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THE FORMATION OF OPPORTUNITY BELIEFS: OVERCOMING IGNORANCE AND REDUCING DOUBT

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Although (opportunity) beliefs are becoming increasingly recognized as fundamental to understanding entrepreneurial cognition and strategic action, little is understood about the mechanisms that are responsible for the formation and evolution of these beliefs. Introducing the mechanisms of gists, matching, and updating from philosophy's and psychology's coherence theory, we propose a theoretical framework to explain how third-person opportunity beliefs (beliefs that one has recognized an opportunity for someone with the right knowledge and motivation) are formed and how they evolve to become first-person opportunity beliefs (beliefs that one has recognized an opportunity for himself or herself). We conclude by examining how the model contributes to literatures ranging from entrepreneurial cognition and action, to strategic myopia and organizational attention, to opportunity recognition, discovery, and creation. Copyright © 2007 Strategic Management Society.

> [The decision to act is] how people . . . combine desires (utilities, personal values, goals and ends, etc.) and beliefs (expectations, knowledge, means, etc.) to choose a course of action
>
> – Hastie (2001:655–656)

INTRODUCTION

Whether discussed as expectations, knowledge, means, real options, scenarios, or contingencies, beliefs play a central role in models of human action that presume logical actors facing uncertain futures. Yet scholars ranging from such diverse fields as institutional economics (e.g., North, 2005), strategic management (e.g., Foss, 2007), and visual cognition (e.g., Rensink, 2002), are in general agreement that we have little scientific understanding of where beliefs come from and how they are formed. As Hastie (2001) observed, however, the decisions that beget human action are the product of beliefs. Therefore, scholarly understanding of decision making and human action is logically dependent upon a better understanding of the source, formation, and effect of beliefs on various human processes that are considered central to social science in general and organizational and managerial studies in particular.

In a world that is assumed by scholars to be uncertain, treatment of these beliefs ranges from subjectively-held but varying in accuracy (e.g., Mises, 1949 in Austrian Economics; Barney, 1986 in Strategic Management), to intersubjective (e.g., North,

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2005 in Institutional Economics; Sarasvathy, 2001 in Entrepreneurship), to radically subjective (e.g., Shackle, 1979 in Subjectivist Economics; Weick, 1979 in Organizational Psychology). Although the underlying influence that these beliefs have on the decision making process is fundamentally similar across domains, the scholar's view of the nature of beliefs is largely a function of the unit of analysis that he or she is interested in examining. For instance, is it any surprise that scholars who study the sources of competitive advantage (e.g., Barney, 1986)—a phenomenon that requires a reasonable degree of correlation between the beliefs of multiple actors—would view and discuss beliefs in terms of accuracy. In contrast, scholars who are interested in explaining when a business person will prefer a novel option over the status quo (e.g., Shackle, 1979) may have less vested interest in determining whether these beliefs correspond with those of other market actors.

When facing uncertainty, however, decision makers must ultimately choose one among many possible courses of actions. In the context of business, these choices constitute investments of resources (capital and labor) which subsequent returns reveal as evidence of either the quality of one's judgment or luck. Assuming the former, numerous scholars in strategic management and entrepreneurship (e.g., McMullen, Plummer, Acs, 2007) have pondered why there is ever space for new firms to emerge and why existing firms do not simply seize these opportunities before entrepreneurs are able to mobilize the resources necessary to exploit them—a task that the strategy literature suggests should be easier for existing enterprises, owing to slack resources (George, 2005), economies of scale (Makadok, 1999) or economies of scope (Helfat and Eisenhardt, 2004.) Therefore, many theories of strategic management logically suggest that existing firms should have a competitive advantage over new firms in the opportunity exploitation process.

The large number of start-ups reported each year (Headd, 2003) and the perpetual churn of firms that comprise the *Fortune* 500 immediately undermine the veridicality of this assumption. Consequently, strategy scholars (e.g., Day and Nedungadi, 1994; Durand, 2003) and entrepreneurship scholars (e.g., Kirzner, 1973, 1985) alike have proposed that the potential explanation for why there is market space for new firms to emerge may be partially cognitive in nature, such that particular abilities, goals, motives, and contexts often interact to facilitate or encumber the formation of beliefs that an opportunity exists for market actors who possess the right knowledge and motivation at the time the opportunity emerges. For example, McMullen and Shepherd (2006) recently proposed an elemental model of entrepreneurial action that formalized how beliefs about the opportunity and one's abilities may reduce the uncertainty that delays or prevents action. In their model, an individual with the necessary knowledge and motivation escapes ignorance, if not doubt, by forming a third-person opportunity belief—a belief that an opportunity exists for someone, even if not for the prospective entrepreneur. Assuming that he or she does form a third-person opportunity belief, then the entrepreneur must overcome doubt by forming a first-person opportunity belief, which is a belief that the opportunity is of value and achievable by him or her, and not just by others. **Entrepreneurial cognition**, then, *is the mental process of overcoming ignorance to inform a third-person opportunity belief and/or reducing doubt to inform a first-person opportunity belief.* After both ignorance and doubt are assuaged such that the environment no longer obfuscates the formation of an intention nor prevents its conversion into behavior, entrepreneurial action ensues.

Consistent with other research on beliefs in cognition and decision making (e.g., Hedstrom and Swedberg, 1998: 128), McMullen and Shepherd (2006) argued that beliefs are shaped via information, experience, and deeper values, but *how* these elements are mixed to generate third- and first-person opportunity beliefs lay beyond the scope of the article in which their model was introduced. The McMullen and Shepherd model resolves some critical issues about the role that uncertainty plays in explaining entrepreneurial action by demonstrating that, when conducted in real time, cost-benefit calculus is based on *a priori* beliefs, not necessarily facts, and that failure to recognize all the elements of entrepreneurial action can lead systems-level theories of the entrepreneur to collapse when they are applied at the individual level of analysis. Their model, however, remains relatively silent about the mechanisms that explain *how* knowledge and motivation lead to belief formation, which is potentially problematic because behavioral mechanisms are often considered essential for building deeper theory about social behavior (Palmer, 2006; Weick, 1995).

In this article, we integrate coherence theory as developed in both philosophy and psychology to develop theory about belief formation that can

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directly augment the McMullen and Shepherd model.[1] There are three mechanisms in coherence theory governing belief formation that need to be incorporated into the broader action model: (1) the preattentive process guiding attention, (2) the process of matching sensory with meta-representations of the environment, and (3) the process for updating knowledge structures. Using these three mechanisms we explain why some actors are more likely to form opportunity beliefs in uncertain environments, especially those arising from divergent, large changes. Such changes are known to be an important source of opportunities (Christensen, 2000; Gladwin, 2002; Tushman and Romanelli, 1985).

Our coherence approach to opportunity beliefs contributes to entrepreneurship and to strategy in at least four ways. First, models of entrepreneurial action have highlighted the importance of escaping ignorance and overcoming doubt to form opportunity beliefs. We extend this research by offering a process model that explains the mechanisms by which this occurs in both the attention and evaluation phases of the entrepreneurial action process. Second, entrepreneurial risk and uncertainty have been conceptualized at the systems level as objective characteristics of the entrepreneurial environment (Knight, 1921). Our model focuses on explaining why individuals act entrepreneurially and therefore conceptualizes entrepreneurial risk, uncertainty, and ambiguity in terms of how they influence opportunity beliefs. Third, research on opportunity recognition and discovery has focused on the role of knowledge in directing attention to the most important data and/or connections (Baron and Ensley, 2006; Grégoire, Barr, and Shepherd, 2006), which is an approach that is consistent with attention-based theories of the firm (Ocasio, 1997). Although we acknowledge these knowledge-driven top-down approaches, we also offer an alternative in which the environment itself directs attention—the entrepreneur uses a gestalt-like representation of the environment (gist) to direct attention to the most important aspects of the environment to inform opportunity beliefs. This bottom-up approach can be considered a competing rationality (see Miller, 2007, this issue). In this paper we offer situation-contingencies that likely guide entrepreneurs' choices between top-down and bottom-up processes for forming opportunity beliefs. Fourth and finally, we hope that our focus on preattentive processes (particularly those based on the formation of multiple gists), on matching sensory and meta-representations of the environment, and updating opportunity beliefs contributes to the growing momentum of strategy and entrepreneurship research on attention and cognition, especially regarding the roles of doubt (entrepreneurial risk, uncertainty, ambiguity, and others), learning, and belief.

