Entrepreneurial Cognition and effect on Neuro entrepreneurship

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ABSTRACT: Cognition research in entrepreneurship is currently very much en vogue – and studies have proliferated at a remarkable rate. A quick search of Google Scholar shows a surge in studies involving entrepreneurial intentions (and also entrepreneurial self-efficacy). Yet we also see a surge of reviews on both topics where the authors ignore excellent prior research and relatively little research that drills down more deeply, e.g., into deeper knowledge structures. In this survey paper, we look at entrepreneurial insight and neuro business enterprise. Enterprise researchers have since quite a while ago snacked around the edges of intellectual science, a large part because to skillfully utilize its theoretical ideas and exact instruments are testing. Consider the main enterprise inquire about the article at any point distributed in Nature was out of the neuroscience labs at Cambridge. Barbara Sahakian's group collaborated with the Judge Institute to contrast top administrators and serial business people on feeling autonomous ("chilly") discernment and feeling subordinate ("hot") cognizance, finding that the business people favored and were better at hot insight. This area has seen the most development and the most fruitful results. The key trigger for this whole approach has been the realization that experts think differently than novices. How experts become experts is reflected in the development of an “expert” scenario. (A scenario is, as its name suggests, a cognitive mechanism that comprises the key elements in a decision situation and the likely ordering of events).

Key words: Entrepreneurial Cognition; Neuro Entrepreneurship; Entrepreneurial Intentions; Entrepreneurial Self-efficacy; Entrepreneurial Learning.

INTRODUCTION

Entrepreneurial cognition refers to *"the knowledge structures that people use to make assessments, judgments or decisions involving opportunity evaluation and venture creation and growth"* (Mitchell et al. 2002, 97) and borrows theories, empirical evidence, and concepts from cognitive psychology and social cognition literature that have been useful to explain the development of entrepreneurs' mental mechanisms and structures responsible for entrepreneurial behaviour and thinking (Santos et al. 2016). Entrepreneurship should be a field sympathetic to the neuro-entrepreneurship research, and by and large, it is. Individuals figure it ought to be vital, and keeping in mind that its relative level of significance may contrast, there is general premium and a *"leaning in"* to what could be realized here.

What is going on here?

1. There are essentials about the area of business unique about Finance or Strategy that make it harder to adjust the discoveries to hypothesis advancement.
2. One of those things is that Finance and Strategy have base-level aggregate theories that make generally useful and reasonable claims about the world in relationship to individuals, or they do not (e.g., they are *theories*).
3. Entrepreneurship has very little theory. So, #1 and #2 are hard(er).
4. In this manner, one potential clarification for why neuro-business enterprise isn't getting footing is that it is based on as well as around (1) a perspective of business enterprise which isn't a hypothesis (singular/open door nexus) and (2) that view itself is based on exceptionally questionable ontological ground (exogenous chance).

The fundamental understanding of building up a reasonable field of neuro-business enterprise lays on the need to acknowledge three certainties:

A. This suggests the accentuation on the prioritization of results like mirror neurons, sympathy, reproduction semantics, the dopamine framework and propensities in a social setting, and correspondence. The most imperative outcome here is reproduction semantics as a model for the brain. Extensive experimental work bolsters this.

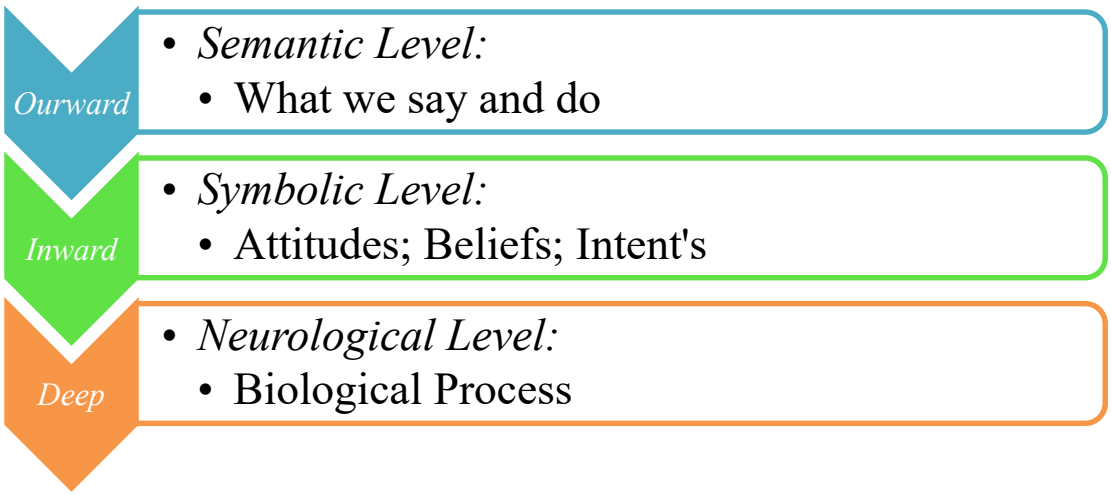
B. We have to dismiss the computational hypothesis of a brain (CTM[1]) that still underlies much work in intellectual brain science, psychological science, and neuroscience. A dismissal of CTM suggests that man is not fundamentally a *"data handling gadget"* or *"mastermind"* or *"objective chief"* or *"levelheaded utility maximizer"* but instead above all else a living being occupied with survival in its condition driven by necessities, qualities, and wants which might be sane. This infers the infusion of sparks (needs, qualities, and desires) into any remotely total comprehension of the psyche as proposed by Reed Montegue (2012) and McBride (2009), among others.

