEA = root mean square error of approximation; SRMR = standardized root mean squared residual; TLI = Tucker Lewis index; CFI = comparative fit index; → = directional path. unc = uncertainty treatment; act_cog_z = activating cognitions; neg_emo = inhibitory emotions; analy = analytical strategies; eship_exp = entrepreneurial experience; eship_edu = entrepreneurial education. † indicates p < .10; * indicates p < .05; ** indicates p < .01; *** indicates p < .001.

Table C-1-3: Moderated mediation analysis (experimental strategies as DV)

Effects	B (β)	SE	z-statistic	p-value	ci.lb	ci.ub
Direct Effects						
unc → act_cog_z	0.74 (0.39)***	0.168	4.39	0.000	0.41	1.06
unc → neg_emo	0.66 (0.42)***	0.173	3.81	0.000	0.32	1.00
unc → experi	5.59 (0.12)**	2.066	2.71	0.007	1.54	9.64
act_cog_z → experi	3.66 (0.14)*	1.516	2.41	0.016	0.69	6.63
unpref_z → experi	4.17 (0.11)**	0.200	20.84	0.000	3.77	4.56
interaction_cog_z → experi	6.86 (0.16)**	2.153	3.19	0.001	2.64	11.08
neg_emo → experi	-0.85 (-0.03)**	0.272	-3.13	0.002	-1.39	-0.32
age → act_cog_z	-0.01 (-0.07)	0.008	-1.01	0.313	-0.02	0.01
age → neg_emo	-0.01 (-0.08)	0.007	-1.20	0.231	-0.02	0.01
age → experi	-0.34 (-0.12)***	0.041	-8.45	0.000	-0.42	-0.26
gender → act_cog_z	0.17 (0.07) †	0.094	1.80	0.071	-0.01	0.35
gender → neg_emo	0.23 (0.12)**	0.076	3.09	0.002	0.09	0.38
gender → experi	3.47 (0.06)	2.970	1.17	0.242	-2.35	9.29
eship_exp → act_cog_z	0 (-0.07) †	0.002	-1.76	0.078	-0.01	0.00
eship_exp → neg_emo	0 (-0.03)	0.002	-0.54	0.586	-0.01	0.00
eship_exp → experi	0.1 (0.1)*	0.045	2.19	0.029	0.01	0.19
eship_edu → act_cog_z	0.03 (0.02)	0.143	0.23	0.819	-0.25	0.31
eship_edu → neg_emo	0.03 (0.02)	0.151	0.20	0.843	-0.27	0.33
eship_edu → experi	-2.94 (-0.06)**	1.036	-2.84	0.005	-4.97	-0.91
Indirect Effects						
unc → cog → experi	2.69 (0.06)***	0.733	3.67	0.000	1.25	4.13
unc → negemo → experi	-0.56 (-0.01) †	0.326	-1.73	0.084	-1.20	0.08
unc → experi	3.83 (0.53)*	1.689	2.27	0.023	0.52	7.14
total	7.72 (0.16)**	2.975	2.59	0.009	1.89	13.55
Conditional Indirect Effects						
cog → experi pp low	-3.2 (-0.01)	2.976	-1.07	0.282	-9.03	2.63
cog → experi pp mid	3.66 (0.14)*	1.516	2.41	0.016	0.69	6.63
cog → experi pp high	10.51 (0.3)***	2.238	4.70	0.000	6.13	14.90

Model fit: χ^2 (13) = 25.73, p = 0.018; RMSEA = 0.060 ; SRMR = 0.038 ; TLI = 0.776 ; CFI = 0.935; R^2 = 0.107

***Note*:** N = 102; 306 observations. B = unstandardized coefficient; (β) = standardized coefficient; SE = standard error; ci.lb = 95% confidence interval lower bound; ci.ub = 95% confidence interval upper bound; RMSEA = root mean square error of approximation; SRMR = standardized root mean squared residual; TLI = Tucker Lewis index; CFI = comparative fit index; → = directional path. unc = uncertainty treatment; act_cog_z = activating cognition; neg_emo = inhibitory emotion; experi = experimental strategies; eship_exp = entrepreneurial experience; eship_edu = entrepreneurial education. † indicates p < .10; * indicates p < .05; ** indicates p < .01; *** indicates p < .001.