OPPORTUNITY BELIEFS IN ENTREPRENEURSHIP THEORY

Belief formation is critical in modern entrepreneurship theory because it helps the entrepreneur to escape ignorance and to overcome doubt. **Ignorance** *refers to a lack of information or a lack of awareness that an opportunity exists within the environment*. For instance, lack of information may be attributable to temporal or spatial distance between the environment in which the opportunity exists and the environment in which the entrepreneur operates. Lack of awareness, on the other hand, results from the method by which information is recognized, scanned, and processed for action. Even after recognizing a potential opportunity and processing information that leads to an evaluation that an opportunity for someone exists, doubt may still inhibit action. **Doubt** is created by entrepreneurial risk, uncertainty, and ambiguity. *Entrepreneurial risk* refers to investments of resources (including the entrepreneur's time and energy) in which the decision maker knows the probability distribution of all possible outcomes from entrepreneurial action, but does not know which outcome will occur; *entrepreneurial uncertainty* refers to investments of resources (again including the entrepreneur's time and energy) in which the decision maker does not know all possible outcomes from entrepreneurial action, and does not know the probability distribution of those outcomes, but does know that this information is not known by others; and *entrepreneurial ambiguity* refers to investment of resources in which the decision maker does not know all possible outcomes of entrepreneurial action, does not know the probability

[1] Thagard and Verbeurgt (1998) also integrated the psychological and philosophical aspects of coherence theory. Although their model was well suited for the Artificial Intelligence context for which it was developed, it is less suited for the entrepreneurial context—entrepreneurs form beliefs that may not be considered as traditionally rational despite using a process that may be (for a discussion of the appropriateness of traditional views of risk and rationality in the entrepreneurial context see Miller [2007, this issue]).

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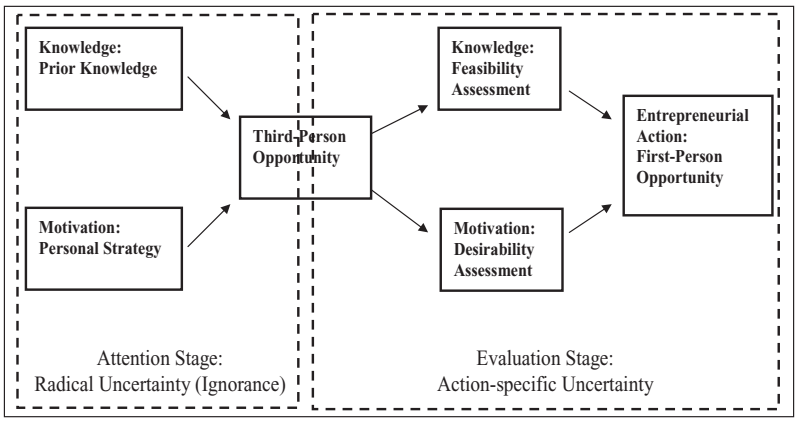

Figure 1. McMullen and Shepherd's (2006) conceptual model of entrepreneurial action

distribution of those outcomes, but knows that his or her lack of knowledge is created by missing information that is relevant and could be known to others (for a review of decision theory see Camerer and Weber, 1992). An individual's level of risk, uncertainty, and ambiguity likely differentially inform beliefs that in turn impact the likelihood of action.

Using an action perspective, McMullen and Shepherd (2006) proposed a model in which ignorance and doubt about an opportunity in the environment are overcome through the concomitant consideration of knowledge and motivation (see Figure 1). At the outset, they argue that opportunities arise from changes in the environment (Eckhardt and Shane, 2003; Schumpeter, 1934)—changes to the market (Drucker, 1985; Christensen and Bower, 1996; Geroski, 2001) and/or technology (Shane, 2000). To exploit the opportunity, an entrepreneur must first escape **ignorance** that an opportunity for someone exists within the environment and then overcome **doubt** about the feasibility and desirability of action. The escape from ignorance concludes with the formation of a *third-person opportunity belief* that initiates the attempt to overcome doubt. To escape ignorance, prospective entrepreneurs must possess sufficient information about the environment, possess enough relevant knowledge to give that information meaning, and be motivated enough to take notice of the information upon encountering it. Motivation can be a function of the attractiveness of the reward promised by the opportunity itself given one's state at the moment of encounter (Kirzner, 1973) or some more enduring individual need (Schumpeter [1934:93] identified power, status, or achievement as possible examples).

Once individuals form beliefs that an opportunity for someone exists in the currently scanned environment, they evaluate whether they can successfully enact the opportunity should they commit to its pursuit (for example, see Krueger, Reilly, and Carsrud, 2000). A first-person opportunity belief yields a decision to commit only if the prospective entrepreneur overcomes sufficient doubt. This process requires the prospective entrepreneur to choose to act in the face of uncertainty after evaluating the risk, uncertainty, and ambiguity features of the opportunity in relation to his or her own knowledge and motivation. Once a first-person opportunity belief is formed it is highly likely to lead to action. As Aristotle (1987) claimed, the conclusion of an actor's desire (for an outcome) and a belief (that one can perform the tasks necessary to achieve this outcome) is not another belief but the action itself. In this sense, first-person opportunity beliefs are akin to intentions that are converted into behavior immediately upon encountering all of the necessary conditions for action initiation.

Yet, as shown in this simplified depiction of the belief formation model and in the more elaborate form discussed elsewhere (McMullen and Shepherd, 2006), *how* knowledge and motivation are combined with information about the environment to generate beliefs is still somewhat of a mystery. Likewise, *how* beliefs evolve from the third- to first-person opportunity type is also an important issue of entrepreneurial cognition that is in need of greater schol-

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arly attention as well. Consequently, we suggest that coherence theory may help to address both of these needs.

COHERENCE THEORY AND BELIEF FORMATION

In an *Annual Review of Psychology* article on change detection, Rensink (2002) described coherence theory as a basis for understanding (1) how scene perception is generated, (2) what change is, and (3) how it can be detected. We chose coherence theory as a framework for developing an entrepreneurial cognition model of how decision makers form opportunity beliefs because the principles of coherence theory extend beyond change blindness in the visual processing literature. For example, the concept of coherence has been used in metaphysics to develop a coherence theory of truth, in epistemology to develop a coherence theory of epistemic justification, and in psychology to explain processes as diverse as discourse comprehension, analogical mapping, and interpersonal impression formation (Thagard and Verbeurgt, 1998). Coherence theory demonstrates how we move from pieces of data that are coherent/incoherent with each other at a local level to a global interpretation of coherence (Thagard, 2004).

Central to the importance of coherence theories (whether to make sense of a text, a picture, a person, or an event) is the 'need to construct an interpretation that fits with the available information better than alternative interpretations . . . one that provides the most coherent account of what we want to understand' (Thagard and Verbeurgt, 1998: 2). It is based on elements, which are representations such as propositions, actions, words, or parts of images. Elements that cohere (fit together) provide an outcome for the tasks such as propositions accepted as true (Lehrer, 1999) (or known or justified depending on the theoretical perspective), actions accepted as desirable (Millgram and Thagard, 1996), and meanings accepted as understood (Kintsch, 1988). For instance, a coherence theory of discourse comprehension explains the assignment of meaning to different words to a coherent whole—' "the pen in the bank" can mean the writing implement is in the financial institution, but in a different context it can mean that the animal containment is in the side of the river' (Thagard and Verbeurgt, 1998: 5). A coherence theory of vision refers to the assignment of parts of an image to a coherent structure or field to explain what is perceived. Our coherence theory of opportunity belief formation is based on environmental stimuli (elements) to provide a perception of the environment that is believed to represent an opportunity (or not).

