



# Unpacking the uncertainty construct: Implications for entrepreneurial action

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## ABSTRACT

Uncertainty is central to entrepreneurship; however robust and generalizable findings that explain the conditions in which uncertainty may impede [or promote] entrepreneurial action remain elusive. We operationalize uncertainty as a multi-dimensional construct composed of state, effect, and response types of uncertainty (Milliken, 1987) to investigate the relationship between uncertainty and entrepreneurial action. We decompose more than 2800 exploitation decision policies nested within a sample of new product decision-makers working in entrepreneurial software firms. We focus on the primary decision-maker's willingness to exploit a given opportunity in the face of varying combinations and manifestations of uncertainty and find that the type of uncertainty experienced influences the willingness to engage in entrepreneurial action differently. Further, we find that differences in how each type of uncertainty is manifested in the environment, the scale of exploitation (i.e. large vs. small), and the entrepreneur's expertise serve to moderate the relationship between uncertainty and action in counter-intuitive ways. We discuss the implications for both theory and practice.

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## 1. Executive summary

Entrepreneurship is a process that involves some degree of uncertainty, and thus the ability of entrepreneurs to interpret and respond to uncertainty is often what determines the degree of success or failure achieved by the venture. In fact, the notion that entrepreneurs make decisions and subsequently act in the face of inherently uncertain, even unknowable, futures is one of the most closely held assumptions in entrepreneurship (e.g., Knight, 1921; Shane and Eckhardt, 2003; Sarasvathy et al., 2003). It is even true that uncertainty likely contributes to the allure of entrepreneurship as a vocation; as John Paul Getty said, "Without the element of uncertainty, the bringing off of even the greatest business triumph would be dull, routine, and eminently unsatisfying."

So, on the one hand, the notion of uncertainty figures prominently in entrepreneurship discourse; however, the ways that uncertainty influences entrepreneurs' behaviors throughout the steps and stages of the entrepreneurial process is ambiguous. Competing and often disparate conceptualizations of uncertainty have been applied throughout the management and entrepreneurship literatures with "inconsistent and difficult to interpret results due to poor reliability and validity of measurement instruments, and no clear evidence of a relationship between objective characteristics of the environment and perceptions of uncertainty" (Milliken, 1987: 135). Milliken suggests that the challenges associated with the uncertainty construct – as it has been applied to both entrepreneurship and management research – is that the extant conceptualizations commonly applied do not distinguish between the types of uncertainty an individual may experience. Put simply, Milliken suggests that *how an individual interprets the uncertainty* represented by a given situation should be the focus of our research.

The purpose of this research is to explore how uncertainty influences the entrepreneur's decision to *act* on an opportunity that is objectively "worth" pursuing. Specifically, we design a decision experiment that offers insights into how different types and

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manifestations of uncertainty promote or impede an entrepreneur's willingness to exploit an opportunity. We operationalize uncertainty based on the typology offered by Milliken (1987), which differentiates between state, effect, and response uncertainty, and decompose more than 2800 exploitation decisions in order to relate varying uncertainty conditions and types to the decision-maker's willingness to engage in entrepreneurial action in the form of a new product launch. Not surprisingly, we find that all else being equal, more uncertainty leads to decreased willingness for action. However more insightful is our finding that the "type" of uncertainty matters; that is, we find that entrepreneurs make different decisions with regard to exploitation depending on the type of uncertainty that they experience. In addition, depending on how uncertainty it is manifested in the environment (e.g., through technology or customer demand) and on the expertise of the entrepreneur, we find that the decision-makers who participated in this study made different and sometimes counter-intuitive decisions with regard to their willingness to engage in entrepreneurial action.

For example, a high level of expertise is one of the most commonly advanced explanations as to why an individual might act in the face of uncertainty. We find that domain-specific expertise might play a more limited role in explaining action in the face of uncertainty than is advanced by the extant literature; expertise moderates the relationship between uncertainty and action only in the case of effect uncertainty (the predictability of future states). It could be that experts try to downplay the importance of predicting the future but focus more on creating the future (i.e., effectual reasoning) or that experts are overconfident and believe that they can overcome the challenges of decision-making in the face of uncertainty because of their "expert knowledge." Finally, we also demonstrate that the scale of the launch (small- vs. large-scale) is important in understanding the relationship between uncertainty and action. In the face of uncertainty related to customer demand, decision-makers choose to experiment with small-scale launch, possibly to learn more about customer preferences or reduce uncertainty. However, as uncertainty related to technology increases, decision-makers' willingness to engage in small-scale launch decreases. This suggests that decision-makers in these firms avoid small-scale experimentation if they feel that the viability of the underlying technology appears to be threatened. In other words, they do not see the necessary return from expending further resources even for small-scale endeavors. In sum, this study represents a step toward cracking open the black box of entrepreneurial decision-making in a way that opens the door to a more comprehensive understanding of how entrepreneurs make decisions in the face of uncertain environments.

## 2. Introduction

McMullen and Shepherd (2006) suggest that entrepreneurship requires a judgment about action. They assert that because action takes place over time in the face of an unknowable future, it should be no surprise that "uncertainty constitutes a conceptual cornerstone for most theories of the entrepreneur" (McMullen and Shepherd, 2006: 132). However, despite the theoretical significance of uncertainty in entrepreneurship, robust and generalizable findings that explain the conditions under which uncertainty may impede [or promote] entrepreneurial action remain elusive. In fact, given the equivocal findings of empirical research relating uncertainty to entrepreneurial behaviors (O'Brien et al., 2003), a case can be made that we actually understand very little about how and under what conditions uncertainty may influence important outcomes in entrepreneurship.

Generally, scholars view the uncertainty construct very broadly, focusing most often on environmental uncertainty, which Miles and Snow define as "the predictability of conditions in the organization's environment" (1978: 195). The motivation for Milliken's (1987) seminal article was to highlight the inadequacies of such an objective and one-dimensional conceptualization of uncertainty. Milliken differentiates between three types of uncertainty experienced by decision-makers: state, effect, and response uncertainty. *State* uncertainty represents the inability to predict how the components of the environment are changing. *Effect uncertainty* describes the inability to predict how changes in the environment will influence the firm. Finally, *response uncertainty* describes a lack of insight into response options given a changing environment and/or the inability to predict the likely consequences of a response choice. Milliken's logic implies a conceptual distinction between types of uncertainty as a function of the nature of the information shortage represented by each type (Milliken, 1987) and suggests that each type of uncertainty may have different implications for sense making and, ultimately, behavior.

Thus, Milliken would argue that answers to questions like how and under what conditions uncertainty will influence entrepreneurial action would depend on the type of uncertainty perceived by the entrepreneur – specifically by what information is missing. The power of Milliken's idea is that an individual experiences uncertainty when he/she needs to make a decision about action – and the decision is informed differently as a function of uncertainty type. This conceptualization opens the door to more precision with regard to defining, using, and measuring the uncertainty construct and, therefore, enables a more powerful investigation of the complex interplay between uncertainty and decision-making.

Since its publication, Milliken's framework has been widely cited for extending and re-framing longstanding theoretical assumptions with regard to the role of uncertainty in domains as disparate as leadership (Waldman et al., 2001), new product development (Moenaert and Souder, 1990), social networks (Gulati and Higgins, 2003), and transaction cost theory (Sutcliffe and Zaheer, 1998). That said, in the 22 years since Milliken's article (1987), empirical research in entrepreneurship remains almost exclusively focused on environmental uncertainty (Song and Montoya-Weiss, 2001). This study represents a first step through the door opened by Milliken in an entrepreneurial context, empirically unpacking the uncertainty construct to consider how different types of uncertainty might influence entrepreneurs' decisions differently when they are faced with action-orientated decisions. Our purpose is to investigate how uncertainty informs the decisions of entrepreneurs to *act* on an opportunity that is objectively "worth" pursuing (McMullen and Shepherd, 2006) and, by doing so, to advance a fundamental reinterpretation of how uncertainty informs entrepreneurial decisions and behaviors.

To this end, we employ metric conjoint analysis and hierarchical linear modeling techniques to decompose more than 2800 exploitation decision policies nested within a sample of new product decision-makers working in entrepreneurial software firms.

A decision policy represents an evaluative judgment (in this case, a judgment as to the decision-maker's willingness to act) based on a discrete set of decision attributes (Karren and Barringer, 2002). We model varying manifestations of each uncertainty type in order to assess if different types and/or manifestations of uncertainty have differential impacts on an entrepreneur's decision to act. In addition, we test how attributes of the individual (i.e., domain specific expertise) and the scale of the proposed launch (large vs. small) might moderate the decision-maker's willingness to act in the face of varying types of uncertainty. For example, we test the cross-level moderation between expertise and each uncertainty type to assess how variance in expertise impacts the relationship between uncertainty and action. We also consider how differences in the magnitude of the launch moderate the relationship between levels of uncertainty and an entrepreneur's decision to act.

Not surprisingly, we expect to find that the willingness to act generally declines as uncertainty increases. However, our more interesting and impactful insights are likely to arise from a comparison of the differential influences of uncertainty type on an entrepreneur's willingness to act. Based on Milliken's theorizing we hypothesize that *response* uncertainty will represent the most impactful impediment to entrepreneurial action, and that how a given type of uncertainty is represented in the environment will have differential impacts on an entrepreneur's decision to act. We suggest that this research makes several important contributions.