Appendix A-2: Detailed sample filtering criteria (Chapter 2)

USA	
Step	Participants excluded (remaining)
Starting sample (participants who provided consent and started the study)	*190*
– Deleted participants who dropped out early/provided incomplete data	25 (165)
– Deleted participants who did not pass our inclusion criteria (identifying as (former) entrepreneur and at least 3 months entrepreneurial experience))	11 (154)
– Deleted inattentive participants who failed a bogus item	2 (152)
– Deleted slowsters/speedsters, who took extremely long or too short to complete the survey	6 (146)
– Deleted careless responders/streamliners (Curran, 2016)	9 (135)
Final sample	135

Germany	
Step	Participants excluded (remaining)
Starting sample (participants who provided consent and started the study)	*140*
– Deleted participants who dropped out early/provided incomplete data	29 (111)
– Deleted participants who did not pass our inclusion criteria (identifying as (former) entrepreneur and at least 3 months entrepreneurial experience))	7 (104)
– Deleted inattentive participants who failed a bogus item	3 (101)
– Deleted slowsters/speedsters, who took extremely long or too short to complete the survey	5 (96)
– Deleted careless responders/streamliners (Curran, 2016)	5 (91)
Final sample	91

Appendix B-2: Overview manipulated variables (both studies) (Chapter 2)

Introduction

In the next part of the survey, we ask you to evaluate business opportunities that differ in different factors. Below we present the different factors of the business opportunities and you will see an example of how you will make the evaluation on the next pages.

Manipulated variables

Attribute	Levels
Interest of the target group predictable? (Desirability)	*Highly predictable:* An initial market analysis on the business opportunity shows that the interest of the target group for potential products and services is highly predictable. *Highly unclear:* An initial market analysis on the business opportunity shows that it is highly unclear whether the target group will be interested in potential products and services.
Feasibility realistic? (Feasibility)	*Highly predictable:* An initial feasibility analysis shows that it is highly predictable that this business opportunity can be converted into an actual product or service. *Highly unclear:* An initial feasibility analysis shows that it is highly unclear how this business opportunity can be converted into an actual product or service.
If successful, high gain expected? (Achievable Gain)	*Highly predictable:* An initial financial analysis shows that it is highly predictable that a high profit can be achieved if the business is successful. *Highly unclear:* An initial financial analysis shows that it is highly unclear whether a high profit can be achieved if the business is successful.
In case of failure high loss avoidable? (Preventable Loss)	*Highly predictable:* An initial company calculation shows that it is highly predictable that a high loss can be avoided in case of failure. *Highly unclear:* An initial company calculation shows that it is highly unclear whether a high loss can be avoided in case of failure.

Appendix C-2: Post-hoc-analyses: Descriptive and inferential analyses by country (Chapter 2)

Table C-2-1: Means, standard deviations, and correlations (USA)

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9
1. Exploitation	3.42	1.76									
2. Social class perception	5.10	1.78	.12**								
3. Necessity-Entrepreneurship	2.24	0.93	.08**	.05*							
4. Education	2.79	0.68	.04*	.26**	-.02						
5. Gender	1.44	0.57	-.05*	-.31**	-.15**	-.24**					
6. Age	36.01	11.72	-.10**	-.12**	-.11**	-.02	.09**				
7. Entrepreneurial experience	53.67	51.90	-.07**	-.14**	-.28**	.04*	-.03	.52**			
8. Firm size	1.16	0.47	.10**	.19**	.03	.06**	.08**	-.19**	-.14**		
9. Firm age	10.29	19.34	-.02	.09**	-.07**	-.01	.01	.13**	.25**	.13**	
10. Industry	2.10	0.54	-.09**	-.15**	-.00	.06**	-.04	.12**	.11**	-.32**	-.09**

***Note*:** $N = 135$. *M* and *SD* are used to represent mean and standard deviation, respectively. * Correlation is significant at the $p < .05$ level (2-tailed), ** Correlation is significant at the $p < .01$ level (2-tailed). All VIFs were below 1.64, thus, we inferred that multi-collinearity was not a problem for our analysis (O'Brien, 2007).