C. The finish of CTM requires an accumulation of devices to supplant the best down the go-to instrument that has been pervasively depended upon since the mid-twentieth century- - the (all-inclusive) Turing machine.

[1] Computational Theory of Mind.

The time has more than coming to turn a critical eye on neuro-entrepreneurship and its potential, ask some hard questions and bring together a diverse group of senior and junior scholars to share their insights and their current work. Doing this in a symposium permits us also to engage the expertise that might be found in other Divisions and Interest Groups. I hope you can join us – there will be fireworks. If the *"heart"* of entrepreneurship is an orientation toward seeing opportunities (e.g., Stevenson & Jarillo, 1990), then from whence do perceptions of opportunity derive? This paper offers researchers an overview of the cognitive processes that drive *"thinking entrepreneurially":* Shapero used the analogy of *"antennae"* – we all have our antennae tuned to specific *"frequencies"* and *"directions."* Another way to look at cognition research is Herbert Simon's three levels of cognitive phenomena (1963): Semantic (surface) level, Symbolic (deep structures) level, and Neurological (biological) level (Fig. 1 below).

Fig. (1). Simon's (1963/1997) three levels of analysis



1. ***Intention:*** In psychological brain research, the aim is the subjective state promptly before executing conduct. The prevailing class of formal goals models utilize two necessary precursors of expectations that can be arranged (regardless of differing wording) as (an) apparent plausibility, and (b) saw the attractive quality. That is, aims require the conviction that the conduct is achievable and the conviction that the conduct is beautiful. In any case, we will see that our demonstration needs genuine returning to.
2. ***Essential Beliefs and Attitudes – Self-efficacy:*** On the off chance that goals rely upon individual convictions and dispositions, at that point analysts keen on entrepreneurial reasoning ought to likewise investigate the forerunners of aims. Specifically, we have seen a groundswell of enthusiasm for one fundamental conviction that has, for some time, been related to starting and holding on at objective coordinated conduct: Bandura's idea of saw self-viability. (Bandura, 1986, 1995)
3. ***Deeper Beliefs and Knowledge Structures:*** Intellectual wonders, for example, expectations lie moderately near the surface in the engineering of our reasoning. Underneath these surface structures are more profound psychological structures of how we speak to learning and how everything fits together. Not exclusively do scientists get a more central perspective of how we figure out how to think entrepreneurially, yet this more crucial look likewise bears us better approaches to

impact the procedures that lie underneath entrepreneurial reasoning. That implies we have new, more ground-breaking systems by which we can upgrade entrepreneurial thinking.

4. ***Entrepreneurial Learning:*** Entrepreneurship instructors, for example, Ron Mitchell and others center enterprise preparing around changing understudies' entrepreneurial contents from moderate learner to generally master making this field a most energizing and most fruitful ground for enterprise researchers. The illustrative work done in business instruction has demonstrated an extraordinary advantage, yet the following stage for scientists is, likewise, with goals, to be vastly improved grounded in principle and Section "Suggestions for Entrepreneurial Learning (and Education)" lays some valuable preparation for investigating how business people learn. More imperative, we consider this to be an intense field for building our examination paper and in creating canny, educated solutions for open strategy.

Notification? Cross-disciplinary Definitional Issues

In the scholarly domain, this must be an extremely deliberate process since, as a matter, of course, it is normal that scholastics progress toward becoming specialists in the fields they are considering and can remain behind any work distributed with certainty. As knowledge advances, however (and it is no different in working to combine the realms of neuroscience, cognitive psychology, and entrepreneurship), there is much additional learning and knowledge that must be gained to have such confidence. The academic could choose to take decades and study each discipline and eventually know enough to do solo cross-disciplinary work. Alternatively, the academic can decide to partner with experts from other disciplines and work together to advance the research paper. However, it is difficult enough to work with other academics within the same training. Is it easier or harder to work with those of unfamiliar disciplines? This can also create a dilemma for the journal editor.

Importance of Technical Competence

There is much to learn about the technical aspects of setting up experiments, sourcing equipment, and technicians, understanding software, and reading and interpreting results that accompany this type of research, but this is indeed a new frontier (Krueger & Welpe, 2007).

Perceptions, Antecedents, and Consequences

If understanding is central to understanding how we apprehend opportunities, then we must know opinions (Douglas, 2009). Here, neuroscience has much to offer us. It also helps us to understand better mechanisms that facilitate or inhibit opportunity-related attitudes such as creativity. Like concentrate dark gaps in space, mind-based research uncovers that the subliminal is available and powerful; notwithstanding, it cannot be straightforwardly watched or estimated (Blair, 2010). It is proposed here that the interface of cognizance may be thought of like three to some degree liquid crossroads of fleeting, neurological space: (1) beginning with *"Oblivious"* where the subliminal might deal with it. However, the cognizant has not seen it otherwise called pre-discernment (Aimar, 2008; Hayek, 1952; Libet, 2004 [1999]); (2) to para-cognition

(something is nagging, on the tip of the tongue, at the edge of consciousness, you have almost got it); (3) to perception or recognition (aha!) (Haynie & Shepherd, 2007; Schraw & Dennison, 1994). Further, there is a feedback loop that sends messages back to the subconscious for recycling and revision (Balzer et al., 1989) (Fig. 2).

Pre-cognition	***Para-cognition***	***Re-cognition***
Libet (2004) Preconscious (Aimar, 2008; Hayes, 1952) Mesacognition	Edge of consciousness	Perception Metacognition (Schraw & Dennison, 1994; Haynie & Shepherd, 2007)
Cognitive feedback (Blazer, Doherty & O'Conner, 1989)		

Fig. (2). The three junctures of temporal, neurological space

Metacognition is the ability to reflect upon, understand, and control one's learning to formulate strategies for processing a changing reality (Schraw & Dennison, 1994). After the cycle from pre-discernment to acknowledgment, which can be in a moment or maybe take months, abilities for metacognition assume a job.