First, we contribute to and extend the research focused on understanding how uncertainty influences the entrepreneur's cognitions, thus opening the door to interesting and counter-intuitive questions with regard to several theoretical frameworks commonly applied to entrepreneurship. For example, consider that Sarasvathy's (2001) notion of effectual reasoning is based on the proposition that entrepreneurs do not attempt to predict an unknowable future but actually *create* their own future through their own actions, knowledge, skills, and available means (Sarasvathy et al., 2003). On one hand, the theoretical arguments developed in this article resonate well with Sarasvathy's logic. We suggest that state uncertainty may not meaningfully impede entrepreneurial action, because such uncertainty is assumed *a priori* in the decision policy of the entrepreneur – as Sarasvathy suggests. However, effectual reasoning also implies a process in which the decision-maker combines a set of available “means” to create some “end” that is only clear and definable post-action. This idea seems to be at odds with our suggestion that the inability to predict the consequences of one's own actions (response uncertainty) – represents a powerful impediment to entrepreneurial action. Such a finding would suggest limits to the utility of effectuation as a lens to inform entrepreneurial behaviors and outcomes comprehensively. This apparent paradox might serve to qualify Sarasvathy's (2001) assertion that effectual reasoning represents the entrepreneur's dominant decision framework and highlights a compelling avenue for future research at the intersection of effectuation and uncertainty. In a similar way, our findings might suggest interesting opportunities to investigate the Resource-Based View (RBV) – another common theoretical frame applied to entrepreneurship. According to the RBV, a firm's ability to generate and sustain entrepreneurial profits is a function of the firm's resource endowments (Barney, 1991; Conner, 1991; Wernerfelt, 1984). To generate entrepreneurial returns, the RBV assumes that decision-makers make choices that position resources in their first best use; in fact, Conner (1991: 121) writes that given “a Resource-Based View, discerning appropriate inputs is ultimately a matter of entrepreneurial vision and intuition.” However, she also highlights that empirical tests of this vision and intuition have not “been a central focus of resource-based theory development” (Conner, 1991:121). Our findings are expected to inform Conner's notion of “entrepreneurial vision and intuition” in that the type of uncertainty the decision-maker experiences may influence his/her willingness to re-deploy and re-combine resources [to their best use] differently in response to a changing competitive environment. Such findings might open the door to consider performance differences between firms based on how the different types of uncertainty experienced by the decision-maker influence the employment of the firm's resource endowments toward generating rents. Such a focus has yet to be incorporated into extant theorizing.

Second, this research has the potential to provide novel empirical insights into the role that uncertainty plays regarding decisions to exploit a new opportunity, which ultimately has implications for the practice of entrepreneurship research. Findings that different types of uncertainty will yield significantly different decisions with regard to action suggest to entrepreneurship scholars that focusing solely on environmental uncertainty in their research – as is the convention today – is potentially problematic. Such a limited focus is likely the cause of the inconsistent and misleading empirical findings represented in the extant entrepreneurship literature. At a minimum, this research might suggest that scholars should take more care when describing the specific type of uncertainty that is operationalized in their research. Alternatively, our findings might highlight the potential impact of enhanced precision with regard to defining, using, and measuring the uncertainty construct.

Finally, because our model includes variables representing differing magnitudes of exploitation (small- vs. large-scale), we are able to consider the various exploitation “trade-offs” that entrepreneurs make in the face of different uncertainty types. We expect that the type of exploitation moderates the relationship between certain types of uncertainty and an entrepreneur's willingness to exploit an opportunity. For example, all else being equal, different types of uncertainty will likely generate alternative preferences for uncertainty reduction strategies, learning strategies, or profit maximization approaches as a function of the relationship between uncertainty type and the scale of the proposed product launch. These findings would represent an opportunity for scholars to reconsider assumptions and empirical findings with regard to how entrepreneurs evaluate potential opportunities (Haynie et al., 2009) and subsequently select strategies for exploitation (Choi et al., 2008).

### 3. Uncertainty and the entrepreneurial environment

#### 3.1. Overview and boundary conditions

Uncertainty is fundamental to entrepreneurship (Knight, 1921; McMullen and Shepherd, 2006). While researchers widely acknowledge the important role uncertainty plays in entrepreneurship, the notion of exactly *how* scholars conceptualize

uncertainty is unsettled in the literature. Some suggest that uncertainty refers to the “inability to assign probabilities as to the likelihood of future events” (Duncan, 1972; Pennings, 1981; Pfeffer and Salancik, 1978), while others define uncertainty to be “a lack of information about cause–effect relationships” (Lawrence and Lorsch, 1967). Still others have suggested that uncertainty describes, “an inability to predict accurately what the outcomes of a decision might be” (Downey et al., 1975; Duncan, 1972; Schmidt and Cummings, 1976). Milliken (1987) suggested that because these definitions are generally not anchored in a context, and because they are objective (as opposed to being conceptualized as a perceptual indicator), there tends to be both theoretical and empirical ambiguity as to the *impact* of uncertainty on action (Miller and Shamsie, 1999). Further exacerbating this ambiguity in entrepreneurship is the fact that practitioners and scholars often describe entrepreneurial environments as risky, ambiguous, dynamic, and turbulent and often imply that these terms are synonymous with uncertainty (Shane, 2003; Lipshitz and Strauss, 1997). We highlight this fact in an effort to clarify our purpose and to set boundary conditions on our research. Our purpose is very specific: we wish to apply Milliken's conceptualization of uncertainty toward investigating how a multi-dimensional view of uncertainty might extend our understanding of the relationship between uncertainty and an individual's willingness to engage in entrepreneurial action. However, it is important to note that our research design acknowledges the following factors: 1) a conceptual distinction between risk and uncertainty such that risk implies that the probabilities of future outcomes are knowable, whereas uncertainty implies that they are unknowable (e.g. Knight, 1921; Alvarez and Barney, 2005)<sup>2</sup> and 2) dynamism and turbulence constitute external factors that contribute to uncertainty. In highly dynamic environments, change is frequent and the outcomes of these changes are not predictable or knowable *a priori* (e.g. Eisenhardt and Martin, 2000).

Ultimately, entrepreneurship scholars investigating the relationship between uncertainty and the outcomes associated with entrepreneurship have focused much of their attention on characterizing the entrepreneurial environment and its underlying dimensions. Examples of such research include Song and Montoya-Weiss's (2001) study of Japanese new product development and Matthews and Scott's (1995) study considering the environmental uncertainty in the context of business planning. The motivation for this type of research is based on the implicit assumption that understanding the dimensions of the entrepreneurial environment lies at the heart of capturing the core uncertainty that entrepreneurs face. Several complementary, but substantively disparate, characterizations of the entrepreneurial environment are represented in the literature. For example, research by Baum et al. (2001) indicates that the entrepreneurial environment can be characterized in terms of dynamism, munificence, and complexity. Alternatively, Weaver et al. (2002) suggest that the dimensions defining the entrepreneurial environment include customer, competitors, technological volatility, and change. Interestingly, while the characterizations of the entrepreneurial environment that these scholars suggest diverge in important ways, we propose here that the idea of uncertainty – *as it is experienced by the individual* – serves to unify the dimensions identified above.

Milliken (1987) writes that the extant conceptualizations of uncertainty commonly applied in both management and entrepreneurship research generally do not distinguish between the types of uncertainty an individual experiences. Thus, despite the theoretical significance of uncertainty in entrepreneurship, the construct “has generally yielded inconsistent and difficult to interpret results due to poor reliability and validity of measurement instruments, and no clear evidence of a relationship between objective characteristics of the environment and perceptions of uncertainty” (Milliken, 1987: 135). In an attempt to situate the uncertainty construct at the level of the individual, Milliken suggests three distinct types of uncertainty: state uncertainty, effect uncertainty, and response uncertainty. *State uncertainty* refers to uncertainty about the external environment caused by an individual's inability to predict how environmental components are changing (i.e., demographic shifts, socio-cultural trends, etc). *Effect uncertainty* relates to an individual's inability to predict how changes in the environment will impact a firm (i.e., knowing that a hurricane is headed in the direction of your house does not mean that you know how the hurricane will impact your house). Finally, *response uncertainty* refers to uncertainty caused by an individual's lack of insight into response options given a changing environment and his/her inability to predict the likely consequences of a response choice (i.e., if the firm enters a new market, but the individual cannot predict how a given competitor will respond) (Milliken, 1987). McMullen and Shepherd (2006: 135) simplify Milliken's three types of uncertainty into three questions “asked by a prospective actor about his or her relationship to the environment: (1) what's happening out there? (state uncertainty), (2) how will it impact me? (effect uncertainty), and (3) what am I going to do about it? (response uncertainty).” Milliken suggests that each of these uncertainty types *considered together* define the nature and character of uncertainty that surrounds a given entrepreneurial decision.

Explicit in Milliken's thinking is the assumption of heterogeneity between individuals with regard to how uncertainty is reflected in the perceiver's decision policies. We hypothesize, capture, and test this assumption. Further, Milliken's work also suggests that different types or manifestations of uncertainty may influence the relationship between uncertainty and action differently; that is, it is likely that a specific type of uncertainty (i.e., state uncertainty), if manifested in the environment in different forms, may have differential impacts on the perceiver's subsequent decision policy. We also hypothesize, capture, and test this implicit assumption in Milliken's theorizing.

In what follows we develop, define, and propose a set of hypothesis that represent the relationship between uncertainty and entrepreneurial action generally and then specifically for each of Milliken's uncertainty types (and the differing manifestations of each type) to determine the effects each may have on entrepreneurial decisions.

<sup>2</sup> The distinction between risk and uncertainty is most evident in our empirical operationalizations (in Table 1), where the “high” levels clearly reflect the “unknowable,” rather than future outcomes that can be predicted or assigned a probability. These operationalizations also further differentiate our study from those that have a risk focus, such as Forlani and Mullins' (2000) study.