Coherence theory is a variant of dual processing theory in social psychology, and as with all dual processing theories, decisions rely on simultaneous, recursive (dual) processing of data and recognition (Chaiken and Trope, 1999). This processing is highly constrained by attention, which is a limited resource, and also dependent on how recognition structures have been influenced by prior learning, scripts, and schemas. Unlike some of the variants of dual processing models, coherence theory focuses on both extreme ends of the data input and recognition systems; that is, on both preattentive stages in processing, as well as the highly cognitive stages of evaluation using coherence statements and knowledge structures to form plausible explanations. At the same time, coherence theory's fundamental premise is that global coherence is sought by actors across stages of social construction, allowing for changes in the 'external environment' to be incorporated as an opportunity belief in a manner that is consistent with the actor's view of reality to create a certain seamless, 'coherent' whole (Rensink, 2002; Thagard, 2001). Thus, coherence theory fits well with the entrepreneurship literature's claim that belief formation is rapid, preattentive and holistic (see Kirzner, 1980), yet also informed by learning and experience (Grégoire *et al.*, 2006).

The essence of coherence theory is depicted in Figure 2, which is created by combining psychological depictions (particularly Rensink's 2002 figure) with philosophical portrayals of them (especially Thagard's 2004 formulation). Coherence occurs via processing at different levels of cognitive organization and consciousness, from low to high. At the bottom-most level are the environment and the representations of it. In the middle level is the matching of representations of the environment ('sensory') with more general statements about it ('meta-representations'). At the top-most level is the formation of coherence statements, by updating and embedding them in knowledge structures. In this framework, a **third-person opportunity belief** is the *state in which an entrepreneur is convinced that there is coherence between the knowledge proposition that there is an opportunity and the set of representations about the environment*. A **first-**

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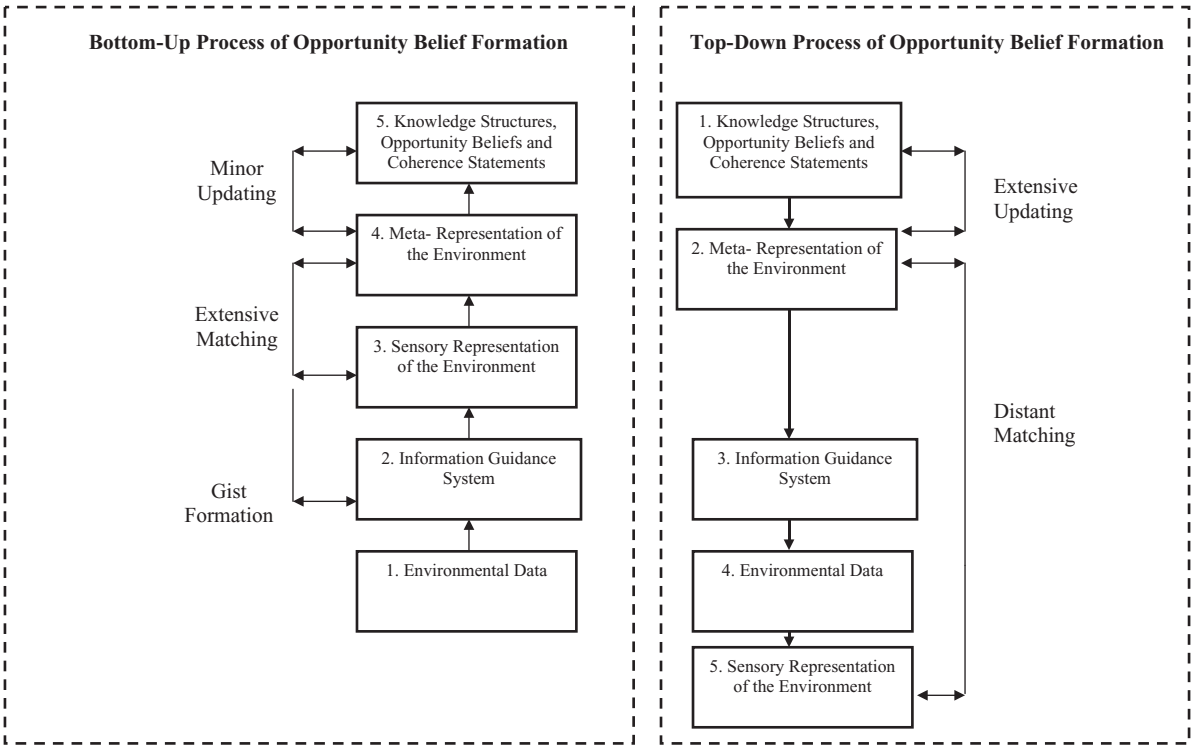

Figure 2. Bottom-up and top-down processes of opportunity belief formation

person opportunity belief is the *state in which the entrepreneur is convinced that a statement about an opportunity's existence belief is not only coherent with representations of the environment, but coherent with the focal entrepreneur's deeper knowledge and value structure*. Such coherence with the entrepreneur's knowledge and value structure is likely to lead to action because a failure to encounter the environmental conditions that are necessary to convert intention into behavior is typically what prevents action (Greve, 2001) and this problem is largely assuaged by the belief that one has identified an opportunity that is personally feasible and desirable (McMullen and Shepherd, 2006).

As also shown in Figure 2, belief formation occurs through two different processing methods: (1) a bottom-up process that runs from the environment to the coherence and knowledge structure (the figure's left-hand side), and (2) a top-down process that runs from the knowledge structure to the environment (the figure's right-hand side). We will discuss the bottom-up process first, and offer propositions about the types of belief formation in it, and its speed. Then, we will discuss the top-down process.

Bottom-up process of opportunity belief formation

In the first stage of the bottom-up process, the entrepreneur considers an array of environmental stimuli that represent substantial detail about the environment, but these stimuli are highly volatile; that is, the environment is viewed as an *undifferentiated flux of data* from which phenomena have to be forcibly carved out (Chia, 2000: 517; Weick, Sutcliffe, and Obstfeld, 2005). This leaves the system with no informational basis upon which to detect and interpret environmental change (Hollingworth, 2006). Bracketing helps stabilize streaming experiences and simplifies the world (Weick *et al.*, 2005: 411). Thus, an information guidance system must be used or generated as a second stage.

In the second stage, the entrepreneur creates *an information guidance system* by allowing the environment itself to stimulate a **gist**—*a gestalt-like, preattentive representation of the environment* (Oliva, 2005). The gist of a scene is processed as a single entity and is not affected by the quantity of objects in a scene (for a review see Biederman,

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1995) nor affected by object information (Schyns and Oliva, 1994) but is generated directly from the many stimuli of the environment without requiring attention to stabilize a sub-set of these stimuli (Oliva and Torralba, 2001; Rensink, 2002). Therefore the gist is generated by the scene and directs attention to form a structure that is the basis for the entrepreneur's perception of the environment. Based on visual experiments, it appears that the formation of a gist as a mechanism for directing attention is adaptive. 'The gist benefits object detection mechanisms almost instantaneously as well as attention deployment and gaze control in cluttered scenes' (Oliva *et al.*, 2003; Torralba and Oliva, 2003). Therefore, the gist of the environment is important because, after being stimulated by the environment, it guides attention to salient environmental stimuli to form the basis of a stabilized and simplified 'picture' of the environment that informs beliefs.