Before the Entrepreneur – An Entrepreneurial Mindset and Complex Thinking

Koppl and Minniti (2003) quickly talk about a few ways to deal with a hypothesis of the psyche as identified with pioneering learning and information structures; however, hold back before tending to natural connections. Aimar (2008) examines the exemplary Austrian market analysts' endeavors to confine and comprehend unsaid and cognizant information and the contrast between the preconscious (Hayek, 1952) and the cognizant. McGrath and MacMillan (2000) portrayed the entrepreneurial mindset as a dynamic decision process that is central to success in an entrepreneurial environment.

Individuals, Learning, and Stage Gates and thinking process

A general level of consciousness one has concerning his or her cognitions focused on a specific entrepreneurial task (Haynie, Shepherd, Mosakowski, & Earley, 2010, p. 221)—has been found to facilitate learning and adaptation in schools (Kamp, Admiraal, Drie, & Rijlaarsdam, 2015; Zohar & Barzilai, 2013) and the entrepreneurial literature (Haynie, Shepherd, & Patzelt, 2012). Indeed, superior learning has been associated with numerous cognitive attributes (e.g., learning style [Dunn, Griggs, Olson, Beasley, & Gorman, 1995], higher-order thinking skills [Zohar & Dori, 2003], and age [Cross, 1981]), processes (e.g., approaches to learning [Biggs, 1993], spatial transfer [Capello, 1999], and collective learning [Abrahamson & Fairchild, 1999]), and strategies (e.g., active learning [Meyers & Jones, 1993], self-regulation [Zimmerman & Pons, 1986], and peer assistance [Fuchs, Fuchs, Mathes, & Simmons, 1997]).

However, there has been little discussion about decision-makers' learning in the stage-gate process. Such a cognitive explanation of stage gates can also have normative implications as we link cognitive attributes, methods, strategies, and collective cognition to value-creation outcomes from the innovation process.

"[T]he degree of complexity of the human mind is logically greater than the complexity of consciousness" (Aimar, 2008). What if the classic trait studies in entrepreneurship had little success because they measured the symptoms if you will, rather than the source of entrepreneurial behaviour? Could the source of entrepreneurial behaviour be deeper, somewhere in our neurology, reflected in the feedback (and forward) process of the *"three junctures of temporal, neurological cognitive space?" (*De Carolis & Saparito, 2006; Shaver & Scott, 1991).

Opportunity Recognition and carter creativity

Hence, positive affect may improve opportunity recognition through increased creative thoughts, but to date, no entrepreneurship study has empirically examined this relationship. Let us now consider that opportunity recognition is very much a creative process (Hansen et al., 2006), and creativity is another domain where we can see the impact of brain-based science. It has been shown that social diversity and creativity have a positive relationship with the new firm formation (Lee, Florida & Acs, 2004).

However while there has been intriguing in the potential association among innovativeness and enterprise (e.g., Gilad, 1984; Whiting, 1988), investigations of inventiveness and business have fundamentally analyzed the distinctions in pioneering perspectives inside imaginative ventures, for the most part in miniaturized scale organisation s (Colas, 2005; Poettschacher, 2005) and distinctive approaches to creative entrepreneurship in the management of and achieving goals for a particular business (Davies, 2005; Rae, 2005). Fewer studies have sought to explore creativity and the formation of new ventures directly.

However, there is typically no connection made at the individual level between job loss and any corresponding psychological depression; that is presumably left to the field of psychology. Anecdotally, it is a shock when one loses one's employment, and it is not a stretch to make such a connection.

However, a link between artistic creativity to psychological depression and other affective disorders has indeed been established (Akinola & Mendes, 2008). Does artistic creativity follow the same processes as entrepreneurial creativity? Alternatively, are these distinct types with procedures carried out in separate areas of the brain?

Akinola and Mendes (2008) completed a test investigation of emotional weakness contrasting standard and post-treatment proportions of levels of an adrenal steroid, DHEAS (dehydroepiandrosterone sulfate) that has been connected to despondency. They found the highest levels of artistic creativity in participants that presented with the lowest baseline levels of DHEAS. It would be interesting to undergo a similar study comparing entrepreneurial creativity under varying conditions linked to depression.

Perhaps even short periods of intense negative emotions resulting from depression can result in great bursts of entrepreneurial creativity. Correspondingly, could there be any portion of the increased entrepreneurial activity that might be explained by psychological depression or, as artists, the entrepreneurs' coping mechanism?

Current Thinking about Entrepreneurial Intentions If we care about how entrepreneurs emerge, then it cannot be too surprising to see the extent of interest in critical preconditions that facilitate or inhibit this emergence (Davidsson, 1991; Krueger, 1993, 2000; McMullen & Shepherd, 2006; McMullen et al., 2007; Levie & Autio,

2008; Shapero, 1975, 1985). Entrepreneurship scholars once used terms such as "budding entrepreneurs," but adoption of the more specific term, *"intentions"* had added focus (and thus more rigor) to this fascinating research area. In return, this is an arena where entrepreneurs can perhaps *"give back"* fruitfully to other disciplines. For example, it is increasingly evident that simplistic modeling may yield a sizable r-squared, but do we understand causation? Conventional wisdom says that any planned behaviour is intentional. Essentially, if a behaviour does not result from stimulus-response, it is intentional. Alternatively, is it? It is certainly not that simple.