### 3.2. Uncertainty and entrepreneurial action

McMullen and Shepherd suggest that uncertainty is what ‘separates entrepreneurial action from mere action’ (McMullen and Shepherd, 2006; Alvarez and Barney, 2005; Sarasvathy, 2001). However, the authors go on to note that “entrepreneurship theorists have embraced the position that uncertainty is detrimental to entrepreneurial action because properties such as hesitancy, indecisiveness, and procrastination are thought to lead to missed opportunities” (McMullen and Shepherd, 2006: 135; Casson, 1982). In fact, there have been many empirical studies demonstrating the powerful relationship between uncertainty and important entrepreneurial outcomes. For example, Gans et al. (2008) demonstrate that reductions of uncertainty with regard to intellectual property rights facilitate trade in the marketplace for new ideas. Similarly, Wu and Knott (2006) demonstrate that the level of uncertainty represented in the environment is related to entrepreneurs’ market entry decisions. Ultimately, we suggest that a fairly well established theme in entrepreneurship (and more broadly in the decision-making literature) is the relationship between uncertainty and action (see also O’Brien et al., 2003; Palich and Bagby, 1995). We represent this literature as the “starting point” for our investigation into entrepreneurship as a multi-dimensional construct, thus, we hypothesize the following:

**H1.** Willingness to engage in entrepreneurial action will decrease as uncertainty (state, effect, and response) increases.

In what follows, we parse out the underlying dimensions of the uncertainty construct as suggested by Milliken (1987) in order to extend insights beyond the somewhat intuitive hypothesis above.

### 3.3. State uncertainty

State uncertainty refers to the “perception by an individual that a particular component of the environment is unpredictable; more specifically, that one does not understand how the components of the environment are changing” (Milliken, 1987: 137). As state uncertainty increases, it becomes increasingly difficult to understand and predict the future state of the external environment. Milliken suggests that “to the extent that volatility, complexity, and heterogeneity make the environment less predictable,” it is likely that the decision-maker is more influenced by state uncertainty as compared to a decision-maker who “functions in a more stable environment” (Milliken, 1987: 137). Milliken (1987) cites several factors that drive state uncertainty, including demographic shifts, socio-cultural trends, and changes in suppliers, customers, and competitors.

The dynamism inherent in entrepreneurial contexts suggests that state uncertainty is enduring and occurs at high levels. For example, technology and customer demand uncertainties – both classic examples of state uncertainty – are prevalent in dynamic markets (Bettis and Hitt, 1995; Eisenhardt and Martin, 2000). State uncertainty driven by technological change and obsolescence may influence an entrepreneur’s ability to predict future technologies. Research suggests that entrepreneurs may avoid exploiting new technology-based products, for example, in environments with high levels of technology uncertainty (Pavitt, 1998). Similarly, substantial changes in customer demand have a negative effect on new product launches, as the state uncertainty associated with future demand patterns may be interpreted as the entrepreneur “losing touch” with the consumer (Jaworski and Kohli, 1993). Customer demand for new products generally depends on whether customers know the product and find it valuable (Aldrich and Fiol, 1994). A lack of familiarity with customer needs, as would occur with high levels of demand uncertainty, increases the uncertainty involved in a new product launch, which would make an opportunity appear less attractive.

As highlighted previously, one of our research aims is to take a first step toward not only understanding if varying uncertainty types have differing impacts on an entrepreneur’s decision to exploit an opportunity, but we also aim to assess if different manifestations of a given uncertainty type impact the entrepreneur’s decision policy differently. For example, given the two manifestations of state uncertainty detailed above – technology and customer demand uncertainties – might one manifestation have a more powerful impact on an entrepreneur’s decision than the other? We suggest that the answer to this question is yes, and while this proposition has, to our knowledge, never been explicitly tested in the context of Milliken’s uncertainty types, our argument is informed by decision-making studies that, for example, relate the notion of perceived control to action. In the face of uncertainty, the extent to which an individual perceives (correctly or incorrectly) that the outcomes associated with a given action are more or less under his/her control, the more likely he/she is to act (Nordgren et al., 2007). As such, consider the example of state uncertainty represented by unknowns relating to changes in technology vs. changes in customer demand. Research suggests that customers are notoriously fickle (Bhattacharya et al., 1998) and change preferences for a myriad of reasons, which are often beyond a firm’s control (Kalyanaram and Krishnan, 1997; Bhattacharya et al., 1998). Research also suggests that managers believe that they can consistently out-innovate their competition when responding to changes in technology and can more or less control their own competitive space (Kandampully and Duddy, 1999; Teece et al., 1997). This suggests that, all else being equal, *how uncertainty is manifested in the environment* in light of what the decision-maker perceives to be more under his or her control, likely has different effects in terms of decision outcomes. As such, we suggest the following:

**H2a.** Willingness to engage in entrepreneurial action will *decrease* as the rate of technological change represented in the environment increases (state uncertainty).

**H2b.** Willingness to engage in entrepreneurial action will *decrease* as the rate of change in patterns of customer demand increases (state uncertainty).

### 3.4. Effect uncertainty

Effect uncertainty relates to an individual's ability to predict how environmental events or changes will impact a firm (Milliken, 1987). Research suggests that in the presence of high levels of environmental dynamism, entrepreneurs tend to relate this dynamism to uncertainty with regard to how their choices and actions might influence the venture (Abernathy and Clark, 1985). More simply, decision-makers often believe that they can satisfy specific needs and changes regarding technological demand (Grewal and Tansuhaj, 2001); however there remains uncertainty with regard to how such changes will impact the venture (Tushman and Nelson, 1990). For example, Christensen and Bower (1996) argue that the changes in customer and technological demands rarely deviate beyond a firm's current knowledge and competencies. However, the less predictable the effects of the changes are, the higher the risk that the firm's existing knowledge and products will not be able to satisfy customer requirements at that moment (Jaworski and Kohli, 1993). For example, a firm producing memory cards for PDAs likely has the technological capability to respond to changes in how consumers "use" the PDA but often will struggle to understand the impact of technological change (i.e., increasing individuals' ability to store large amounts of memory on a portable drive) on the existing competitive dynamic in their industry. As this example implies, we suggest that entrepreneurs will generally avoid exploiting opportunities in situations in which they are not able to understand or predict how changes in the environment will affect the firm. Thus,

**H3a.** Willingness to engage in entrepreneurial action will *decrease* as the predictability of the impact of technological change decreases (effect uncertainty).

**H3b.** Willingness to engage in entrepreneurial action will *decrease* as the predictability of the impact of demand change decreases (effect uncertainty).

### 3.5. Response uncertainty

Response uncertainty is defined as a lack of knowledge of response options and/or an inability to predict the likely consequences of a response choice (Milliken, 1987). In cases in which there is a need to act, response uncertainty is of utmost importance (Duncan, 1972). Experiencing ambiguity with regard to the consequences of the decision-maker's own actions, in essence, contradicts the purpose of the action itself, whether it is eliminating a threat or taking advantage of an opportunity. In the context of this study, we operationalize action in the context of exploiting an entrepreneurial opportunity. Successful action in the case of dynamic markets, while bearing in mind demand and technological uncertainty, furthers competitive advantage. As competitive advantage is fleeting in dynamic markets (Eisenhardt and Martin, 2000), earning repeated advantage represents the basis for successful competition. For this to occur, understanding the breadth of response options and the consequences of a response choice are paramount.

In the context of deciding to exploit an entrepreneurial opportunity, there are two likely consequences of a response choice: a lead-time advantage over competitors (Lieberman and Montgomery, 1988) and the ability to build upon existing firm-specific competencies through the exploitation of a new opportunity (Miller, 1996). Moreover, while an entrepreneur may understand that these outcomes are *possible* consequences of the decision to exploit, the inherent inability to predict these outcomes characterizes response uncertainty. That is, the inability to predict the likelihood of realizing these potential positive outcomes following an entrepreneur's actions provides doubt concerning the actual benefits about making a strategic move. As such, it is likely that response uncertainty will influence an entrepreneur's decision to exploit. Thus,

**H4a.** Willingness to engage in entrepreneurial action will *decrease* as the firm's ability to predict the likelihood of sustaining innovation decreases (response uncertainty).

**H4b.** Willingness to engage in entrepreneurial action will *decrease* as the firm's ability to predict the likelihood of achieving a lead-time over competitors' decreases (response uncertainty).

Tolerance of environmental uncertainty is a trait commonly attributed to entrepreneurs (McClelland, 1961). This notion is attributed to specific attitudes, internal locus of control (cf. Delmar, 2000), and, to a larger degree, their reliance of specific cognitions and heuristics (Busenitz and Barney, 1997; Baron, 1998). In other words, attitudes and patterns of reasoning relate positively to an entrepreneur's perceived ability to counter market uncertainty. Uncertainty with regard to the consequences of one's own actions, however, cuts to the core of extant theory in terms of the psychology of the entrepreneur. For example, the literature suggests that entrepreneurs maintain high levels of confidence (Busenitz and Barney, 1997; Forbes, 2005) and self-efficacy (Baron and Markman, 2003; Chen et al., 1998) and that they are driven by a belief in their own ability to "create" in the face of changing and uncertain environments (Saravathy, 2001). As such, ambiguity with regard to a lack of knowledge of response options and/or the inability to predict the probable consequences of a response choice likely mitigates confidence, efficacy, etc. Therefore, in keeping with our overarching proposition that not all uncertainty is created equal, we suggest that response uncertainty will have a greater impact on an entrepreneur's decision to exploit as compared to high levels of the other uncertainty types (state and effect uncertainty). Thus,

**H5.** All else being equal, the negative relationship between state, effect, and response uncertainty and the willingness to engage in entrepreneurial action will be *more negative* for response uncertainty, than for state and/or effect uncertainty.

We have hypothesized above that the differential impacts of uncertainty types related to an entrepreneur's decision to exploit are likely to be based on the relationship between the form in which the uncertainty is manifested and the extent to which the entrepreneur perceives his/her ability to control outcomes in the face of uncertainty. It is likely that differences between individuals with regard to feelings of control in the face of uncertainty are a function of individual attributes, such as prior knowledge or experience. Expertise is one construct that captures such individual differences in a holistic way.