At the third stage, the entrepreneur uses focused attention to 'hold' environmental stimuli in a coherence structure (Rensink, O'Regan, and Clark, 1997). The structure is really a field in which a perception of the environment is stabilized, allowing new data from attended environmental stimuli to provide a 'new' *sensory representation*, which is compared to the preceding representation held in short term memory. Thus, change is detected when new information about one or more features of the attended environmental stimuli transforms an existing coherence structure. Because attention is limited (Ocasio, 1997; Simon, 1947), and coherence structures can only be maintained as long as attention remains focused (Wolfe, 1999), only specific features of an environment can be attended. That is, not all stimuli can be included in a coherence structure and only a limited number of specific coherence structures can be maintained (Kahneman, Treisman, and Gibbs, 1992; Rensink 1999, 2000).

At the fourth stage, the entrepreneur engages prior experience with the stimuli, particularly the existence of sensory representations (generated by previous coherence structures) that yield higher level ('meta') representations of the environment (Simons and Levin, 1998). These meta-representations come directly from *coherence statements*—pre-existing propositions about reality that have incorporated cognitive frames and beliefs. These meta-representations of the environment are then *matched* with sensory representations for comparison to determine the extent to which they form a coherent whole (Read and Marcus-Newhall, 1993; Thagard, 1989, 1992, 2001). For instance, a statement that 'the market is growing' is a meta-representation of the environment that is embedded in a broader statement about growth and a knowledge structure about what that entails. It is based on, but not the same as, the sensory representation that 'the number of products sold in the market grew.' The two match quite well and allow for relatively quick recognition of any changes in the number of units sold in the market to be interpreted in terms of growth.

At the fifth and final stage, the entrepreneur attempts to construct internally consistent and valid statements about the environment that are congruent with the deeper knowledge structure. Philosophical coherence theory maintains that knowledge structures are quite sweeping and identify directly with reality (Thagard, 2001). This means that they contain conditions for truth or veracity; that is, of deeper belief. Beliefs are established iteratively via updating (Dietrich and Moretti, 2005; Lehrer, 1999), where mismatches between the meta-representation of the environment generated from coherence statements and/or sensory representations generated from gists are resolved (Read and Marcus-Newhall, 1993; Skyrms, 1992, 1993). If two sets of opposing coherence statements are created, then radical new coherence statements and even knowledge structures may result (Gopnik and Meltzoff, 1997; Millgram, 2000). For instance, the sourcing of wine from other countries has been a popular production method in the wine industry for many years, but branding wine as 'global' in marketing terms is quite new. A radical claim arising from these two statements is that an entrepreneur can create a 'global wine company' by branding a wine globally, but still sourcing it more locally (Bartlett, 1999).[2]

The bottom-up process can occur quite quickly, particularly the first four steps. Research has shown that change blindness can be recognized and overcome in a dozen seconds (Rensink, 2002). However, determinations of coherence in cognitive terms are a more taxing process, because they require the internal truth of statements to be established by the entrepreneur. Cognitive psychology suggests that the complexity of operations and the depth of changes in recognition structures put exponential burdens on the individual (Fiske and Taylor, 1991). Shifting schema or cognitive categories can be effortful

[2] The updating of coherence theory is different from that of Bayesian updating (see Thagard, 2004).

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and take time. Although schemas of other forms of knowledge are relatively perseverant, they appear to be less so than for those schema that individuals use to categorize themselves (McCall and Simmons, 1996; Swann, Stein-Seroussi, and Giesler, 1992). That is, existing schemas of self are highly perseverant even in the face of considerable feedback suggesting their inappropriateness (Swann, 2005). Given these constraints, and based on our description of the bottom-up process, we propose that:

Proposition 1a: When entrepreneurs generate multiple, relatively congruent gists of the environment, they will rapidly form both third- and first-person opportunity beliefs.

Proposition 1b: When entrepreneurs generate multiple gists of the environment that challenge either coherence statements or deeper knowledge structures, they will form third-person opportunity beliefs rapidly, but form first-person opportunity beliefs slowly.

Top-down process of opportunity belief formation

The top-down processing of belief progresses through the stages of our coherence model in a modified, reverse order of stages from that in the bottom-up order. As shown on the right-hand side of Figure 2, at **Stage 1** an entrepreneur engages the environment based on his or her deeper knowledge structure (Thagard, 2004; Weick, 1995). In this top-down process, strong first-person opportunity beliefs can be established by the entrepreneur in Stage 1—the entrepreneur forms coherence statements of opportunity and self that reflect first-person opportunity beliefs. Indeed, at **Stage 2** strong beliefs contained in coherence statements become the basis for updating meta-representations of the environment or for creating new categories of recognition (Barr, Stimpert, and Huff, 1992).

As a consequence of the strong updating and coherence formation, Stage 2 in the top-down process directly affects **Stage 5,** the sensory representation of the environment. Stage 5 is the product of an imposed, cognitive representation that screens data in a preattentive fashion. In a similar way, socialized common ground between managers (Kogut and Zander, 1992), absorptive capacity (Cohen and Levinthal, 1990; Rosenkopf and Nerkar, 2001; Zahra and George, 2002) and organizational routines (Nelson and Winter, 1992) direct decision makers' attention to specific aspects of the environment (Ocasio, 1997; Simon, 1947). The environment at Stage 5 is much more complex and volatile than perceived, leading to only partial recognition of it. Experiments in change blindness (Rensink, 2002) demonstrate that strong visual figures or categories of recognition in a prior perceived picture lead to high levels of myopia when there are substantial changes in later pictures presented to respondents.

Knowledge structures that generate coherent statements of opportunity and self develop a concise meta-representation that narrowly focuses attention on aspects of the environment that form the sensory representation of the environment. These narrow preconceived notions of the environment (meta-representation) are more likely to match the sensory representation (which is derived from those notions). That is, entrepreneurs are less likely to focus attention on those aspects of the environment that could represent non-path dependent disconfirming evidence of the veracity of existing coherence statements. With fewer mismatches between the meta- and sensory representations of the environment, entrepreneurs rapidly form opportunity beliefs but the narrowly focused attention likely results in blindness to environmental information salient to informing opportunity beliefs. Thus, we propose:

Proposition 2a: When the knowledge structure generates representations of the environment, there will be strong coherence between statements of opportunity and sensory representations of the environment, and entrepreneurs will form third-person and first-person opportunity beliefs rapidly.

Proposition 2b: When the knowledge structure generates representations of the environment, entrepreneurs are blinder to information that could have informed their opportunity beliefs.

As can be seen in our description of the bottom-up and the top-down approaches to belief formation, the entrepreneur cannot 'have it all.' Limits of attention and cognitive capacity imply that entrepreneurs must spend more time and energy on matching (incorporating more salient information but slower in forming first-person opportunity beliefs) or on updating (more quickly generating first-person opportunity beliefs but being blinder to salient information that could inform those beliefs).

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CONTEXTUAL AND MODERATING FACTORS

Contextual and moderating factors are implicit in our description of the coherence model above. The most relevant contextual factor for Figure 2 is the nature of the environment faced by the entrepreneur. The environment provides the data for the entrepreneur to process and also determines the selection of his or her response. In the literature on organizational change (Greenwood and Hinings, 1996:1024) and exploitation of opportunities (Christensen and Bower, 1996, Eckhardt and Shane, 2003; Geroski, 2001), there are two, generic types of opportunities: (1) those arising from large, divergent, often rapid change—i.e., from 'discontinuities,' and (2) those arising from smaller, more convergent, often less rapid shifts—'incremental changes' (Tushman and Romanelli, 1985). These changes must be detected to form an opportunity belief. How beliefs are formed from each type of change will be examined.