Table C-2-2: Regression models for direct and indirect effects (USA)

	Model 1: Exploitation (direct effects)			Model 2: Exploitation (indirect effects)		
Variable	*B*	*SE*	*p*	*B*	*SE*	*p*
Direct Effects						
Desirability	-1.04	0.05	< .001***	-1.31	0.16	< .001***
Feasibility	-1.13	0.06	< .001***	-1.43	0.17	< .001***
Achievable Gain	-1.27	0.07	< .001***	-1.73	0.20	< .001***
Preventable Loss	-1.05	0.06	< .001***	-1.44	0.17	< .001***
Social class perception	0.09	0.04	.054	-0.05	0.07	.400
Controls						
Age	0.00	0.00	.152	0.00	0.00	.152
Gender	-0.04	0.17	.826	-0.04	0.17	.826
Education	0.04	0.09	.687	0.04	0.09	.687
Firm age	0.00	0.00	.478	0.00	0.00	.478
Firm size	0.28	0.10	< .01**	0.28	0.10	< .01**
Entrepreneurial experience	0.00	0.00	.815	0.00	0.00	.815
Necessity-Entrepreneurship	0.09	0.04	.110	0.13	0.08	.110
Interaction Effects						
Desirability X Social Class				0.05	0.04	.070†
Feasibility X Social Class				0.06	0.06	.059†
Achievable Gain X Social Class				0.09	0.04	< .05*
Preventable Loss X Social Class				0.08	0.05	< .05*
Conditional R^2	0.61			0.62		

***Note*:** N = 135; 2160 observations, B = unstandardized regression coefficients; SE = standard errors. † *B* is (marginally) significant at the p < .10 level, * *B* is significant at the *p* < .05 level, ** *B* is significant at the *p* < .01 level, *** *B* is significant at the *p* < .001 level. For all models we use hierarchical mixed regression models employing the lme4 package in R.

Table C-2-3: Means, standard deviations, and correlations (Germany)

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9
1. Exploitation	3.43	1.70									
2. Social class perception	5.63	1.61	.02								
3. Necessity-Entrepreneurship	2.60	0.91	-.04	-.26**							
4. Education	4.32	0.99	.01	.13**	.19**						
5. Gender	1.29	0.45	-.09**	-.19**	.04	.07**					
6. Age	34.29	8.06	-.03	-.02	.29**	.14**	.07**				
7. Entrepreneurial experience	51.18	56.42	-.03	-.10**	.00	-.12**	-.03	.47**			
8. Firm size	1.02	0.15	.01	.13**	-.02	-.13**	.07**	-.18**	-.05*		
9. Firm age	5.44	6.30	-.05*	-.15**	.04	-.12**	-.04	.35**	.67**	.03	
10. Industry	2.00	0.42	-.04	.14**	-.01	-.21**	-.06*	-.16**	-.20**	.00	-.16**

***Note*:** $N = 91$. *M* and *SD* are used to represent mean and standard deviation, respectively. * Correlation is significant at the $p < .05$ level (2-tailed), ** Correlation is significant at the $p < .01$ level (2-tailed). We calculated variance inflation factors (VIFs) to control for multi-collinearity. All VIFs were below 2.13, thus, we inferred that multi-collinearity was not a problem for our analysis (O'Brien, 2007).

Table C-2-4: Regression models for direct and indirect effects (Germany)