### 3.6. Expertise, uncertainty, and entrepreneurial decision-making

Experts are individuals who have realized a high level of individual competence in a given domain, at least partly due to multiple years of experience (Foley and Hart, 1992). In both the entrepreneurship and management literatures, scholars have demonstrated a growing interest in the role that expertise may play in decision-making; however, the relationship between expertise and uncertainty in a decision setting remains unsettled in the literature. Read and Sarasvathy (2005: 45) suggest that “Exceptionally high task performance is consistently associated with experts... Yet, management research has barely begun to leverage advancements made in the psychology and cognitive science literature to investigate expertise in a business setting”. Assuming that uncertainty relates to one's ability to predict outcomes and future changes that are inherently unknowable, some argue that “consequence probabilities are not worth characterizing when final actions must be taken based on information available now” (Cox et al., 2008: 465). Theoretically, such a perspective suggests that expertise would not serve to mitigate uncertainty and would thus result in a normatively “better” decision. What is inherently “unknowable” is just that. However, stepping beyond this philosophical argument, researchers have found that domain expertise contributes to the ability to construct complex cognitive representations of uncertain and dynamic decision tasks, which in turn begets improved decision performance (McDonald et al., 2008; Charness, 1991; Wiggins and O'Hare, 1995).

As numerous findings in cognitive psychology point out, expertise plays a crucial role in decision-making (e.g., Chase and Simon, 1973; Anderson, 1990). Experts “know more” (cf. Fiet, 2002) and they “know differently”; that is, they employ different cognitive processes compared to novices (Adelson, 1981; Gustafsson, 2006). Further, expertise serves to reduce behavioral bias in the face of decision-making uncertainty, making experts less “aware” of the potential impact uncertainty will have on a given decision (Kaustia et al., 2008). Thus,

**H6(a–d).** The negative relationship between high levels of state and effect uncertainty and the willingness to engage in entrepreneurial action is *less negative* as domain specific expertise increases.

### 3.7. Uncertainty and the scale of exploitation

In highly dynamic markets in which uncertainty reigns, it is not possible to “wait and see” or to use a follower strategy, as competitive positions change and windows of opportunity close (Bourgeois and Eisenhardt, 1988). Achieving competitive advantage is difficult, if not impossible, without engaging in some sort of large-scale operation. Entrepreneurs will engage in various actions in order to reduce the level of uncertainty that they encounter. This supports the idea that firms will prioritize an incremental process over a comprehensive process in changing markets (Braybrooke and Linblom, 1963; Daft and Weick, 1984). On the other hand, research bears witness that entrepreneurs may behave entrepreneurially before all potential uncertainties are resolved (Busenitz and Barney, 1997; Baron, 1998). In industries with moderate uncertainty, entrepreneurs have demonstrated more willingness to engage in large-scale action in order to maximize revenues (cf. Stevenson and Jarillo, 1990) as compared to highly uncertain markets. In extremely fast-changing markets, however, a more experimental, small-scale approach is often preferred so that entrepreneurs can learn more about the environment (McGrath, 1999). Thus,

**H7a–f.** The negative relationship between state, effect, and response uncertainty and the willingness to engage in entrepreneurial action is moderated by the scale of the exploitation such that the relationship is *less negative* for a small-scale launch than for a large-scale launch.

## 4. Research method

### 4.1. Sample

The sample for this study consisted of primary new product development decision makers working in the Swedish software industry. We chose this industry because it is notorious for fast-changing technology, a blurred competitive market, and shifting customer demands (Carmel, 1995; Zahra and Bogner, 2000). Therefore, we feel that this industry is theoretically relevant for studying decision-making under uncertainty. The Swedish software industry is flourishing and is comprised of many small entrepreneurial firms. We purposefully focused on small firms in this study because we were interested in concentrating on firms' primary decision-makers; in larger firms, exploitation decision are likely to be made through a bureaucratic hierarchy, not by a single/small group. Thus, by focusing on small firms, we feel that we are able to re-create a more realistic decision context and thus increase the experiment's validity.

We contacted a reputable software association in order to generate a list of industry members, and obtained a register of 670 decision-makers. We removed 67 decision-makers/firms from the register because the individuals had no responsibility for new

product launch decisions, or because the firm did not have appropriate products to launch (e.g., they worked more as consultants or were more service related within the software sector). As such, our final sample included 603 primary decision-makers of which 90 completed our experiment (15% response rate). Following the guidelines set out in [Short et al. \(2002\)](#), we conducted a number of tests to examine the potential of non-response bias. Firstly, we used *t*-tests to examine differences between responding and non-responding firms in terms of their age, size (number of employees), and sales levels. Secondly, we used ANOVA to examine differences in variance between responding and non-responding firms. These tests did not result in any statistically significant ( $p < .10$ ) differences. Further, we adopted the early vs. late respondent approach to examine non-response bias (see [Armstrong and Overton \(1977\)](#) or [Covin \(1991\)](#) for an explanation). This method implies that temporally later respondents to data collection efforts more closely reflect non-respondents than do earlier respondents. Therefore, we also compare early and late respondents (we defined “late respondents” as the last 20% of respondents). At the firm level of analysis, we used *t*-tests to examine the size and sales levels of the early and late respondents. At the individual level of analysis, we compared early and late respondents based on their highest level of education, age, and experience (both in terms of industry experience and decision-making experience). Once again, we did not find any statistically significant differences ( $p < .10$ ). This suggests that non-response appears to be stochastic and, subsequently, that our sample is not subject to any patterned non-response bias.

Among participants, 77% reported to be the primary decision-makers at firms with 50 employees or fewer. Ninety-five percent of the participating firms had 100 employees or fewer. Almost half of the firms had sales below \$1.5 million (USD). Given these descriptive attributes, we are confident that the sample can be characterized as consistent with other studies representing small entrepreneurial firms. Nonetheless, the participants had extensive industry and decision-making experience. The average number of years of industry experience was 13.79 with 91% of participants having five or more years of experience. Sixty-two percent of the participants had five or more years of experience as decision-makers concerning new product launch (mean 9.81 years), and almost 90% of the participants had at least some college education. Forty-four percent had engineering or technology backgrounds, whereas 28% came from business educational backgrounds. As such, we are confident that our sample consists of qualified decision-makers concerning new product exploitation decisions.

#### 4.2. Conjoint analysis

In this study, we used conjoint analysis to capture and decompose the decision policies of individuals responsible for new product development in the software industry, so that we could evaluate the decision-maker's willingness to act in the face of uncertainty. Conjoint analysis is a technique that requires participants to respond to a series of decision “scenarios.” For each scenario, participants indicate a judgment (a decision) based on a discrete set of decision criteria that define that particular scenario. The underlying factors responsible for the respondent's decision policy are decomposed using hierarchical liner modeling techniques ([Shepherd and Zacharakis, 1997](#)). Conjoint analysis is focused on how people actually make decisions ([Green, 1984](#)), and is grounded in extensive research on information processing ([Broonn and Olson, 1999](#)). According to [Green et al. \(2001: 56\)](#), “thousands of applications of conjoint analysis have been carried out over the past three decades.” Conjoint studies have had great impact in the fields of marketing, psychology, strategic management, and many other disciplines ([Green and Srinivasan, 1990](#)). In entrepreneurship research, for example, [Choi and Shepherd \(2004\)](#) employed conjoint analysis to consider how stakeholders evaluate a venture's newness, and [Shepherd et al. \(2000\)](#) investigated how venture capitalists assess the profitability of a new firm depending on its strategy. Further, because we hypothesize that decision-makers will use a contingent decision policy, conjoint analysis is a highly appropriate method to investigate the evaluation policies of the sample without relying on the respondents' introspection, which is often biased and inaccurate ([Fischhoff, 1982](#); [Priem and Harrison, 1994](#)).

#### 4.3. Instrument

In designing this study, we utilized an orthogonal fractional factorial design from [Hahn and Shapiro \(1966\)](#). As such, the inter-correlations between the variables are zero (orthogonal), which means that multicollinearity is not an issue, which “increases the robustness of the conjoint by making it less likely that coefficients have counter-intuitive signs” ([Huber, 1987](#)). Our fractional factorial design confounded the main-effects and all two-way interactions of most interest with other two-way and higher order interactions, which makes it unlikely that the latter will bias our results ([Green and Srinivasan, 1990](#); [Louviere, 1988](#)). We fully replicated the conjoint in order to test for reliability at the individual level of analysis. Given that each of our decision scenarios was characterized by seven decision attributes – operationalized at two levels (either high or low) – our fractional factorial design required each respondent to evaluate 16 separate decision scenarios (in order for us to test all of the main-effects and the two-way interactions of theoretical interest). In order to test individual level reliability, the design was fully replicated. As such, each entrepreneur evaluated 32 decision scenarios in total.

The conjoint experiment was computer based. Respondents logged on to a secure server and began the experiment by reviewing a brief explanation of the experimental procedure and some general assumptions with regard to the decision to exploit. Specifically, participants were told to assume that the decision to exploit is situated in the current economic environment and that they are not constrained by capital. Further, the instructions to respondents indicated that a decision to exploit would translate to an immediate launch of the new product. That is, there was irreversibility in the decision process (see [Schoonhoven et al., 1990](#); [Choi and Shepherd, 2004](#)). At this point, the experiment would commence. The respondents were presented with the first decision scenario and asked to assess (on a nine-point Likert-type scale) their willingness to proceed with a product launch given the unique combination of uncertainty attributes represented in the decision scenario (described in more detail below). With each



response, the simulation proceeded automatically to the next scenario, and it was impossible for the respondents to refer back to a previous decision profile.