The most relevant moderating factors are the variations in cognitive processing that may be used by the entrepreneur because they affect the flow from Stage 1–5 in the coherence model of belief formation. The two moderating factors we investigate are both based on the constraints put on cognitive processing; that is, the limits created by *attention* and *cognitive complexity*. Psychologists have examined these limits at length and found that there are different models of focusing attention (e.g., for a review see Ocasio, 1997) and different forms of cognitive manipulation to detect change (Fiske and Taylor, 1991; Spender and Eden, 1998). Below we discuss two types of attention: continuous and oscillating. We also discuss the breadth and depth of cognitive structures, along with the degree of updating an entrepreneur may use. We will offer propositions about the effects of each environmental context as well as the effects of mode of focusing attention and complexity in each context on opportunity belief formation.

Discontinuities versus incremental changes in the environment

Discontinuities, which are based on large, rapid, divergent changes, are of central interest to entrepreneurs, for they create or offer the opportunity for 'creative destruction' (Schumpeter, 1942) and radical industry transformation (Christensen, 2000; Gladwin, 2002). In contrast, *incremental* shifts, which are based on small, slower, convergent changes, are more typical of a maturing industry and are often considered to be the most standard type of change faced by an individual or firm. In the case of discontinuities, bottom-up processing should have clear advantages over top-down processing for the initial recognition or discovery of change. In the bottom-up processing, multiple gists will be formed in Stage two to inform a sensory representation of the environment, and if not successfully matched with the meta-representation of the environment at Stage four (see Figure 2), the entrepreneur will detect a change. This will lead the entrepreneur to form a third-person opportunity belief rapidly. Given the rapid and divergent nature of the changes, however, considerable information processing will be required in Stages 1–4, making it very difficult for the entrepreneur to determine whether he or she has the ability and desire to pursue this opportunity—to form a first-person belief. Only in the case of a slower, less divergent change could cognitive resources be shifted to updating and the subsequent forming of a belief that a first-person opportunity exists. In other words:

> *Proposition 3: When viewing discontinuous change through a bottom-up process, entrepreneurs will rapidly form third-person opportunity beliefs, but slowly form first-person opportunity beliefs; and when viewing incremental shifts through a bottom-up process, entrepreneurs will form both third-person and first-person opportunity beliefs rapidly.*

Discontinuities, when viewed using a top-down approach will be more difficult to recognize as an opportunity for others, but, ironically, easier for individuals to recognize as opportunities for themselves. Viewing discontinuities from a top-down process first, allows for more immediate and stronger updating of the individual's knowledge structures (and resulting coherence statements of opportunity and self) based on mismatches between the meta- and sensory representations of the environment. This effortful updating and subsequent changes in the meta-representation increases the likelihood that the entrepreneur will recognize or discover the opportunity from the detected change in the environment as 'fitting' with his or her knowledge/abilities and desires.

But this intense focus on self and internal processing has the Achilles' heel of lacking focus on other aspects of the environment, including first-person

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assessments by other entrepreneurs. For example, the window of opportunity may have already closed because other entrepreneurs have already exploited the opportunity or discovered essential information that makes attempts to exploit the opportunity more difficult than before. For example, in carbon nanotechnology, in the late 1990s, scientists working on lattice type structures in nano institutes and company labs were quick to announce the stability of these nano structures, but they did not note that competitors working on geodesic structures ('Buckyballs', after Buckminster Fuller) had found these alternate nano structures to be stronger than lattices—and more reproducible *en masse*—further investment has gone into lattices by these labs, but those who work in geodes have seen far more growth and new patenting (Lounsbury, Jennings, and Wry, 2007). Thus,

Proposition 4: When viewing incremental and discontinuous shifts through a top-down process, entrepreneurs will rapidly form first-person opportunity beliefs, but for discontinuous shifts they will encounter more blindness to salient information.

The moderating effect of attention on beliefs and exploitation

Attention refers to the focusing of cognitive resources on stimuli. Two standard types of attention exist: continuous and oscillating (Ocasio, 1997). As a rule, sensory representations must become less detailed with increases in the complexity of structural elements, which provide the representation of the environment from which change can be referenced (Rensink, 2002). Thus, the more attention given to forming sensory representations, the more detail and structure to the data an entrepreneur can create, i.e., the more detailed (and more stable) that representation of the environment.

The more continuous focus on the environment and meta-representations of it, however, the less likely it becomes that a new gist (a subsequent new sensory representation of the environment) will be formed. For instance, as Daft and Weick (1984) have shown, attention within clothing companies that 'used a data collection system to record routinely such things as economic conditions, past sales, and weather forecasts' becomes highly focused and patterned (Daft and MacIntosh, 1978; Daft and Weick, 1984: 289). Accordingly, decision makers in these companies begin to suffer from 'conditioned viewing' (Aguilar, 1967)—'conditioned in the sense that it is limited to the routine documents, reports, publications, and information systems that have grown up through the years . . .' (Daft and Weick, 1984: 289).

Thus, in the case of a large, rapidly diverging change, it is less likely that the continuous focus of attention will allow for the recognition of the next, large divergent shift, whether it be a change in technology, market, or internal organizational arrangement. But, in the case of a small, converging change, continuously focused attention is more likely to allow entrepreneurs to recognize the nuanced difference in the environment surrounding them. In other words,

Proposition 5: When focusing their attention continuously, entrepreneurs will slowly form third- and first-person opportunity beliefs about discontinuities, but rapidly form third- and first-person opportunity beliefs about incremental change.

Compared to continuous attention, oscillating attention has the advantage of not leading to cognitive exhaustion as quickly while also allowing for 'snapshots' of the environment that may detect large change (Rensink, 2002). Oscillating attention can provide a kaleidoscope of entrepreneurial perceptions. According to Nord and Connell (1993: 117), 'Turning a kaleidoscope can: (1) dislodge old patterns, (2) generate new patterns, and (3) foster awareness that numerous configurations are possible.' Dislodging old patterns can be beneficial when they have become core rigidities that limit learning and adaptation (West and De Castro, 2001).[3]

[3] Another major issue with oscillation while using an environment driven approach is that, by providing different snapshots (sensory representations over time), they will generate false positives over time. The formation of multiple gists from oscillating focused attention could register a change even when there has been no strategically relevant change in the environment. In other words, individuals may find themselves responding to a misperception, misinterpretation, or misunderstanding of the environment that was brought about by fluctuation in the instrument (one's allocation of attention) as opposed to fluctuation in the actual structure of the environment. Therefore, oscillation is more likely to lead to a belief that there is an opportunity and subsequent action, but because not all opportunity beliefs necessarily prove true, logic suggests that, holding all else constant, the more beliefs that are formed, the more that some of them will be turn out to be false upon enactment.

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Nevertheless, given its periodic nature, oscillating attention may not lead to changes in coherence statements or broader knowledge structures, which are fundamental to the formation of first-person opportunity beliefs about radically new opportunities. Oscillating attention leads to the formation of multiple gists rapidly because gists are created within the same overall meaning frameworks. Yet changing coherence statements requires matching and updating, a cognitively taxing process (Thagard, 2000). For example, the U.S. military collected snapshot data on the Japanese prior to World War II that actually showed several war-like scenarios were developing. But the response pattern in the Philippines and Hawaii was based on the prewar coherence statements that said local strikes and terrorist attacks were likely, not a full-scale assault. The Joint Chiefs did not have time to meet to discuss the 'meaning' and patterns in a critical and evaluative fashion. Hence, all the planes in both territories were placed in close proximity on runways, to guard them from small, ground-based strikes versus large, aerial ones (Pearl Harbor Commission Report, 1946). Thus,

Proposition 6: When oscillating the focus of attention, entrepreneurs form third-person opportunity beliefs about discontinuities and incremental changes rapidly, but form first-person opportunity beliefs about discontinuities and incremental changes more slowly.