When is *"intent"* intent? Consider the classic work of Benjamin Libet et al. (1983), where experimenters can often detect human intent in advance, suggesting a neurological antecedent to intent and behaviour. What does this say about all our other carefully considered cognitive phenomena in entrepreneurship?

It bids us be cautious in our methods and rigorous in our theories, but it also tells us of the high potential for future research. If we are keen on concentrate on new pursuits, at that point, we have to comprehend the procedures that pave the way to their introduction. Clinicians have long observed goals to be very helpful in understanding conduct. Additionally, an expanded spotlight on aims pushes analysts from more review look into plans toward more forthcoming outlines.

It allows a greater emphasis on predicting versus explaining. However, it is not entirely clear that this is what we see empirically. The expansiveness and profundity of research on entrepreneurial expectations are very much archived somewhere else (e.g., Gregoire et al., 2009; Krueger, 2009b), yet let us briefly recap its development.

Theory of Reasoned Action, Theory of Planned Behaviour, and Shapero's Model of the Entrepreneurial Event

Ajzen and Fishbein's Theory of Reasoned Action (TRA) and Ajzen's Theory of Planned Behaviour (TPB) surfaced as the dominant class of intentions while, interestingly, the domain of entrepreneurship already provided a model quite similar to TPB presaging Ajzen's TPB by several years.

The first tested in the entrepreneurship domain was Shapero's model, where it found considerable support (Krueger, 1993a). Subsequently, Krueger and Carsrud (1993) proposed the consideration of Ajzen's TPB (Carsrud & Krueger, 1996). Others, especially Kolvereid (1996; Iakovleva & Kolvereid, 2009), have found great success in adapting TPB to entrepreneurial samples. This, at last, produced a relative trial of TPB and saw, discovering support for the two models (Krueger et al., 2000).

Post hoc investigation recommended that the ideal model would incorporate affinity to act from SEE and social standards from TPB (see Fig. 3). Both Ajzen and Shapero give us a hypothesis-driven and experimentally vigorous model at the surface level (Simon's "semantic" level).

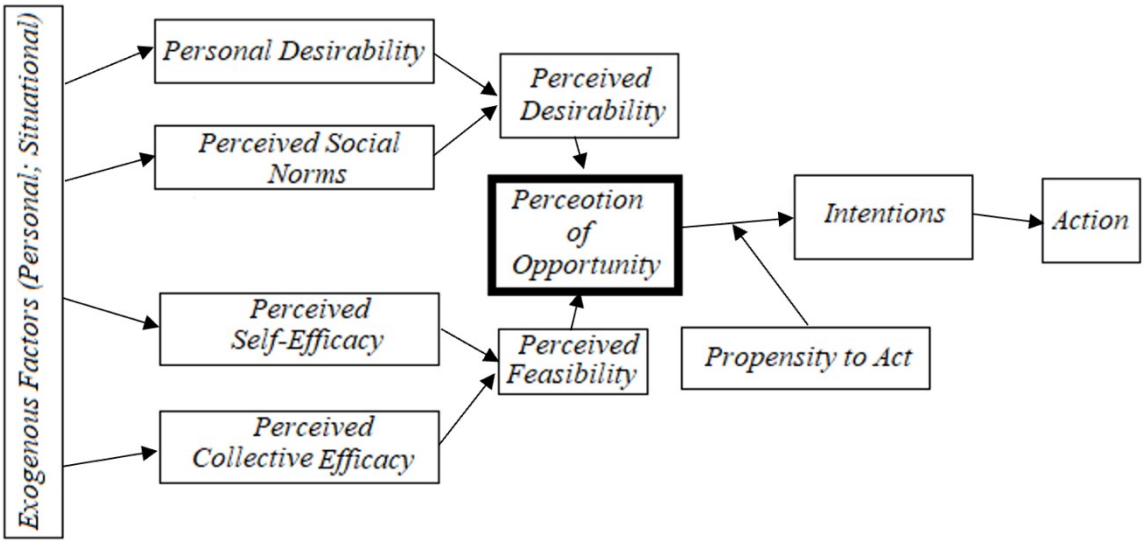


Fig. (3). Intentions model (Krueger, 2000; Krueger & Brazeal, 1994; Krueger et al., 2000; Shapero, 1982)

However, it does appear that the strengths of the formal intentions model have led scholars to use it with high confidence and perhaps too little critical thinking. As Libet's findings show, chinks in the model's armor are growing.

Disadvantages of Intentions Models

First, intentions can change, especially for relatively distal or complex behaviours. As such, the intent to start a business is far from persistent.

The direction of Causality? Next, there is still debate over the direction of causality. In particular, intentions can be seen as merely another attitude, just more visible. Robinson et al. (1991) argued for Allport's (1935) approach where behaviour depends on a troika of critical perspectives: Affective, cognitive, and conative [intent], even developing a much-underused measure of entrepreneurial attitudes.

More recently, work by Brännback et al. (2006) and Krueger and Kickul (2006) both stumbled across an unusual finding. While saw the attractive quality and saw attainability were critical predecessors of goals, a simple test found that allure and purpose additionally plainly anticipated achievability and that practicality and purpose unmistakably anticipated allure – similarly. Brännback et al. 's. (2007) information appears to propose that attainability may end up being the needy variable.