	Model 1: Exploitation (direct effects)			Model 2: Exploitation (indirect effects)		
Variable	*B*	*SE*	*p*	*B*	*SE*	*p*
Direct Effects						
Desirability	-1.14	0.07	< .001***	-0.37	0.26	0.148
Feasibility	-1.22	0.07	< .001***	-1.29	0.35	< .001***
Achievable Gain	-1.24	0.07	< .001***	-0.66	0.23	< .01**
Preventable Loss	-1.18	0.08	< .001***	-1.16	0.30	< .001***
Perceived Social Class	-0.03	0.04	.496	0.08	0.07	.208
Controls						
Age	0.00	0.00	.647	0.00	0.00	.647
Gender	-0.41	0.15	< .01**	-0.41	0.15	< .01**
Education	0.03	0.07	.646	0.03	0.07	.646
Firm age	-0.02	0.01	.130	-0.02	0.01	.130
Firm size	0.38	0.16	< .05*	0.38	0.16	< .05*
Entrepreneurial experience	0.00	0.00	.893	0.00	0.00	.089
Necessity-Entrepreneurship	-0.10	0.07	0.180	-0.10	0.07	.180
Interaction Effects						
Desirability X Social Class				-0.14	0.04	< .01**
Feasibility X Social Class				0.01	0.06	.820
Achievable Gain X Social Class				-0.10	0.04	< .05*
Preventable Loss X Social Class				0.00	0.05	.952
Conditional R^2	0.59			0.61		

***Note*: $N = 91$; 1456 observations, B = unstandardized regression coefficients; SE = standard errors. * *B* is significant at the $p < .05$ level, ** *B* is significant at the $p < .01$ level, *** *B* is significant at the $p < .001$ level. For all models we use hierarchical mixed regression models employing the lme4 package in R.

Appendix D-2: Descriptive statistics of objective social class by country (Chapter 2)

Descriptive statistics of objective social class (Country 1 - USA)				
Education (Father)	**Dimension**	**n**	**% of Total**	**Cumulative %**
1	Lower secondary school	11	8.1 %	8.1 %
2	Middle school	50	37.0 %	45.2 %
3	A-levels	10	7.4 %	52.6 %
4	Vocational school	52	38.5 %	91.1 %
5	University degree	12	8.9 %	100.0 %
6	Doctorate	0	0%	100.0%
Education (Mother)	**Dimension**	**n**	**% of Total**	**Cumulative %**
1	Lower secondary school	5	3.7 %	3.7 %
2	Middle school	55	40.7 %	44.4 %
3	A-levels	10	7.4 %	51.9 %
4	Vocational school	62	45.9 %	97.8 %
5	University degree	3	2.2 %	100.0 %
6	Doctorate	0	0%	100.0%
Occupational status (Father)	**Dimension**	**n**	**% of Total**	**Cumulative %**
1	Employed/Worker	72	53.3 %	53.3 %
2	Entrepreneur/Self-employed	33	24.4 %	77.8 %
3	Manager/Professional	24	17.8 %	95.6 %
4	Unemployed	6	4.4%	100.0%
Occupational status (Mother)	**Dimension**	**n**	**% of Total**	**Cumulative %**
1	Employed/Worker	69	51.1 %	51.1 %
2	Entrepreneur/Self-employed	13	9.6 %	60.7 %
3	Manager/Professional	27	20.0 %	80.7 %
4	Unemployed	26	19.3 %	100.0 %
Income (Father)	**Dimension**	**n**	**% of Total**	**Cumulative %**
1	(0-500$)	2	1.5 %	1.5 %
2	(501-2000$)	20	14.8 %	16.3 %
3	(2001-3000$)	17	12.6 %	28.9 %
4	(3001-4000$)	18	13.3 %	42.2 %
5	(4001-6000$)	12	8.9 %	51.1 %
6	(6001-8000$ (or more))	28	20.7 %	71.9 %
0	(I don’t know)	38	28.1 %	100.0 %
Income (Mother)	**Dimension**	**n**	**% of Total**	**Cumulative %**
1	(0-500$)	24	18.3 %	18.3 %
2	(501-2000$)	24	18.3 %	36.6 %
3	(2001-3000$)	19	14.5 %	51.1 %
4	(3001-4000$)	14	10.7 %	61.8 %
5	(4001-6000$)	10	7.6 %	69.5 %