#### 4.4. Variables

##### 4.4.1. Dependent variable

The purpose of this research is to measure the effects of uncertainty on an individual's decision to engage in entrepreneurial action. Decisions to exploit perceived opportunities (i.e., to engage in entrepreneurial action) can be seen as being binary: one can either exploit or not exploit. However, employing a binary dependent variable in an experimental study poses grave challenges to understanding the true effects of uncertainty on decisions, as there would be little variance in the dependent variable to explain. We therefore operationalize our dependent variable (on a nine-point Likert-type scale) as the willingness to begin immediate action, thereby marshalling resources toward a new product introduction. Again, the dependent variable is operationalized to imply irreversibility in the process, consistent with the recommendations of Schoonhoven et al. (1990). This measure is comparable with Choi and Shepherd's (2004) use of "opportunity exploitation" and Brundin et al. (2008) idea of the "willingness to engage in entrepreneurial action" as the key dependent variables. Although we note that willingness to engage in entrepreneurial action is not synonymous with action behavior, this variable is valid for our conjoint study. Further, new product launches constitute an important part of sustained competitiveness and growth in high-velocity contexts, such as the software industry (Zahra and Bogner, 2000).

##### 4.4.2. Independent variables

Each scenario presented to the entrepreneurs characterized their willingness to launch decisions in the context of seven discrete decision attributes. Six of the seven attributes described varying types and manifestations of uncertainty, consistent with our theoretical development and hypotheses (two manifestations each of state, effect, and response uncertainty). The seventh variable modeled the scale of launch and varied between two levels: a large-scale launch or a small-scale launch. Table 1 includes the operationalizations of each of the independent variables that represent the basis for the entrepreneur's decision with regard to willingness to launching.

**4.4.2.1. Domain specific expertise.** As developed in this article and further substantiated in the extant literature, experience in a particular industry and experience in complex decision-making situations likely influence the relationship between uncertainty and action. Expertise implies that a decision-maker possess a strong knowledge relevant to the decision domain (e.g., Wiggins and O'Hare, 1995). For this study, we capture domain specific expertise using a six-item measure adapted from Wiklund and Shepherd's (2003) approach to capture expert knowledge, including that of a comparison to the knowledge of others in the industry, as well as established measures focusing on the entrepreneurs' expertise in exploiting opportunities (e.g., Chandler and Jansen, 1992; Chandler and Hanks, 1998). The scale includes questions, such as "Compared to others in my industry, I feel

**Table 1**  
Operationalizations of decision attributes.

Variable	Low*	High
State uncertainty (rate of demand change)	The demand for your product is likely to fluctuate, but the rate of change is moderate and steady.	The rate of demand for your product will fluctuate significantly.
State uncertainty (rate of technological change)	Future technological innovations affecting the viability of the product are likely to occur, but they are likely to be incremental (not discontinuous).	Future technological innovations affecting the viability of the product are likely to be frequent and major, including changes to the underlying technologies related to product usage.
Effect uncertainty (predictability of demand change)	You have strong idea of your customers' preferences and demands with regard to your product, and these are predictable over time.	It is not possible to predict in advance demand changes affecting the viability of the product.
Effect uncertainty (predictability of technological change)	You are in a strong position to predict the nature and source of innovations that affect the viability of the product.	It is not possible to predict with any certainty the kinds or timing of future technological innovations that will affect the viability of the product.
Response uncertainty (ability to sustain innovative leadership)	You have tangible reasons to believe that your firm has the ability to sustain viability in this product market through further radical and/or incremental innovations.	It is not possible to foresee the ability of your firm to sustain viability in this product market through further radical and/ or incremental innovations.
Response uncertainty (potential lead-time over competitors)	While you are not able to fully predict the speed or nature of action of your competitors, you believe that if you act your product will enjoy advantages long enough to realize entrepreneurial returns.	You have no insights as to how your competitors will react in response to your product introduction, and therefore you cannot predict how long your product will enjoy advantages before a competitive response erodes profits.
Launch method (small vs. large scale)	You plan to launch the product on a small scale, to a limited number of customers.	You plan to launch the product on a large scale, to the national market immediately.

\*Acknowledging that – in an entrepreneurial context – it is unlikely that uncertainty is ever objectively 'low,' our operationalizations are relative; that is, low levels reflect the 'norm' with regard to uncertainty, while high levels reflect extreme conditions.

that I am an expert when it comes to developing innovative solutions to customer problems” and “Compared to others in my industry, I feel that I am very proficient at seeing new opportunities.” The six expertise items were scored on five-point Likert-type scales and reflect a number of areas of expertise that are germane to making new product decisions in dynamic environments. Factor analysis using principal components extraction and varimax rotation was employed to ensure that the items accurately measured one expertise construct. A single superior factor emerged and explained 50% of the variance. We assessed the internal consistency of this one factor by calculating its Cronbach's alpha coefficient. The Cronbach's alpha was 0.78, which is satisfactorily above Nunnally's (1978) suggested level of 0.70. We summed the six items into one index construct called “Domain specific expertise.”

## 5. Results

### 5.1. Individual level results

Individual level models explained a significant proportion of variance ( $p < 0.05$ ) with a mean adjusted  $R^2$  of 0.84. These results are consistent with those found in similar conjoint designs (Choi and Shepherd, 2004; Haynie et al., 2009; Shepherd et al., 2000). These findings indicate that the independent variables' attributes provided in the experimental design were the primary drivers of the “willingness to act” decisions captured in the dependent variable and lead us to believe with a high level of confidence that our data appropriately capture the decision policies of our sample with regard to the decision to exploit. To provide assurance that the entrepreneurs consistently performed the conjoint task, we carried out reliability analysis between each participant's evaluation of both the original and the replicated decisions within the conjoint experiment. Based on the test–retest analysis, we found that the participants were sufficiently reliable ( $p < .05$ ) in their judgmental consistency across the replicated profiles.

### 5.2. Aggregate results

Our statistical analysis draws on 32 decisions per individual, based on a sample of 90 entrepreneurs, thus giving us 2880 exploitation decisions at Level-1. To address the likely violation of the data's assumed independence (each set of 32 decisions is particular to an individual), we employ Hierarchical Linear Modeling (HLM) to decompose our sample's decision policies at the aggregate level. HLM appropriately addresses autocorrelation and potential heteroskedasticity characteristic of nested data (Hofmann, 1997). We report only the full model rather than two sets of results: one model for the main-effects only and one for the main-effects and the interactions. This reporting of results is consistent with other studies that have used orthogonal factorial designs for metric conjoint analyses (cf., Priem, 1994; Priem and Rosenstein, 2000). Because the research design assures that there is zero correlation between the independent variables, testing and subsequently reporting two models (main-effects and full) is neither necessary nor appropriate.

The results presented in Table 2 report the direct effects of the uncertainty types and scale of exploitation on the entrepreneurs' willingness to act, the interaction of uncertainty type with the scale of launch, and the cross-level moderation of the direct effects of uncertainty on the willingness to act, as a function of domain specific expertise.

All main-effects that relate uncertainty to the willingness to act, with the exception of uncertainty based in the rate of demand change, were significant and negative, indicating that – holding all else constant – as levels of each uncertainty type increase, the willingness to act decreases. These findings demonstrate overall support for H1, H2a (rate of technology change;  $\beta = -0.194$ ,  $p < .005$ ), H3a (predictability of impact of technology change;  $\beta = -0.192$ ,  $p < .001$ ), H3b (predictability of impact of demand change;  $\beta = -0.297$ ,  $p < .001$ ), H4a (sustainability of innovation;  $\beta = -0.356$ ,  $p < .001$ ), and H4b (lead-time;  $\beta = -0.237$ ,  $p < .001$ ). However, H2b was not supported.

We hypothesized that response uncertainty would have the largest effect on entrepreneurs' willingness to act (as compared to state or effect uncertainty). To examine the differential impact of types of uncertainty, we followed Lee and Tsang (2001) and compared the corresponding coefficients for the different types of uncertainty. We compared the combined effect size of response uncertainty on the dependent variable to the combined impact of both effect and state uncertainty on the dependent variable. Analysis indicates that the effect of response uncertainty is different and more negative than either state ( $t = -8.57$  with 2878 degrees of freedom,  $p < .001$ ) or effect uncertainty ( $t = -1.70$  with 2878 degrees of freedom,  $p < .044$ ). This provides support for H5.

Further, we hypothesized that the decision-maker's expertise would moderate the negative relationship between action (willingness to launch) and the various manifestations of state and effect uncertainty. These hypotheses constitute cross-level interactions between uncertainty represented by the environment (level-1 variable) and the expertise of the decision-maker (level-2 variable). The additional variance explained (by adding the cross-level moderation of expertise) over the model where only level-1 effects are included is 0.81 (Pseudo  $R^2 = .81$ ). We found no significant moderation as a function of domain specific expertise for either manifestation of state uncertainty; thus, H6a–b is not supported. We did find that expertise significantly moderated the negative relationship between the decision-makers' willingness to act and both manifestations of effect uncertainty. Specifically, the negative relationship between the willingness to launch and increasing levels of effect uncertainty became *less negative* for those with higher levels of expertise. This supports H6c ( $\beta = .038$ ,  $SE = .014$ ,  $p < .05$ ) and H6d ( $\beta = .029$ ,  $SE = .014$ ,  $p < .05$ ).

Finally, we hypothesized that the scale of launch would moderate the relationship between the different uncertainty types and entrepreneurs' willingness to exploit. Specifically, we suggested that the negative relationship between high uncertainty and

**Table 2**  
Results.

Final estimation of fixed effects (w/ robust standard errors)				
	Coefficient	Standard error	t-ratio	Effect
<i>Level-1</i>				
Rate of demand (state)	0.124	0.083	1.492	0.09
Rate of technology (state)	−0.194	0.057	−3.374**	0.13
Predictability of demand (effect)	−0.297	0.065	−4.558***	0.21
Predictability of technology (effect)	−0.192	0.052	−3.728***	0.17
Sustainable innovation (response)	−0.356	0.062	−5.725***	0.31
Lead-time (response)	−0.237	0.060	−3.950***	0.19
Launch type (small vs. large)	−0.640	0.111	−5.770***	0.49
Launch × rate of demand	−0.215	0.082	−2.613**	
Launch × rate of technology	0.231	0.072	3.214**	
Launch × predictability of demand	0.116	0.084	1.370	
Launch × predictability of technology	0.233	0.080	2.778**	
Launch × sustainable innovation	0.185	0.076	2.447*	
Launch × lead-time	0.005	0.085	0.063	
Intercept	4.753	0.099	47.855***	
<i>Level-2 (cross-level moderation with state and effect uncertainty)</i>				
Expertise × rate of demand (state)	0.014	0.022	0.648	
Expertise × rate of technology (state)	0.021	0.015	1.332	
Expertise × predictability of demand (effect)	0.038	0.019	1.943*	
Expertise × predictability of technology (effect)	0.029	0.014	1.986*	

$n = 2880$  (Level-1);  $n = 90$  (Level-2).