Dynamic Modeling of Intent: Implementation Intentions

Gollwitzer (Gollwitzer & Brandstatter, 1997; Gollwitzer & Sheeran, 2006) and others have gone beyond intentions toward a goal and investigated intentions toward implementation. Strong intentions toward implementing an intended strategy may play a more significant role than we might think and often entail different dynamics than intentions toward the goal per se. That is, goal intent is not enough; a strong intent to implement may well represent a very different set of mental models much as Bratman

(1987) argued that intent is not a genuine intention without a significant level of commitment to that intended goal or behaviour. Little research has looked explicitly at implementation intentions in entrepreneurial settings, although studies are currently underway (see Elfving et al., 2009, for initial supportive evidence).

Dynamic Modeling of Intent: Bagozzi's Theory of Trying (TT)

Figure (4) depicts one highly promising vehicle for embracing these specific dynamics in Bagozzi's Theory of Trying (ToT; Bagozzi & Warshaw, 1990; Bagozzi et al., 2003; Dholakia & Bagozzi, 2002). Moreover, part of the complexity of using lies in explicit consideration of emotional reasoning. *"Hot"* cognitions are, however, necessary to consider in dynamic models of human cognition (Fig. 4).

Consider Bagozzi's most recent version, his theory of effortful decision-making (Bagozzi et al., 2003) in Fig. (4). Note that this variation on the Theory of Trying explicitly includes two phases of the decision process, goal intent, and implementation intent. However, also note that rather than taking a simple snapshot of attitudes relating to the intent, the model explicitly considers the cognitive and emotive appraisal processes that we observe in any significant human decision-making.

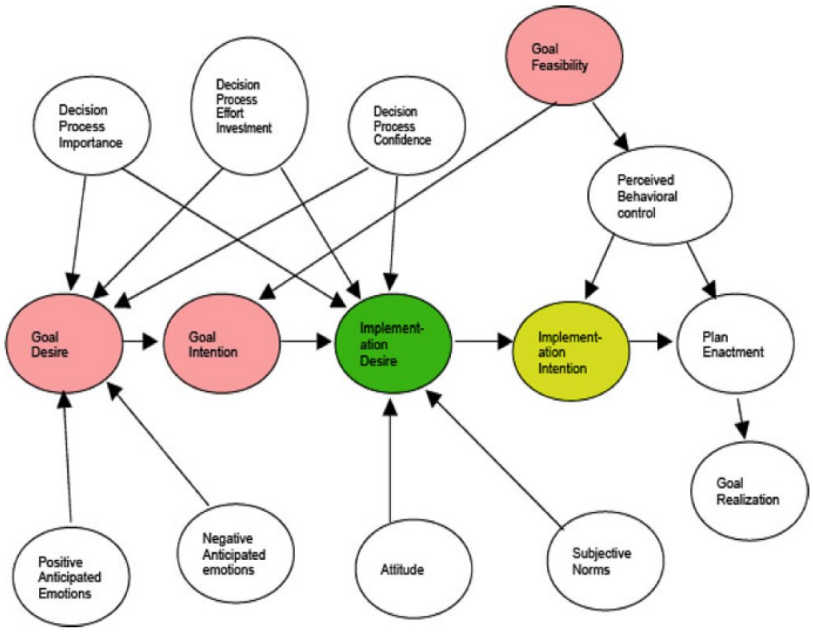


Fig. (4). Theory of effortful decision making (Bagozzi et al., 2003; Carsrud & Brännback, 2009)

In this case, we know that entrepreneurs engage in such appraisal, and this has become an important research area of its own (e.g., Michl et al., 2009). To put another way, the Theory of Trying captures that the process of how entrepreneurial intentions evolve entails hot cognitions, not just cold cognition (Lawrence et al., 2008). What is essential is to see that *"neuro-entrepreneurship"* is ready to join neuroeconomics, neuromarketing, neuro finance (and even neuroethics) as a fertile field of study (Stanton et al., 2008, Krueger & Day, 2009).

Passion, Affect, and Emotions

Is it possible to discuss entrepreneurs without discussing entrepreneurial passion (Cardon et al., 2009)? The financial measurement seems to connect fundamentally judicious *("cool")* perception while examination of the social analysis appears to draw in both (*"hot"* cognizance), which is valuable in understanding the job of entrepreneurial energy (Krueger et al., 2009). The subsequent stage will be to start digging all the more profoundly into the essential convictions that stay examination.

While Bandura's description of the self-efficacious individual (optimistically persistent) sounds as though he is referring to entrepreneurs, the first inkling of self-efficacy's importance came from Robert Scherer and his associates (1989) who found that parents' impact on their children's entrepreneurial attitudes depended on whether they influenced their children's sense of entrepreneurial competence (see also Neergaard's work in Section *"Deep Beliefs and Knowledge Structures"* below.)

Crucial Conceptual Work: Considerably prior, Shapero (1975, 1982) talked about the centrality of saw plausibility in deciding what a potential open door is trustworthy; however, without utilizing the term self-adequacy. This prompted operationalizing Shapero's model of the entrepreneurial occasion with self-adequacy as the key predecessor of saw practicality (Krueger and Brazeal, 1994; Krueger et al., 2000).

While interest was slow to enhance in using self-efficacy in entrepreneurship (Krueger, 1989), Brown (1996) proposed a look at self-efficacy regarding resource acquisition, marshaling resources being a crucial element in successful entrepreneurship. While Brown focused on a specific dimension, Alex DeNoble et al. (1999) developed a measure to tap multiple entrepreneurial competencies while Chen et al.'s (1998) measure are broader still.

Vital Early Empirical Work: While self-efficacy was initially conceived as a Person X Situation variable, some scholars have explored self-efficacy as a person variable. Work by Scherer, Shapero, and others led to a significant experimental study that directly tested the impact of self-efficacy on opportunity and threat perceptions and risk-taking (Krueger, 1989; Krueger & Dickson, 1994).