The moderating impact of complexity and cognitive capacity

In coherence theory, complexity and cognitive capacity are captured by (1) the elaborateness of the knowledge structure in which coherence statements are embedded, (2) the breadth and depth of each statement itself (which reflects that structure), and (3) the ability of the actor to update these statements. Both the psychological and philosophical views of coherence presume that, the broader the knowledge structure and coherence statement reflecting that structure, the more likely the entrepreneur can make sense or generate meaning about a change. Thus, broad structures and coherence frameworks will lead to the detection of large, rapid, divergent changes in the external environment, but not to the detection of smaller, slower, convergent ones.[4] For example, experiments involving real world fine-grained changes in a visual environment suggest that change blindness is associated with relatively sparse meta-representations (Levin *et al.*, 2002). For example, narrower coherence statements of the Internet appeared to provide a meta-representation and subsequent belief that it was a communication device that only needed to be added on to current organizational communication systems, where broader coherence statements provided a meta-representation that the Internet represented a cultural change in the way people construct their work realities (e.g., Keisler and Sproul, 1991) leading to opportunity beliefs, such as reconfiguring the structure and human capital of organizations by pursuing outsourcing and global networking. Thus,

Proposition 7: When using broad coherence statements, entrepreneurs form third- and first-person opportunity beliefs about discontinuities rapidly, but form such beliefs about incremental changes more slowly.

At the same time that it underscores the importance of knowledge structures and coherence statements, a central activity of actors (in both philosophical and psychological versions of coherence theory) is *updating* (Read and Marcus-Newhall, 1993; Skyrms, 1992). Updating refers to using information that is embedded in sensory representations to update meta-representations and the coherence statements on which they are based. Thus, updating means that prior coherence statements may be modified in a way that attends to the new information (Skyrms, 1993; Thagard, 2004). In addition, more philosophical versions of coherence theory argue that the knowledge structures themselves on which statements rest will be updated periodically as a result of multiple mismatches of sensory and meta-representations (Sloman, 1997; Thagard, 1992). Updating allows for the categorization schemas and rules on which they are based to be overturned quickly, if they do not

[4] There is some correspondence, in other words, between sensory and meta-representations in coherence theory; but the key difference of coherence theory from strict correspondence views is that the meta-representation (Y) can fill in gaps of sensory data and sensory data must be judged as a whole to be 'sensible' before it has meaning; otherwise updating of the sensory and/or meta-representations is necessary (Thagard, 2001; Walker, 1989).

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provide good coherence for real time sensory and meta-representations formed by actors. The search for truth (coherence) outweighs any belief that has been established up to that point (Dietrich and Moretti, 2005; Read and Marcus-Newhall, 1993).

An increased level of updating has a variety of effects on the opportunity belief formation process. The more that the actor updates, the more likely that he or she will overturn prior relevant coherence statements—and even knowledge structures, which implies that the less that he or she can immediately recognize a radical change via broad, extant statements (see Proposition 7 above). In addition, the updating effort will require attentional resources and in so doing 'break' the continuous focusing of attention on specific environmental stimuli. In turn, this will decrease the ability to recognize smaller or rapid changes (see Proposition 5), leading not just to temporary myopia but to a complete disorientation and non-recognition of the environment during the updating periods—much like a subject experiences in foreground-background switch experiments (Rensink, 2002). Yet, without regular updating, even very broad coherence statements are likely to miss many forms of moderate or small changes, or large, but converging ones. Also, without regular updating, the ability to form first-person beliefs about one's capacity to pursue the opportunity, based on new information about one's ability, experience, or the environment, will be diminished. Thus, we propose that:

Proposition 8: The use of frequent updating by entrepreneurs will lead to the rapid formation of third-person and first-person opportunity beliefs about discontinuities; but lead to opportunity belief formation arising from incremental changes more slowly.

DISCUSSION AND CONCLUSION

Miller (2007, this issue) asks how does one search for yet-to-be-discovered opportunities when the assumptions underlying the expected utility perspective of risk and rationality have little relevance for entrepreneurship as opportunity discovery or opportunity creation? We agree with Miller (2007, this issue) that there are variants to rationality, that entrepreneurs must decide among competing rationalities to guide action, and that this could be a situation-contingent decision (that may be made by the entrepreneur without being fully aware of it).[5] In this paper we describe a bottom-up and top-down process of opportunity belief formation and propose the situation-contingent nature of the choice between these rationalities. Specifically, Table 1 contains our propositions regarding the impact of the coherence process on the formation of beliefs concerning different types of opportunities. As the table makes clear, entrepreneurs cannot 'have it all' when facing uncertain strategic decisions. They can rely on only one coherence process at a time, and they must decide on particular environments, forms of attention, and cognitive resolution as they form opportunity beliefs. The bottom-up process leads to rapid formation of third-person opportunity beliefs, but not first-person; the top-down process leads to rapid formation of first-person opportunities but greater blindness to salient information. Continuous attention leads to rapid recognition of third- and first-person beliefs in more incremental environments, but not in more discontinuous ones, whereas oscillating attention rapidly forms third-person opportunity beliefs in both incremental and discontinuous environments. Broad coherence and frequent updating are also better for discontinuous environments than for more incrementally changing ones.

There is also a limitation arising from the ability of the entrepreneur as a decision maker to combine coherence processes and moderating factors in different environments. For example, given its heavy burden of data input and representation, the bottom-up process tends to work better with broader coherence statements and infrequent updating. In contrast, the top-down process, with its emphasis on updating, tends to be better when using narrower forms of coherence statements requiring more frequent updating.

In light of these contingencies forced by constraints, there are particular sets of cognitive strategies that an entrepreneur is likely to follow to overcome ignorance and doubt over opportunity. In particular, one strategy is to use a bottom-up process and more frequently oscillate attention, use broad coherence statements, and update only periodically. In this case the entrepreneur resembles the

[5] Also see Companys and McMullen (2007) for a typology of entrepreneurial opportunity in which the authors demonstrate how the conceptual nature of entrepreneurial opportunity determines the strategies that market actors use to discover and exploit them.

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Table 1. Coherence processes of opportunity belief formation and proposed contextual and moderating relationships

	Matching	**Updating**
1. Bottom-up	**(1a) High:** When entrepreneurs generate multiple, relatively congruent gists of the environment, they will rapidly form both third and first person opportunity beliefs	**(1b) Low:** When entrepreneurs generate multiple, incongruent gists of the environment, they will form third-person opportunity beliefs rapidly, but form first-person beliefs slowly.
2. Top-down	**(2b) Low:** When the knowledge structure generates representations of the environment, entrepreneurs are blinder to information that could have informed their opportunity beliefs.	**(2a) High:** When the knowledge structure generates representations of the environment, entrepreneurs will form third-person and first-person opportunity beliefs rapidly.
	Discontinuous Changes	**Incremental Changes**
3. Bottom-up	Entrepreneurs will rapidly form third-person opportunity beliefs, but slowly form first-person opportunity beliefs	Entrepreneurs will form both third-person and first-person opportunity beliefs rapidly.
4. Top-down	Entrepreneurs will rapidly form first-person opportunity beliefs, but will encounter more blindness to salient information	Entrepreneurs will rapidly form first-person opportunity beliefs, and encounter less blindness to salient information
5. Continuous focusing of attention	Entrepreneurs will be slow to form third-person or first-person opportunity beliefs	Entrepreneurs will rapidly form third-person and first-person opportunity beliefs
6. Oscillating attention	Entrepreneurs rapidly form third-person opportunity beliefs but form first-person opportunity beliefs more slowly	Entrepreneurs rapidly form third-person opportunity beliefs but form first-person opportunity beliefs more slowly
7. Broad coherence	Entrepreneurs form third- and first-person opportunity beliefs rapidly	Entrepreneurs form third- and first-person opportunity beliefs more slowly
8. Frequent updating	Entrepreneurs rapidly form third-person and first-person opportunity beliefs	Entrepreneurs form third-person and first-person opportunity beliefs more slowly

quintessential 'opportunist' or 'generalist' who has been discussed in the attribute literature (c.f., Shane 2000). Behavioral manifestations of this approach are likely to be highly reminiscent of industrial organization-inspired models of strategy (Porter, 1980, 1985), real options (McGrath, 1999), random experimentation (Collins, 2001), or low cost probes (Brown and Eisenhardt, 1997) in which opportunities exist to be discovered (Kirzner, 1985) and in which the real hurdle that entrepreneurs must overcome to realize a profit is a lack of information (e.g., Fiet, 2002). Such an entrepreneur may be able to see big changes, but because scanning would occur at a fairly superficial level, the entrepreneur would most likely be ill-equipped to pursue many, if not most, of them successfully.