Note: All variables were standardized and group centered.

\*\*\*  $p < 0.001$ .

\*\*  $p < 0.01$ .

\*  $p < 0.05$ .

action would become less negative for small-scale product launches than for large-scale launches, all else being equal (H7a–c). Four of the six hypothesized two-way interactions between launch type and the various manifestations of uncertainty types were significant but not necessarily in the direction we initially hypothesized. To aid in the interpretation of these significant relationships, consistent with the techniques recommended by Cohen and Cohen (1983), high and low levels of willingness to launch were plotted on a y-axis for (the dependent variable) and type of uncertainty was plotted on the x-axis. These plots are Figs. 1–4.

Specifically, Fig. 1 plots the significant interaction between rate of demand change (state) and scale of launch and indicates that in the face of uncertainty manifest as rate of demand change (state), a small-scale launch is preferable to a large-scale launch. As hypothesized, we find a significant difference in the change in slope for large-scale launch as compared to small-scale launch, going from low to high levels of demand change uncertainty. However, we hypothesized that the direction of the change would remain negative (relative to willingness to launch), but that the slope would be “less negative” for the small-scale launch as compared to the large-scale launch. To our surprise, we find that in the face of increasing uncertainty (high) with regard to customer demand, the entrepreneurs represented in our sample actually become *more willing* to launch on a small scale as compared to when uncertainty is low. Thus, while H7a was significant, we report it as non-supported. We represent this counter-

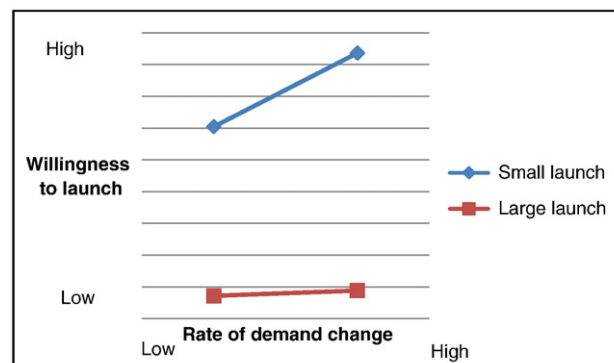


Fig. 1. Scale of launch and rate of demand change [state].

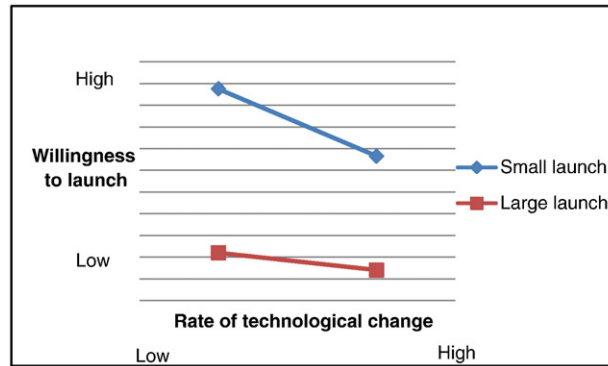


Fig. 2. Scale of launch and rate of technological change [state].

intuitive finding as potentially important and insightful as to the strategies employed with regard to possibly learning or experimentation in the face of dynamic demand change. We explore this finding further in the discussion.

Fig. 2 plots the significant interaction between rate of technology change (state) and scale of launch and indicates that a small-scale launch is preferable to a large-scale launch regardless of the level of uncertainty concerning the rate of technological change. Further, as hypothesized, we find a significant difference in the change in slope for a large-scale launch as compared to a small-

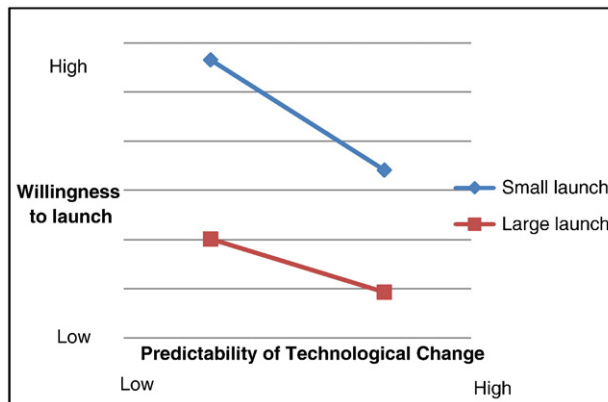


Fig. 3. Scale of launch and predictability of technological change [effect].

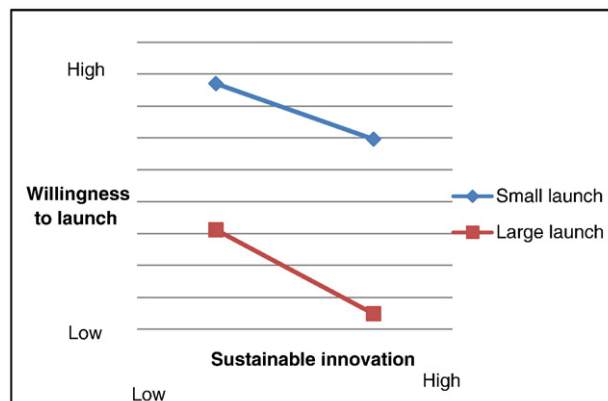


Fig. 4. Scale of launch and sustainable innovation [response].



scale launch, going from low to high levels of demand change uncertainty (state) – however, again, not in the way hypothesized. The plot indicates that willingness to engage in entrepreneurial action declines more steeply for a small-scale launch than for a large-scale launch, moving from low to high levels of technological uncertainty. Thus, H7b is not supported. However, again, this significant finding warrants further investigation, and we consider alternative explanations for this finding in our discussion.

Fig. 3 plots the significant interaction between the predictability of technological change (effect) and scale of launch and indicates that in the face of any level of uncertainty with regard to the predictability of technological change, a small-scale launch is preferable to a large-scale launch. However, like for the rate of technological change (Fig. 2), we find that willingness to engage in entrepreneurial action declines more steeply for a small-scale launch than for a large-scale launch, moving from low to high levels of effect uncertainty based in entrepreneurs' inability to predict changes in technology. Thus, H7d is not supported.

In Fig. 4, we plot the significant interaction between the perceived ability to sustain innovation (response) and scale of launch, and the plot indicates that a small-scale launch is preferable to a large-scale launch regardless of the level of response uncertainty with regard to the ability to sustain innovation. Further, we find a significant difference in the change in slope for a large-scale launch as compared to a small-scale launch in that going from low to high levels of uncertainty with regard to the ability to sustain innovation, the plot indicates that the entrepreneurs' willingness to launch declines more steeply for a large-scale launch than for a small-scale launch. This finding supports H7e ( $\beta = .185$ ,  $SE = .076$ ,  $p < .05$ ). We found no significant moderation based on the scale of launch between willingness to launch and the predictability of demand (H7c) and lead-time (H7f).

### 5.3. Post hoc analysis

One of the important propositions suggested by our investigation of the relationship between uncertainty and action is the notion that how a given type of uncertainty is manifested will have different implications for entrepreneurs' decision to act. For example, we argued based on the literature that with regard to the ability to perceive a sense of control over the outcomes associated with exploitation, different manifestations of both state and effect uncertainty will have differential impacts on the subsequent decision policy of the perceiver. Indeed, finding differences among types of uncertainty was the motivation behind H5. We performed two tests positioned to provide insight into the relative impact of each decision attribute with regard to the willingness to act decision.

First, following Judd and McClelland (1989) we empirically derived the relative importance of each decision weight,  $\alpha_j$ , which represents the importance of the  $j$ th attribute in the context of the other six attributes in the model. The overall willingness to act decision was then estimated as a multi-attribute function of the seven attributes in order to calculate an "effect size" for each individual variable. This allows for a comparison of the relative importance of each decision attribute on the willingness to act decision. The relative effect sizes are reported in the right-most column of Table 2.

Second, we compared the coefficients of the different manifestations of the same type of uncertainty to determine if they are statistically different using the same method described above. With regard to state uncertainty, we found that the coefficient for the rate of technological change ( $\beta = -0.194$ ) had a significantly larger effect ( $t = 3.83$  with 2878 degrees of freedom,  $p < .0001$ ) on the dependent variable than did the rate of demand change ( $\beta = -0.124$ ). With regard to the differing manifestations of effect uncertainty, we found marginal statistical significance ( $t = -1.62$  with 2878 degrees of freedom,  $p < .053$ ) for the differential impact of the predictability of demand change ( $\beta = -0.333$ ) and of the predictability of technology change ( $\beta = -0.261$ ) on the decision to exploit. These findings generally demonstrate that, all else being equal, how a given type of uncertainty is manifested in the environment will have different impacts of entrepreneurs' decisions to exploit.