This study found that self-efficacy significantly influenced opportunity and threat perceptions. In turn, opportunity and threat perceptions changed risk-taking in two different tasks. More important, the findings show that the impact of self-efficacy was task-specific; that is, despite the two tasks being highly similar, self-efficacy on one task did not influence self-efficacy on the other.

Measurement is essential, and challenges remain in measuring entrepreneurial self-efficacy. Chen and colleagues (1998) developed a self-efficacy instrument that attempts to capture the critical dimensions of entrepreneurial competency. DeNoble et al. (1999) developed an instrument that captures a narrower notion of entrepreneurial competency with less focus on managerial tasks. Both instruments appear psychometrically sound and demonstrate considerable validity. Similarly, students in entrepreneurship classes demonstrate small, but significant positive changes in entrepreneurial self-efficacy even over a semester (e.g., Krueger, 2001).

Future Directions for Entrepreneurial Self-Efficacy Research: Considerable work remains ahead in developing (and deploying) more refined self-efficacy measures. Brown's example of developing a reliable, valid measure of a more specific competency fits well with the conception of self-efficacy as task-specific; other competencies are

worthy of similar analysis. We also need to assess the relative impact of more task-specific measures and general self-efficacy.

We should also test the relationship between levels and changes in self-efficacy with deeper cognitive structures. If Bandura is correct, major shifts in self-efficacy should be associated with a significant change in scenarios and schematic plans [see next section]. For example, is a high level of self-efficacy at opportunity recognition related to evidence of an expert scenario for opportunity recognition? In many ways, the entrepreneurship domain should prove ideal for testing these as yet untested relationships.

However, the two most promising trajectories for entrepreneurial self-efficacy research are relatively new. Helle Neergaard and colleagues (Mauer et al., 2009) have turned the table and examined self-efficacy as a consequence (entrepreneurial self-efficacy as a dependent variable, not independent). From whence do self-efficacy beliefs arise? How do they develop cognitively? For example, how do youthful experiences affect self-efficacy perceptions, whether playing sports or even fairy tales?

The other key direction derives from the realization that self-efficacy is likely intertwined with different control beliefs. Monsen and Urbig (2009) have combined self-efficacy and locus of control into a very promising model of mixed control beliefs that has significant implications for other cognitive phenomena, including entrepreneurial intentions.

Deep Beliefs and Knowledge Structures

Most human decision-making occurs via automatic processing. Oversimplifying a bit, we possess a broad set of if-then rules to guide our behaviour. Only relatively few human decisions are processing mindfully, and even there, we might find these deep assumptions still in play.

Bird (1992) argued early on that entrepreneurs' intentions are driven by deeper structures such as schemata. More important, though, is that this under-researched arena could prove immensely fruitful, not just for research but also for enhancing our ability to stimulate entrepreneurial thinking at an intense level. It might, for example, allow us additional tools to compare different types of entrepreneurs (e.g., Westhead et al., 2005).

This is much more than a metaphor. These deeper structures are potent influences on how we think. If we are to increase entrepreneurial thinking beyond a superficial level, we need to help entrepreneurs change these deeper structures in inappropriate directions.

Automatic versus Intentional Processing

Deep beliefs come into play unobtrusively whenever we gain sufficient experience such that a once mindful process evolves into an automated process. While we may often exhibit intentional, planned behaviour, much of our decision-making operates via automatic processing, driven by deep assumptions of which we are likely unaware. This is highly adaptive in that we cannot consciously process every single decision we face. If we have automated how to drive out of a skid on an icy road, that is good. If our deep assumption is an ugly racial prejudice, that is very bad. What may seem purely instinctive is often wholly learned. Understanding the deep "why" of our

decision-making is imperative. Cognitive mechanisms worth considering here include mental prototyping, schemata (and schemas), scenarios, and schematic plans.

Mannequin, Scenarios, and Schematic plans

This area has seen the most development and the most fruitful results. The key trigger for this whole approach has been the realization that experts think differently than novices. How experts become experts is reflected in the development of an *"expert"* scenario. (A text is, as its name suggests, a cognitive mechanism that comprises the key elements in a decision situation and the likely ordering of events.). The *"expert"* scenario can differ from the *"novice"* scenario in any number of ways: It can be more complicated but can be more parsimonious. In most cases, the knowledge involved will differ (the obvious example being that experts will typically have more accurate information). We cannot readily identify a scenario directly, but we can recognize the degree to which an expert (or novice) scenario is present. We do so by identifying critical cues that signal expertise (e.g., Mitchell & Chesteen, 1995; Mitchell et al., 2000).

Mitchell's original work focused primarily on differences between expert and novice scenarios regarding entrepreneurship writ large (1995). However, he and his colleagues have continued by identifying expert scenarios for subprocesses such as expert scenarios for marshaling resources or for identifying opportunities (Gustavsson et al., 2007) while others have extended the approach to intriguing domains (Neck et al., 2007; Welsh & Krueger, 2009). As we shall see in Section *"Implications for Entrepreneurial Learning (and Education),"* this has powerful implications. Connie Marie Gaglio and Jerome Katz (2001) approach the same topic of entrepreneurial scenarios but from the perspective of seeking opportunity, to use Kirzner's (1982) term, entrepreneurial *"alertness."* Understanding the overall expert scenario is invaluable, but drilling down to more specific cognitive processes (e.g., counterfactual thinking) affords researchers a look at the most fundamental aspects of entrepreneurial thinking. This too has important implications for teaching and training.