6	(6001-8000$ (or more))	11	8.4 %	77.9 %
0	(I don't know)	29	22.1 %	100.0 %
Entrepreneurial background (Father)	**Dimension**	**n**	**% of Total**	**Cumulative %**
1	Yes	25	18.5 %	18.5 %
2	No	110	81.5 %	100.0 %
Entrepreneurial background (Mother)	**Dimension**	**n**	**% of Total**	**Cumulative %**
1	Yes	27	20.0 %	20.0 %
2	No	108	80.0 %	100.0 %
Family migration background	**Dimension**	**n**	**% of Total**	**Cumulative %**
1	Yes	27	20.0 %	20.0 %
2	No	108	80.0 %	100.0 %
Descriptive statistics of objective social class (Country 2 - Germany)				
Education (Father)	**Dimension**	**n**	**% of Total**	**Cumulative %**
1	Lower secondary school (Hauptschule)	7	7.7 %	7.7 %
2	Middle school (Realschule)	11	12.1 %	19.8 %
3	A-levels (Abitur)	14	15.4 %	35.2 %
4	Vocational school (Berufsausbildung)	24	26.4 %	61.5 %
5	University degree	31	34.1 %	95.6 %
6	Doctorate	4	4.4 %	100.0 %
Education (Mother)	**Dimension**	**n**	**% of Total**	**Cumulative %**
1	Lower secondary school (Hauptschule)	18	19.8 %	19.8 %
2	Middle school (Realschule)	18	19.8 %	39.6 %
3	A-levels (Abitur)	8	8.8 %	48.4 %
4	Vocational school (Berufsausbildung)	22	24.2 %	72.5 %
5	University degree	23	25.3 %	97.8 %
6	Doctorate	2	2.2 %	100.0 %
Occupational status (Father)	**Dimension**	**n**	**% of Total**	**Cumulative %**
1	Employed/worker	48	52.7 %	52.7 %
2	Entrepreneur/Self-employed	23	25.3 %	78.0 %
3	Manager/Professional	20	22.0 %	100.0 %
4	Unemployed	0	0%	100.0%
Occupational status (Mother)	**Dimension**	**n**	**% of Total**	**Cumulative %**
1	Employed/worker	55	60.4 %	60.4 %
2	Entrepreneur/Self-employed	11	12.1 %	72.5 %

3	Manager/Professional	10	11.0 %	83.5 %
4	Unemployed	15	16.5 %	100.0 %
Income (Father)	**Dimension**	**n**	**% of Total**	**Cumulative %**
1	(0-500€)	3	3.3 %	3.3%
2	(501-1500€)	1	1.1 %	4.4%
3	(1501-2500€)	16	17.6 %	22.0%
4	(2501-3000€)	16	17.6 %	39.6%
5	(3001-5000€ (or more))	32	35.2 %	74.6%
0	I don't know	23	25.3%	100.0 %
Income (Father)	**Dimension**	**n**	**% of Total**	**Cumulative %**
1	(0-500€)	16	17.6 %	17.6 %
2	(501-1500€)	16	17.6 %	35.2%
3	(1501-2500€)	23	25.3 %	60.5%
4	(2501-3000€)	12	13.2 %	73.7%
5	(3001-5000€ (or more))	7	7.7 %	81.4%
0	I don't know	17	18.7%	100.0 %
Entrepreneurial background (Father)	**Dimension**	**n**	**% of Total**	**Cumulative %**
1	Yes	29	31.9 %	31.9 %
2	No	62	68.1 %	100.0 %
Entrepreneurial background (Mother)	**Dimension**	**n**	**% of Total**	**Cumulative %**
1	Yes	12	13.2%	13.2%
2	No	79	86.8%	100%
Family migration background	**Dimension**	**n**	**% of Total**	**Cumulative %**
1	Yes	20	22.0%	22.0%
2	No	71	78.0%	100%

Appendix A-3: Scenario description and overview of manipulated variables (Study 1)

(Chapter 3)

Scenario description

Please imagine the following situation: You work in a start-up that is currently evaluating new business opportunities to scale the business. Your supervisor, the company's CEO, asks you to give an initial assessment of several business opportunities that differ in various dimensions. He requests you to evaluate the potential business opportunities presented below from your perspective for the start-up based on the summarized information. The evaluation is completely anonymous. Your evaluation actively supports your start-up. Prior to the experiment, participants received the following overview of all manipulated variables:

Attribute	Levels
Leader's passion type	*Harmonious:* Your leader lives out their entrepreneurial passion harmoniously. *Obsessive:* Your leader lives out their entrepreneurial passion obsessively.
Leader's passion strength	*Moderate:* Your leader displays moderate entrepreneurial passion for this business opportunity. *High:* Your leader displays enormous entrepreneurial passion for this business opportunity.
Predictability of feasibility of business opportunity	*Low:* An initial feasibility analysis shows that it is hard to predict how this business opportunity will translate into an actual product or service. *High:* An initial feasibility analysis shows that it is easy to predict how this business opportunity will translate into an actual product or service.
Predictability of desirability of business opportunity	*Low:* An initial market analysis of the business opportunity shows that the target group's interest in potential products and services is hardly predictable. *High:* An initial market analysis of the business opportunity shows that the target group's interest in potential products and services is well predictable.

Appendix B-3: Scenario description and overview of manipulated variables (Study 2)

(Chapter 3)

Scenario description

Please imagine the following situation: You work in a start-up, and the company's CEO is also your direct supervisor. Currently, the start-up is looking for opportunities to scale and grow the company. With this in mind, the CEO asks for your input on several business opportunities.

In advance, these business opportunities have already been positively reviewed for their desirability and feasibility and are considered suitable in principle. You are tasked to subjectively assess these business opportunities and to what extent you would recommend them for exploitation. Please imagine that after reading the business opportunities, you can perceive the following:

Attribute	Levels
Uncertainty with regard to the evaluation of the business opportunity	*Low:* After assessing the business opportunity, you perceive relatively little uncertainty regarding the evaluation of the business opportunity. *High:* After assessing the business opportunity, you perceive a lot of uncertainty regarding the evaluation of the business opportunity.
Uncertainty with regard to potential effects of your evaluation	*Low:* When reading this business opportunity, you perceive relatively little uncertainty about whether taking the business opportunity will have a positive or negative impact on the start-up you are working in. *High:* When reading this business opportunity, you perceive a lot of uncertainty about whether taking the business opportunity will have a positive or negative impact on the start-up you are working in.
Uncertainty regarding the ability to influence the business opportunity	*Low:* For this business opportunity, you perceive relatively little uncertainty about the extent to which you can influence the development of the business opportunity with your behavior. *High:* For this business opportunity, you perceive a lot of uncertainty about the extent to which you can influence the development of the business opportunity with your behavior.

Appendix A-4: List of included journals (sorted by relevance) (Chapter 4)

Journals	Paper count
Academy of Management Journal	21
Academy of Management Review	21
Journal of Management	17
Journal of Applied Psychology	13
Entrepreneurship: Theory & Practice	11
Journal of Personality and Social Psychology	10
Organizational Behavior & Human Decision Processes	10
Academy of Management Annals	8
Journal of Business Venturing	8
Administrative Science Quarterly	7
Journal of Organizational Behavior	7
Strategic Management Journal	7
Psychological Inquiry	6
Strategic Entrepreneurship Journal	6
European Journal of Work & Organizational Psychology	5
Frontiers in Psychology	5
Journal of Business & Psychology	5
Journal of Business Research	5
Journal of Management Studies	5
Organization Science	5
Annual Review of Organizational Psychology and Organizational Behavior	4
Human Relations	4
Human Resource Management	4
Journal of Behavioral Decision Making	4
Journal of Change Management	4
Personnel Psychology	4
Work, Aging & Retirement	4
Applied Psychology: An International Review	3
Journal of Occupational & Organizational Psychology	3
Leadership & Organization Development Journal	3
Advances in Experimental Social Psychology	2
American Psychologist	2

Annual Review of Psychology	2
California Management Review	2
European Management Journal	2
European Management Review	2
FNT in Entrepreneurship (Foundations and Trends® in Entrepreneurship)	2
International Journal of Human Resource Management	2
Journal of Anxiety Disorders	2
Journal of Applied Behavioral Science	2
Journal of General Management	2
Journal of International Business Studies	2
Journal of Management & Organization	2
Journal of Occupational Health Psychology	2
Journal of Small Business Management	2
Long Range Planning	2
Management Science	2
Research in Organizational Behavior	2