## 6. Discussion and conclusion

The notion of uncertainty resides at the core of entrepreneurship from the domain's founding theories (Kirzner, 1973; Knight, 1921; Coase, 1937; Schumpeter, 1934) to the contemporary frameworks purported to inform entrepreneurial behaviors and outcomes, such as entrepreneurial intentions (Bird, 1988), effectuation (Sarasvathy, 2001), real-options reasoning (McGrath, 1999), and the RBV (Barney, 1991). We suggest that the theoretical importance of uncertainty to entrepreneurship, when considered in the context of the equivocal and sometimes contradictory findings of the empirical literature, highlights a need to reconsider this important construct. We suggest that more precision applied to how entrepreneurship scholars define, operationalize, and measure the uncertainty construct will enable a more powerful investigation of the complex interplay between uncertainty and entrepreneurial decision-making. We assert that our findings serve to support this proposition. Our results highlight some potential shortcomings of conceptualizing uncertainty broadly and simply as the predictability of conditions in the environment, as is convention in entrepreneurship today. Put plainly, we demonstrate that *not all uncertainty is created equal* in the eyes of the entrepreneur. Further, how uncertainty is represented in the environment, considered in concert with the conditions around which exploitation would occur, suggests that uncertainty has complex and sometimes counter-intuitive implication for judgments about action. In what follows we discuss how our findings might inform and extend existing perspectives and frameworks commonly purported to explain entrepreneurial outcomes and behaviors.

### 6.1. Uncertainty types

One of the most potentially impactful findings of this research is that entrepreneurs place different weight or importance on different types of uncertainty with regard to action decisions. We find that decisions concerning entrepreneurial action are most

strongly influenced by perceptions based in an entrepreneur's assessment of the uncertainty related to the outcomes of his/her own actions. Alternatively, much less importance is ascribed to being able to understand or “predict” uncertainties perceived to be outside of his/her sphere of control. We feel that this particular finding has implications for a number of different theories within entrepreneurship and strategic management.

Perhaps one of the most compelling contemporary theories of entrepreneurial behavior is that of effectuation (e.g. Sarasvathy, 2001). Effectuation represents a pattern of reasoning that focuses on the future and grounds sense making in the recognition of available “means” and conceptualizations of some future state created from those means. Some have suggested that effectuation represents the dominant pattern of reasoning employed by entrepreneurs (Sarasvathy et al., 2003). One of effectuation's important tenets is that in the face of uncertainty, entrepreneurs do not attempt to predict the future, but rather, they control an inherently unknowable future through their own actions and choices. Consistent with effectuation, our findings do demonstrate that uncertainty beyond the entrepreneur's control is a less important impediment to action as compared to what the entrepreneur *does* in the face of such uncertainty. However, effectuation also prescribes that the outcomes, or “ends”, resulting in an effectual process are *a priori* unknown to the entrepreneur. Our findings suggest, however, that entrepreneurs are reluctant to act when the consequences of their actions cannot be predicated or evaluated. This finding raises a central question with regard to the suggestion that effectuation represents the dominant pattern of reasoning employed by entrepreneurs; that is, if the inability to understand or predict the consequences of action represents such an impediment to action (as our findings suggest), how can we explain Sarasvathy's contention that effectuation represents the psychological basis for entrepreneurial behaviors? We are not proposing that our findings potentially refute effectuation as a means of understanding entrepreneurial behavior. However, we do suggest that our results may represent a starting point for the development of new theoretical insights into the origins of the effectual patterns that have been demonstrated across samples of entrepreneurs and, more generally, into how entrepreneurs behave when facing uncertainty.

In another case, our finding that environmental uncertainty (state uncertainty) ranked as the least impactful impediment to action raises some potentially profound questions for entrepreneurship and management scholars. In particular and most pointedly, it begs the question as to in what settings and contexts environmental uncertainty is – or is not – meaningful as an explanatory variable in entrepreneurship. Our findings seem to indicate that entrepreneurs “assume away” uncertainties relating to the rate of change in the external environment, at least in the context of evaluating the potential of an opportunity for action. Additionally, our results suggest that entrepreneurs might assume a general level of environmental uncertainty into their decision-making process such that changes in the external environment are “taken for granted.” Put simply, it might be that in some settings and contexts, environmental uncertainties seem to play only a small role in informing action decisions.

Our finding with regard to how state uncertainty influences action may also impact theories that are based on behavior being a reflection of the uncertainty in the environment. For instance, contingency theory suggests that there should be a fit between the environment and behavior (e.g., structure, strategy, etc.) in order to obtain optimal performance (Miller, 1988). Empirical operationalizations using contingency theory within entrepreneurship have tended to use the environment and its uncertainty as a main variable on which behavior is contingent (e.g., Covin and Slevin, 1989; Chandler and Hanks, 1994; Lumpkin and Dess, 2001). While these studies have certainly helped advance our understanding of new-, small-, and entrepreneurial-firm performance, our study may imply that a new contingency factor should be employed in future studies. In particular, our finding that entrepreneurial action is more contingent on different types of uncertainty, namely on response and effect uncertainty (as opposed to state uncertainty), leads us to believe that a contingency approach based on the type of uncertainty may be appropriate. It is important to note that the focus of extant articles employing a contingency lens in entrepreneurship is on performance, while ours is on entrepreneurial action.

## 6.2. “What” is uncertain is important

We also found strong support for the notion that how a given type of uncertainty is manifested in the environment will influence an entrepreneur's decision policy differently. As highlighted in the previous section, different uncertainty types have differential impacts on the decision to act. Further, for each type of uncertainty, we find that how the uncertainty is manifested matters *differently* with regard to the willingness to act. For example, for both effect and state uncertainty, manifestation of each type in the form of demand-based change had a differently impactful effect on the decision to act (or not) than when each type was represented as technological change. This finding suggests several key cautions for future research focused on the relationship between types of uncertainty and action.

First, operationalizing uncertainty as a one-dimensional construct, as has been generally the case in entrepreneurship research, will likely lead to inconsistent and exceedingly difficult to interpret results. Our study bears out Milliken's (1987) proposition that extant conceptualization based on treating uncertainty as an objective and externally measurable construct is problematic. Milliken notes that there is “no clear evidence of a relationship between objective characteristics of the environment and perceptions of uncertainty” (Milliken, 1987: 135). Therefore, treating uncertainty as something “outside” of the perceiver's cognitions is the cause of results that are inconsistent and difficult to interpret, which are representative of much of the extant research on uncertainty in management and entrepreneurship. Our study provides empirical evidence that supports this argument.

Second, in this study, we take the idea of situating uncertainty within the individual even farther than explicitly suggested by Milliken in that we operationalize different manifestations of each uncertainty type and demonstrated that even different manifestations of a given type may have varying impacts on the perceiver's decision. By employing both a market-based and a

technological-based perspective grounded in how we operationalize each uncertainty type, we allow for a potentially broader framework with which researchers can consider the conditions entrepreneurs face when making action decisions. For instance, Song and Montoya-Weiss (2001) empirically focus on technological uncertainty, a common practice in innovation literature. On the other hand, the marketing literature and many parts of the entrepreneurship literature, such as those studies that employ a “discovery” or “alertness” lens, tend to focus on uncertainties related to the market side (e.g. Gaglio and Katz, 2001). As such, we show that both sides are important, even though they concern different types of uncertainty. While we do not attempt to reconcile these arguments or take one particular side here, we feel that our findings should simply be interpreted as a further caution to future researchers as they attempt to interpret (and generalize from) findings that relate a given type of uncertainty to a specific behavior or outcome.

### 6.3. The scale of exploitation

Beyond prescriptions for researchers, some of our findings regarding the differential impacts of uncertainty on action extend our current understanding of the roles of experimentation and learning in entrepreneurship. When considering the relationship between uncertainty and action, we built upon research suggesting that the scale of exploitation has important consequences for decision-making in entrepreneurship (Shane and Venkataraman, 2000; Schoonhoven et al., 1990). As such, it was important for us – in the context of a rigorous approach to decomposing the relationship between uncertainty and action – to model how the scale of exploitation may moderate how uncertainty influences entrepreneurial action. We hypothesized simply that with increased uncertainty, the negative relationship between the various types (and manifestations) of uncertainty and entrepreneurs' willingness to act would be less negative for a small-scale launch than for a large-scale launch. In all cases, the decision-maker was more willing to launch on a small scale than on a large scale given any level of uncertainty. The relationship between the type of uncertainty and willingness to act was significantly moderated in four out of six potential cases, however not always in the direction hypothesized. We represent these significant “non-findings” as some of the most interesting results from the study.

One of the most interesting moderations relates uncertainty based on the rate of demand change (state) to the willingness to act. We found that while the relationship became more negative for a large-scale launch, the significant difference in slope (between the large- and small-scale launch) was based on the finding that the willingness to launch on a small scale in the face of demand-change uncertainty actually increased as uncertainty increased. There are several possible explanations for this finding deserving of future research. Indeed, as uncertain situations call for a trial-and-error approach, entrepreneurs can launch a new product on a smaller scale, mitigating uncertainty while concurrently learning about changing customer-demand patterns. For example, it could be that the software entrepreneurs who took part in this study preferred “uncertainty-reduction” strategies to profit-maximizing strategies. Indeed, attempting to reduce uncertainties is a common practice for many high-technology firms. For instance, many software firms often engage in rigorous testing, such as launching beta versions of their products at heavily discounted prices or with trial customers, prior to officially launching their products to a broader market as one way to reduce uncertainty and solve potential problems (Eisenhardt and Tabrizi, 1995). Alternatively, these small firms may assume a strategy based in a portfolio approach akin to an options reasoning (McGrath, 1999), and within this portfolio, there may be some winners and some losers. This type of approach also falls in line with the literature on effectual reasoning, namely the “affordable loss” principle (Sarasvathy, 2001). However, this finding may simply be an artifact of the sample that we are studying. As was mentioned earlier, small firms may be more strapped for resources and vulnerable to errors based on unexpected negative consequences of a faulty decision. Small software firms may also only engage in small-scale launches to local customers but not deal with national or international market launches.