Cognitive schematic plans have not been widely deployed in entrepreneurship research until recently (Brännback & Carsrud, 2009). Jenkins and Johnson (1997) cleverly linked the cognitive schematic plans of entrepreneurs to measures of intention. Given the evidence from Mitchell and his colleagues that entrepreneurial training can measurably change an individual's scenarios toward those of an expert, so too should we see measurable changes in an entrepreneur's (nascent or otherwise) schematic plans. We might also find it useful to see how schematic plans and scenarios relate to one another. Entrepreneurship could prove an ideal venue for such research that would contribute far beyond entrepreneurship research.

Knowledge Structures Matter: Some Final Evidence

In recent years, we have realized new insights into how we learn to think entrepreneurially. We have found constructs that fully moderate the intentions model. Differences in cognitive style can yield dramatically different pathways in the formation of intent. That is, the intentions model for learners who score as preferring intuitive thinking differs significantly from the model for those scoring as preferring an analytic cognitive style (Krueger & Kickul, 2006). *"Another example:" "Push" or "necessity"* entrepreneurs may differ from "opportunity" or "pull" entrepreneurs. Might one expect

that an entrepreneur pushed into self-employment by necessity would focus first on feasibility perceptions, whereas an entrepreneur *"pulled"* by an opportunity would consider desirability perceptions first? This implies explicit consideration of differing initial beliefs (e.g., cognitive styles) among our students and, given the constructivist paradigm, implies encouraging a broad range of cognitive styles and other learning styles in our students. If the differences in something as simple as cognitive style matters that much, then what are the implications for all the different ways that students may differ cognitively?

Future Research Direction: Phase Changes Revisited

In children, it is the *"terrible twos"* that demarcates infancy and early childhood. This affords us a good sense of someone's psychosocial development and how to help them navigate transitions. What if entrepreneurial intentions evolve similarly, exhibiting phase changes? (Erikson, 1980). If we plot intentions against an essential attitude such as self-efficacy, we tend to see evidence that the optimal fit is not linear. It might be that clamor and estimation blunder are opened up capriciously. However, one can likewise put forth the defense that we are observing a couple of expressions that focuses on the information that mirrors a stage change in the development of people's entrepreneurial reasoning. That is, as entrepreneurial goals develop, they experience distinctive stages. How do learning structures contrast over the stages? What are the necessary formative encounters related to each stage and with each change? For instance, Erikson (1980) would contend that advances would fundamentally draw in hot discernment. (If it is not too much trouble, see Fig. 5 beneath.) Such proof would likewise be of priceless analytic help to teachers and experts.

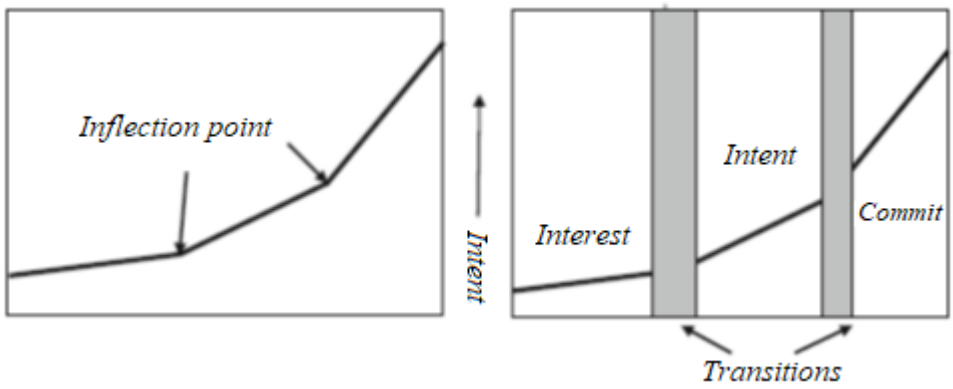


Fig. (5). Phase change model of intentions (Brännback et al., 2007; Krueger, 2009)

Implications for Entrepreneurial Learning (and Education)

What do entrepreneurs need to learn? How do they best learn that knowledge and the necessary skills? It seems reasonable to note that entrepreneurs need to learn how to identify opportunities. Most research into entrepreneurship education has been descriptive, despite increasing interest in theory-driven research (much like research into opportunity recognition). Inspiring an ill-informed student to launch a venture borders on the negligent. The goal, of course, is to move learners from a mindset that is closer to a novice entrepreneur toward a mindset more like that of an expert entrepreneur with *"informed intent"* (Hindle & Klyver, 2009; Krueger et al., 2007).

***"Filling a Pail"* or *"Lighting a Fire"*?**

There are two dominant paradigms in education. The traditional approach focuses on fact-based learning (includes rote memorization and repetitive drilling). Instructors typically provide the models and framework for knowledge being transferred to students. Constructivism argues for situated learning where students acquire knowledge but also have to improve their ways of organizing the knowledge (building and changing their mental models to represent knowledge). *"Learning the answers"* versus *"finding the questions"* is one way to think about the difference, or one might use the words of W.B. Yeats paraphrased in the subhead above. Entrepreneurship educators tend to fall into the second camp (Krueger, 2009a). Traditional methods provide greater control to the instructor and can appear as more efficient for large groups of students. Constructivist approaches tend to be much more student-centered, but this reflects how humans learn in daily life: by trial and error in a social setting. Moreover, if one wishes to change deeper cognitive structures such as scenarios, then more student-centered learning is imperative. For instance, Albert Bandura's Social Learning Theory suggests an iterative process by which deeply held beliefs and attitudes co-evolve as learners actively acquire, process, and organize new knowledge.