Quite a different strategy is to focus attention more continuously, use much narrower coherence statements, and more frequently update them. An entrepreneur using this cognitive strategy may look more like a specialist or 'hedgehog', which has been so lauded recently in the strategy literature (e.g.,

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Collins, 2001). For example, Collins (2001) suggests that great firms—those significantly outperforming the stock market over several years—tend to have leaders that come to an understanding of their organization's role in the greater environment. This understanding then acts like a theory or sense of identity through which the leader filters information and attempts to make sense of data when choosing among various, but potentially competing, beliefs and courses of action. Such an entrepreneur would only occasionally be able to recognize big changes because most other changes would go unnoticed or dismissed as irrelevant for the entrepreneur's purposes or too far from the entrepreneur's identity. This entrepreneur, however, would be better at adapting to smaller, more convergent changes, owing to the close attention he or she is likely to pay to data that are considered relevant to his or her worldview, theory, identity, or equivalent notion of cognitive framing/sensemaking.

Naturally, other, more mixed cognitive strategies can be followed as well. These mixed versions are based on the premise that whichever type of coherence process is chosen (bottom-up or top-down), the moderating and environment-based factors should be chosen to counterbalance them so that entrepreneurs can form both third- and first-person opportunity beliefs to ensure that judicious action occurs. For instance, the entrepreneur might use a bottom-up process, but then employ oscillating attention and either narrow coherence or increase the frequency of updating to help build the sort of deeper knowledge essential for the formation of first-person opportunity beliefs. This type of entrepreneur, however, may under-perform relative to generalists or specialists in either discontinuously or incrementally changing environments. Using narrower coherence statements, the entrepreneur might not recognize large change, and if he or she did, the entrepreneur might still be less predisposed to act than the top-down specialist who believes in himself or herself. Only in more moderately changing environments would such a person outperform either the generalist or the specialist.

Contributions

Our coherence approach to belief formation has the potential to make at least three solid contributions to entrepreneurial and strategy theory on decision making. First, the coherence approach adds directly to the McMullen-Shepherd (2006) model of entrepreneurial action in the face of uncertainty. The coherence view elucidates the way in which third- and first-person opportunity beliefs are formed by providing the key mechanisms from coherence as the basis of this model (see Figure 1). Scanning, gist formation, and coherence statement matching/updating all occur in the early or preattention stage. Beliefs are known to shape perception immediately and actively (e.g., Fiske and Taylor, 1991; Weick, 1995). Yet this early stage is influenced by prior knowledge and degree of doubt and ignorance about the opportunity.

This modification of the McMullen-Shepherd model puts new weight on the rapid, preattentive processes that guide entrepreneurs. As entrepreneurship has become more elaborate and accepted as a field, so has the tendency to elaborate steps and moves made by entrepreneurs. But one of the fundamental insights into the field, and its attraction to researchers, is its action-oriented nature. As Georgescu-Roegen (1958) concluded some time ago: 'many idle controversies involving the nature of expectation could be avoided by recognizing at the outset that man's conscious actions are the reflection of his beliefs and of nothing else.' We think that belief and preattention work so strongly to set up the opportunity recognition and evaluation stages that they may cause path dependence in these areas. An opportunity belief becomes stronger as more doubt is resolved and consequently, action is more likely. This may not make sense in standard terms, but in terms of real options theory, which is becoming more important in finance and risk evaluation, such perceptions figure in strongly. The entrepreneur may just be exercising his or her most valuable real option, based on belief, perception, and prior experience.

This modification, which emphasizes the preattentive process, further incorporates the notion of the environment as opportunity into entrepreneurial decision making as exploitation (Shane and Venkataraman, 2000). Although research has emphasized the role of prior knowledge, focusing attention on what are believed to be the most salient aspects of the environment (Baron and Ensley, 2006; Grégoire *et al.*, 2006; Shane, 2000), there has been little entrepreneurship and strategy research that investigates the role that the environment itself can play (through gists) in allocating attention to aspects of the environment. There has been acknowledgement that entrepreneurs and strategists use intuition but the investigations of intuition again have focused

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on prior knowledge—heuristics (Ross and Nisbett, 1991), proceduralization (Miller and Ireland, 2005; Mitchell, Friga, and Mitchell, 2005), and decision consciousness (Zollo and Winter, 2002). In this paper we complement the above research on opportunity recognition and discovery by exploring the role of preattentive processes on gist formation, which are distinct from studies of automaticity (Logan, 1992; Logan, Taylor, and Etherton, 1999), and how that information is matched and updated, perhaps into patterns. Creation theory acknowledges that the 'seeds' of opportunity do not necessarily lie in previously existing industries or markets and are therefore often unrelated to historical and current knowledge and information (Alvarez and Barney, 2007, this issue). Perhaps bottom-up approaches to opportunity belief formation (and particularly the gist as a mechanism) represent an important aspect of entrepreneurial cognition within a creation theory perspective, whereas top-down approaches are more consistent with the principles of discovery theory.

Future research can further explore the nonknowledge mechanisms that enable pattern recognition. That is, can recognition of some types of patterns, such as those that are divergent, large, and rapidly changing, be enhanced by bottom-up, preattentive processes of attention allocation? Does the absence of knowledge necessarily trigger a reliance on a bottom-up approach (gists) to focus attention? Or, do knowledge and experience enhance the effectiveness of gists for pattern recognition by (a) facilitating the individual's understanding of when best to use it, (b) enhancing the clarity of the matching process; and/or, (c) improving the updating process used to form belief in a new pattern? In addition, gists have been linked to emotional cues (Thagard, 2001). Like emotional cues, they are felt body senses that are immediate and may trigger gut reactions. Gists, as holistic representations may also access the amygdale (Dimasio, 1999; Goleman, 1995) and similar prefrontal cortex mechanisms. Given the potential link between emotional cues as gut feelings and gists, coherence approaches may be used with recent 'hot' approaches to cognition and decision making research (Mayer, Salovey, and Caruso, 2004; McEnrue and Groves, 2006).

The second contribution is to attention theory as synthesized by Ocasio (1997; Hoffman and Ocasio, 2001) and used in decision analysis (Burgelman, 1991; Cohen and Levinthal, 1990; Greve, 2003). These theoretical variants all maintain that attention allows for decision makers to enhance decision processing but that attention is a scarce resource and one governed by organizational and behavioral principles. Three principles govern attention in organizations: its focus, the specific situation, and its distribution in the organization. The principles of distribution, selection, and the focusing of attention in organizations make it ideal for tracking numerous small changes (convergent, rapid); the rules and routines can easily be set up to allow for the local environment to be attended to and provide managers fine-grained information about that local environment (March, 1981). Nevertheless, research on organizational change has shown that large structural shifts in environmental conditions are consistently undetected by managers even when attention has been focused on an area (Christensen, 2000; Gladwin, 2002). For example, in the Mann Gulch disaster, Weick (1996) details how, even with the development of professional fire training procedures in the prior decade, firemen were still unable to recognize that the Mann Gulch fire was a *different form*, leading many of them to their deaths.