***Note*:** In addition to these 48 journals, we included one paper from each of the following 53 journals: *Asia Pacific Journal of Management*, *Asian Business & Management*, *Behavioral Sciences*, *Business Horizons*, *Career Development International*, *Cognition & Emotion*, *Current Directions in Psychological Science*, *Decision Sciences*, *Emotion*, *Employee Relations*, *Entrepreneurship Research Journal*, *European Business Review*, *European Psychologist*, *Frontiers in Human Neuroscience*, *Human Resource Management Review*, *International Journal of Entrepreneurial Behavior & Research*, *International Journal of Management Reviews*, *Journal of Business Ethics*, *Journal of Communication*, *Journal of Consumer Research*, *Journal of Economic Behavior & Organization*, *Journal of Economic Psychology*, *Journal of General Psychology*, *Journal of International Management*, *Journal of Leadership & Organizational Studies*, *Journal of Managerial Psychology*, *Journal of Organizational Change Management*, *Journal of Personality Assessment*, *Journal of Political Economy*, *Journal of Positive Psychology*, *Journal of Research in Personality*, *Journal of Risk & Uncertainty*, *Journal of Risk Research*, *Journal of Safety Research*, *Management Research Review*, *Motivation Science*, *Nature Human Behaviour*, *Nature Reviews Psychology*, *Neural Networks*, *Organizational Psychology Review*, *Phenomenology and the Cognitive Sciences*, *Psychological Bulletin*, *Psychological Review*, *Public Management Review*, *Quarterly Journal of Experimental Psychology*, *R&D Management*, *Review of Public Personnel Administration*, *Scandinavian Journal of Psychology*, *Social Behavior and Personality*, *Synthese*, *The Leadership Quarterly*, and 10 book chapters.

Appendix B-4: Contents and categorization of reviewed literature (Chapter 4)

Level of analysis	*n* (total number of studies)	conceptual	quantitative	qualitative	chapters
General calls for research on uncertainty and its effective management	**10**	**10**	**0**	**0**	**0**
Category 1: Uncertainties in the organizational environment	**61**	**27**	**34**	**0**	**0**
1.1 Conceptualizing of external uncertainties (task environment)	6	0	6	0	0
1.2 Conceptualizing of external uncertainties (uncertainty perception)	13	5	8	0	0
1.3. Organizational responses to external uncertainties (strategic management)	14	7	7	0	0
1.4 Organizational responses to external uncertainties (risk management)	11	9	2	0	0
1.5 Organizational responses to external uncertainties (learning and internal adaption)	17	6	11	0	0
Category 2: Uncertainties in the operational environment	**49**	**13**	**32**	**1**	**3**
2.1 Uncertainty sources (Leadership and communication)	23	5	16	1	1
2.2 Uncertainty sources (Changes in work and knowledge demands)	16	6	9	0	1
2.3 Uncertainty sources (Changes in role demands and social working organization)	10	2	7	0	1
Category 3: Employees' uncertainty regulation in the operational environment	**70**	**22**	**43**	**2**	**3**
3.1 Theoretical perspectives: Management of uncertainties in organizations	17	13	2	0	2
3.2 Employees' uncertainty regulation (Leadership and communication)	11	1	10	0	0
3.3 Employees' uncertainty regulation (Changes in work and knowledge demands)	13	0	12	1	0
3.4 Employees' uncertainty regulation (Changes in role demands and social working organization)	12	0	12	0	0
3.5. Employees' general responses to uncertainty	9	5	2	1	1
3.6 Interventions to improve employees' responses to uncertainty	8	3	5	0	0

Category 4: Individual factors shaping employees' uncertainty regulation	**125**	**37**	**84**	**0**	**4**
4.1 Personality and uncertainty	28	7	21	0	0
4.2 Motivation and uncertainty	23	1	18	0	4
4.3 Cognition and uncertainty	32	15	17	0	0
4.4 Affect and uncertainty	42	14	28	0	0
Total	**315**	**109**	**193**	**3**	**10**