While uncertainty with regard to customer demand motivates small-scale experimentation, the relationship between uncertainty based in technological change (both rate and predictability) and action was significantly moderated by the scale of launch in a way that contrasts the findings discussed above regarding the portfolio or learning approaches to small-scale launches. In the case of technological-based uncertainties, the negative relationship between willingness to launch and uncertainty increases at a higher rate (steeper slope) for a small-scale launch than for a large-scale launch. In the case of technology and change, it could be that entrepreneurs have internalized the notion of such uncertainty being inherently unknowable, therefore see little return to the firm (learning, profit) from resources expended on small-scale exploitation. Further, it is likely that high levels of technologically based change mean that there are serious threats to the underlying technology's viability. Thus, the logic for a small-scale launch is further compromised.

These findings do have some validation in the existing literature about innovation in new and small technology-based firms. Developing a resource base, such as establishing a technological/software platform, involves substantial cost and time (Brush et al., 2001), both of which may be scarce for new and small firms. Therefore, many firms frequently avoid directing resources to these activities unless they see a high likelihood of potential returns. Attempting to “keep up” or spread their resources to deal with substantial technological uncertainty may simply not be an option and certainly do not outweigh the risks and potential benefits involved in a small-scale launch. Small technology-based firms have been shown to engage in entrepreneurial action based on their technological sunk costs, namely, in such a way as to best take advantage of their existing technology (e.g., Kelley and Rice, 2001). Further, McKelvie (2007) finds that technological knowledge is a more important predictor of entrepreneurial action than market knowledge in small technology-based firms and that these firms engage in internal knowledge transformation mechanisms in order to use their existing technological knowledge better. Together, these empirical findings provide some support for differences between market- and technology-based uncertainties and strategies that small technology-based firms

may employ to navigate these challenges. Ultimately, these findings suggest that more robust empirical work is required to tease apart the relationship between uncertainty and action, a relationship that our findings suggest to be exceedingly complex and nuanced.

#### 6.4. The role of expertise

In line with the equivocal findings in the literature on the role of expertise in decision-making, we find mixed support for our hypotheses concerning its role on the relationship between uncertainty and individuals' willingness to engage in entrepreneurial action. While we did not find any effects of domain specific expertise on the relationship between state uncertainty and entrepreneurial action, we did find a significant effect for expertise on the relationship between both conceptualizations of effect uncertainty (predictability of demand change and technological change). We find that these types of uncertainty have a less negative effect on entrepreneurial action for experts and suggest two explanations for this. A first explanation, consistent with [Sarasvathy's \(2001\)](#) notion of effectuation, is that those entrepreneurs with substantial expertise downplay the importance of attempting to predict an unknowable future; they accept that a more fruitful approach is to attempt to create a future instead. In other words, our findings may provide further empirical support for work examining effectual logic and how expertise leads decision-makers to focus less on prediction ([Dew et al., 2009](#)). A second explanation concerns overconfidence and hubris. Indeed, self-perceived experts may over-estimate their own ability to predict the future; they "know more" and should therefore "know better" ([Fischhoff, 1982](#); [Arkes et al., 1986](#); [Gustafsson, 2006](#)). As such, uncertainty concerning the predictability of future states may seem to be important, as the experts may view themselves as being able to circumvent this potential problem based on their expert knowledge. The potentially harmful effect of expertise on overconfidence in decision-making has previously been studied in the context of venture capitalists ([Zacharakis and Shepherd, 2001](#)). In light of our empirical findings and the arguments above as to why expertise may lessen the negative impacts of uncertainty, we concur with [Read and Sarasvathy \(2005\)](#) that future research should further examine the effects of expertise in entrepreneurship, particularly how it affects perceptions of uncertainty.

#### 6.5. Uncertainty, risk, ambiguity, and entrepreneurial action

While we do acknowledge that uncertainty and risk are not synonymous, we feel that our findings provide potentially important input into the ongoing debate in the literature concerning the risk propensity of entrepreneurs. Two recent meta-analyses concerning the risk propensities of entrepreneurs found contrasting results. [Stewart and Roth \(2001\)](#) find that entrepreneurs have a higher risk propensity than do managers and that these differences are even larger when considering the differences between growth-oriented entrepreneurs and income-substitute entrepreneurs. In response to this study, [Miner and Raju \(2004\)](#) conduct their own meta-analyses and find the opposite to be true: entrepreneurs are in fact more risk avoidant. Our present study suggests that entrepreneurial decision-makers tend to avoid uncertainty but that the extent to which this avoidance takes place depends not only on the nature of the uncertainty, but also on the magnitude of the entrepreneurial action (i.e., launch type), and the decision-maker's expertise. In other words, more in line with [Miner and Raju \(2004\)](#), we suggest that there may be a number of contextual factors that influence this important relationship. Once again, we note that there are differences between risk and uncertainty, but the definitions of risk employed in the [Stewart and Roth \(2001\)](#) and [Miner and Raju \(2004\)](#) studies provide some overlap with the definition of uncertainty used by [Milliken \(1987\)](#). Nevertheless, we adopt a more cautious approach to this discussion rather than suggesting definitive implications of our findings on the risk propensity debate.

In a similar vein, there appears to be an interesting paradox between two attributes that are classically ascribed to entrepreneurs, specifically a tolerance of ambiguity and a need for control (e.g. [McClelland, 1961](#)). The paradox lies in that to be tolerant of ambiguity implies that the entrepreneur gives up a certain level of control. Our results at least partially speak to this paradox, although with the caveat that our data focus on uncertainty and not specifically tolerance of ambiguity or need for control. We find that decision-makers considering entrepreneurial action have an overall tendency to prefer control over ambiguity (inasmuch as uncertainty and ambiguity are inter-twined). Perhaps of greater interest is that this preference becomes clearer when it comes to uncertainty about the actions that are actually under the decision-maker's control. In other words, while software decision-makers may tolerate some ambiguity, they are less willing to tolerate ambiguity surrounding the impact of their actions (response uncertainty). Once again, our findings, which correspond well with the work on effectual logic (e.g., [Dew et al., 2009](#); [Sarasvathy, 2001](#)), provide further evidence that there may be important differences in the type of uncertainty encountered in the face of entrepreneurial action, which would provide a more detailed approach than that which has generally been adopted in the literature. As such, we offer some empirical evidence that may help unpack part of this paradox and recommend more detailed research into the conditions that may govern the acceptance of greater (or lesser) uncertainty and the different types of uncertainty at play within these relationships.

#### 6.6. Limitations

This research shares some limitations with most judgment-based management research. Most of these involve challenges to the external validity of "paper-based" experiments; many criticize that artificial experiments do not have the immediacy or emotional importance of "real life", nor do they consider all the information used to make entrepreneurial decisions in everyday



situations. However, there is evidence that even in the most artificial situations, conjoint analyses significantly reflect the decision policies individuals actually use (e.g. Brown, 1972; Hammond and Adelman, 1976). We attempted to overcome this issue by specifically following the recommendations of Shepherd and Zacharakis (1997) and Karren and Barringer (2002) by including only attributes for which strong theoretical reasoning exists. Further, in an attempt to assess the “real-world” importance of the decision criteria presented in this experiment, we analyzed the espoused importance of the uncertainty attributes among our participants. As part of a post-hoc questionnaire, each participant was asked to rate (on a nine-point Likert scale) the perceived importance of each uncertainty type on his or her willingness to act. Paired sample *t*-tests between these responses confirmed no significant difference ( $p > 0.10$ ) between the decision-makers' espoused and in-use decision policies with regard to the importance of the attributes employed in the study. This finding somewhat blunts the concern/limitation that the findings are typically only as good as the match between the hypothetical scenario and a situation the decision-maker would face in real life.

Beyond issues of validity, the design of the study limits the extent to which we are able to investigate and speculate on the relative magnitude of the individual decision attributes (effect size). Effect sizes are not often reported for conjoint studies because some have called into question the “practical” significance of effect size in the context of experimental decision studies in which the dependent variable is captured on a Likert-type scale. The relative magnitude of the decision criteria's importance (i.e., the different uncertainty types) is an important theoretical concern that cannot be adequately addressed by this study, and represents an opportunity for future research. Ultimately, despite these limitations, this study provides a meaningful first step toward clarifying the role of uncertainty in the entrepreneurial decision-making process.

Furthermore, the nature of the sample provides both a potential limitation and an avenue for future research. Our study employs a sample of primary decision-makers in small entrepreneurial software firms. The nature of the entrepreneurial action described in our experiment concerns a subsequent new product launch. While the context of the decision and the nature of the action we study are undoubtedly entrepreneurial and while we have sometimes referred to the decision-makers as “entrepreneurs,” we are hesitant to suggest that decisions concerning other types of entrepreneurial action, or in other contexts, will follow the same pattern as our results. For instance, decisions concerning the founding of a *de novo* new firm and the effects of uncertainties faced within that type of entrepreneurial action might differ from our results. Therefore, we suggest that future research attempt to study how uncertainty is manifested in other entrepreneurial situations and how these manifestations affect decisions to engage in entrepreneurial action. The type of entrepreneurial action may also further contribute to our discussion on the risk propensity of entrepreneurs. We do maintain, nevertheless, that our study is important in providing a valuable first step to better understanding the role of uncertainty in entrepreneurial decision-making.

## 6.7. Conclusion

Milliken's uncertainty types offer a useful construct to explore heterogeneity among entrepreneurs at a cognitive level. If we are to understand the entrepreneur's contribution to the act of entrepreneurship on a deeper level, we must study individuals' decisions to engage in entrepreneurial action in the context of uncertainty. The overarching goal of this study was to take a first empirical step toward understanding how uncertainty is represented in the decision policies of entrepreneurs when they are engaged in decision-making processes central to entrepreneurship: opportunity exploitation. Our findings suggest important prescriptions that provide novel insights and challenges to existing theories that employ the uncertainty construct. The findings also inform methodology and research design with regard to modeling uncertainty in entrepreneurship research. It is our hope that this article motivates additional empirical research positioned to investigate the complex and sometime counter-intuitive ways that uncertainty might propel – or impede – entrepreneurial action.

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