Our coherence model presents an updating urge that is quite a different feature of detection-interpretation than these attention theories; that is, bottom-up approaches may help break the inertia and path-dependence acknowledged to be part of top-down approaches that underlie attention theory. Based on our model, breaking path dependence appears to inform an actor's opportunity beliefs (at least those from divergent, large, rapid changes) but leaves unanswered questions regarding the organizational consequences of managers acting on an opportunity that breaks the path, and potentially creates a new one. Linking the bottom-up approach of our coherence model to the strategy literature on path dependence and opportunity exploitation is likely to make important contributions to the fields of entrepreneurship and strategy.

Organizations are likely to vary on the strength by which the organizational context guides the attention of its decision makers. Large, established organizational contexts likely provide considerable 'guidance' for decision makers' focused attention. Newer and smaller organizations, by contrast, are often characterized by little role formalization (Aldrich, 1979; Stinchcombe, 1965), less functional specialization (Sine, Mitsuhashi, and Kirsch, 2006), fewer or no layers of middle managers (Mintzberg, 1979), and a lack of routines (Aldrich, 1979; Stinchcombe, 1965). As a result, newer and smaller organizations rely more heavily on managerial discretion (Sine

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et al., 2006) and are not as 'cognitively constrained' by organizational context as more established organizations. With fewer rules, routines, power and politics, managers of newer and smaller organizations are more likely to be 'free' to use the bottom-up process for informing opportunity beliefs. Future research can investigate whether managers of newer and smaller organizations are more likely to form opportunity beliefs across divergent, large changes than are managers of older and larger organizations.

The third contribution is to a re-emerging scholarly conversation centered on entrepreneurial decision making and inspired heavily by the work of economists Frank Knight (1921) and George Lennox Sharman Shackle (1979). Like both Knight's and Shackle's approaches, we conceive of decisions and the actions they yield as based on the perpetual exercising of cost-benefit logic at varying levels of consciousness. Unlike these scholars, however, we suggest that the costs and benefits considered in the decision making process are neither objective in the strict realist sense as favored by Knight (1921), nor entirely subjective as advocated by Shackle (1979). Instead, we take a more intersubjectivist stance (e.g., Davidson, 2001; Giddens, 1984) in which actors are considered procedurally rational but not necessarily substantively rational (see North, 1990 for further articulation of this distinction). We believe this position allows for the wide-spread and/or personal ignorance that characterizes the social world as well as the uncertainty that accompanies an understanding of human action bound in time and space. In addition, an intersubjective stance allows for a convergence of worldviews, which is necessary for social action to occur. In this sense, the entrepreneur envisioned during the exposition of the proposed theoretical framework is more consistent with the focal actors of Giddens' (1984) Structuration theory or North's (1990, 2005) institutional economics than orthodox economics.

By acknowledging that the beliefs that impact decisions and actions are not necessarily based on facts, our approach allows the threat of entrepreneurial loss to exist conceptually without that loss having to be attributed entirely to changes in environmental conditions. For instance, the entrepreneur may correctly anticipate the market and effectively marshal resources to convert profit possibility into profit realization only to realize afterward that his or her ignorance regarding other possible uses of his or her time has led to a significant opportunity cost. In such a scenario, a suboptimal belief that action A would provide some expected level of utility can preclude engagement in action B, and even though the entrepreneur may succeed in action A, the action can fail to fulfill the deeper motive for which it was intended, leaving the entrepreneur to experience a sense of regret upon realizing that action B may have been a better investment of resources. There is little room for emotions such as 'regret' in more objectivist models of entrepreneurial decision making because decision makers are always assumed to have made their decisions using the best information available at the time of decision while employing preferences that are typically discussed by economists as 'revealed' and stable. In other words, wants, desires, or utilities are facts in most objectivist models of entrepreneurial decision making, whereas our proposed model treats them as beliefs that time may or may not reveal as misguided.

Lastly, the uncertainty discussed in Knight's and Shackle's theories does not address ignorance and is circumscribed to the domain of doubt. The decision problem is assumed by both scholars to have been thrust upon the entrepreneur. Consequently, there is no need for the entrepreneur to escape ignorance to come to the realization that a need for a decision exists. In other words, individuals are perpetually in the evaluation stage and there is little room for discussions of concepts such as preattentive processes. In contrast, our coherence theory of opportunity belief recognizes that individuals are typically preoccupied with the pursuit of some goal or another as a matter of conducting their lives and that some mechanism must account for the human ability to exchange a suboptimal but uncompleted activity for some new but uncertain course of action that promises a greater return. In other words, in a world of uncertainty, mechanisms are necessary to provide self-interested actors the means by which they identify relatively more productive and profitable uses of the resources under their influence, including their time, talent, and capital. The gists, matching, and updating of our model provide the mechanisms needed to adapt to a perpetually changing environment.

A final contribution is to entrepreneurial strategy, by elaborating upon the mechanisms that determine adaptation to different types of environment (see Table 1), we have been able to identify different sets of cognitive strategies that an entrepreneur might use to succeed. Current entrepreneurship theory tends to rely on strategy more generally to provide the acceptable set of strategies that an entrepreneur may

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use (Companys and McMullen, 2007). We argue that because entrepreneurs have limited cognitive resources, yet are able to make choices about environments and about employing cognitive capacity, they can increase the likelihood of success to deal with changes in the environment. We maintained that bottom-up-focused cognitive strategies might work better, but with a certain degree of randomness, in large, divergent, rapidly changing environments, compared to top-down-focused ones; combined cognitive strategies that balance constraints might work better in moderately changing environments, but under-perform either strategy in environments with either discontinuous or incremental change.

Future empirical research

The propositions offered in this paper are testable, both across environments and across entrepreneurs. We can imagine that across industries changing at different rates, several types of entrepreneurs might exist. The proportion of entrepreneurs of a given type surviving and succeeding should co-vary with the type of industrial change they experience, controlling for other market, firm, and individual variables. We also think that the propositions might first be tested in laboratory studies of individual decision making. Scholars could select individuals with entrepreneurial experience and elicit their different responses to different entrepreneurial scenarios using different cognitive strategies. By combining such macro and micro studies, we think that research on the proposed coherence theory approach to entrepreneurial cognition and action might offer a useful contribution to the field of 'entrepreneurial strategy' and 'strategic entrepreneurship'.

Gists, being preattentive, are more difficult to study directly, than attention and the other coherence mechanisms (for a discussion of the challenges and potential solutions see Mitroff, Simons and Franconeri, 2002). But even gists have been examined, if only at a more micro level. For example, Oliva and colleagues are attempting to find how long it takes to form a gist (e.g., Oliva and Schyns, 2000). Empirically testing the above propositions must also capture focused attention to distinguish between continuous and oscillating focused attention models. Because activities often signal where attention is focused, future research could map activities to time to capture the rhythm of oscillation (Ancona and Chong, 1996). This mapping of activities to time can be done through field work (e.g., Brown and Eisenhardt, 1997; Gersick, 1988) and laboratory simulation (Gersick, 1989). For example, following Gersick (1989) a laboratory simulation could be constructed where considerable data about multiple events are available to decision maker(s) with researchers monitoring activities to capture whether, when, and how often 'activities' oscillate between different environments. Researchers could also manipulate the type of environmental change represented in the data and capture whether the change was detected.

To gain a deeper understanding of the strategic aspects of entrepreneurial cognition and strategic action, we believe future research needs to focus on opportunity belief formation, explicitly examining the processes used to overcome ignorance and to reduce the doubt of entrepreneurial risk, uncertainty, and ambiguity. We hope this article has shown that key to such advancements is greater scholarly attention on the bottom-up process of opportunity belief formation and the mechanisms of gist, matching, and updating.

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