Thomas Monroy (1995) was perhaps first to articulate that traditional classroom methods were not only less frequently used in entrepreneurship classes but probably are less effective than more experiential approaches. Instead, expert entrepreneurship educators tend to emphasize *"problem-based learning"* where learners focus on real-world issues, a focus that is a staple of most entrepreneurship courses. Indeed, the most popular and successful training techniques used in entrepreneurship tend to strongly reflect the constructivist model: Living cases (e.g., SBI), shadowing, etc. (Jack & Anderson, 1999; Krueger, 2009a; Krueger & Hamilton, 1996). Even when applied to more behaviourist tasks like business plans, reflective, constructivist approaches yield significant improvement (e.g., Honig, 2004). Organisation s (and communities) seeking a more entrepreneurial climate require more entrepreneurial thinking in its members (Krueger, 2000; Krueger & Brazeal, 1994). Classrooms are no different. As with organisation s, educators must seek to develop a fertile seedbed that supports entrepreneurial thinking. This cognitive infrastructure supports entrepreneurial thinking and the changes in cognitive structures such as intentions and attitudes and even deeper cognitive structures such as students' mental models of *"what is an entrepreneur?" Am I an entrepreneur?"* However, what influences change in such deep knowledge structures? What changes those deep anchoring beliefs?

Critical Developmental Experiences

Prior experience positively influences the perception of future opportunities (Shane, 2000), but this operates at a much deeper cognitive level (Krueger, 2007, 2009b). As learners move from novice mindsets toward expert mindsets, some changes are highly incremental, especially where knowledge content is involved. However, the crucial changes affect knowledge structures where change is often more abrupt (e.g., *"aha!"* moments). The Center for Creative Leadership has found that top managers share a surprisingly small set of critical developmental experiences [see Fig. 4] and an even smaller set of lessons learned (McCall et al., 1988). We might profitably reprise that research for entrepreneurs. For example, we have some evidence that growing up in a

family business influences attitudes and intentions toward entrepreneurship (Krueger, 1993b). Formal training/teaching can also matter as entrepreneurial training programs significantly affect the various antecedents of entrepreneurial attitudes and intentions (Cooper & Lucas, 2007). Even formal coursework (Cox, 1996; Krueger, 2001) appears to have a small but measurable impact on critical beliefs (e.g., self-efficacy) and attitudes (including intent) (Fig. 6).

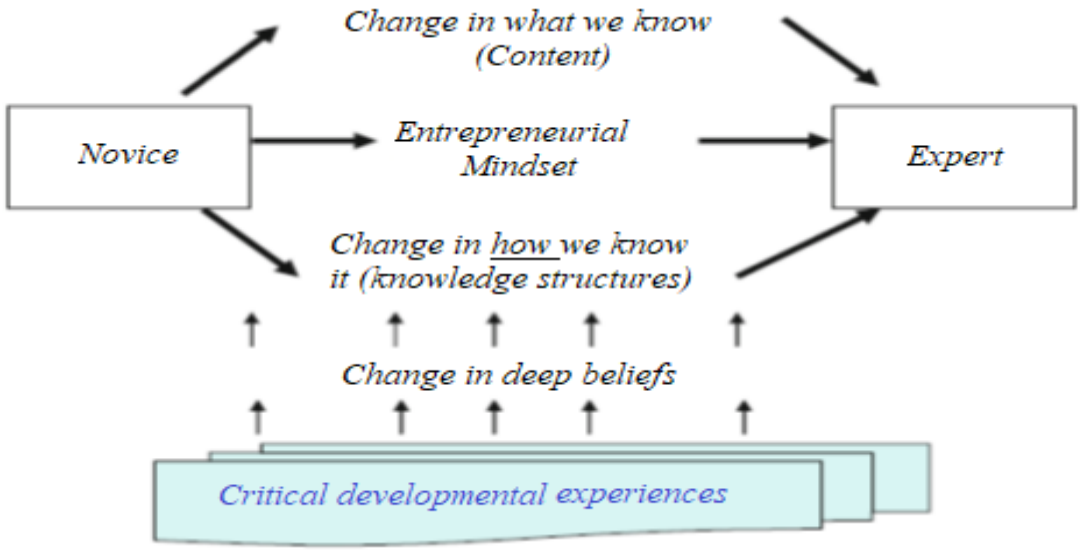


Fig. (6). Critical developmental experiences and deep belief change (Krueger, 2007, 2009a)

The issues surrounding how learning processes can change deeply held mental models in the direction of better entrepreneurial thinking, whether in terms of learning to see more/better opportunities or to see oneself as an entrepreneur (or, as we have noted, both) represent powerful research opportunities that also bring immediate practical impact. Consider that the University of Victoria, Texas Tech, Western Ontario, and elsewhere have developed pedagogies that heavily emphasize helping students acquire expert scenarios (e.g., Mitchell, 2005; Mitchell et al., 2000, 2009). This suggests that measures of deep structures, whether scenarios or schematic plans or other possibilities, can be usefully deployed to research how entrepreneurial thinking changes across a training program (Krueger, 2001; Mitchell et al., 2000). The rule of thumb is that to become an expert requires 10,000–20,000 hours of deliberate practice at activities that move one toward the expert mindset (Baron & Henry, 2006; Ericsson & Charness, 1994). However, what are those deep belief-changing activities? For example, both Baron (2000b) and Gaglio (2001) demonstrate how the cognitive mechanism of counterfactual reasoning is a potent lever for encouraging and reinforcing students to question their existing mental models.

In short, we have ample reason to believe that if the expert mindset exists, then we can use what we know about the expert mindset to guide our teaching (e.g., Krueger, 2009a; Mitchell, 2005) and move learners toward a truly informed intent. However, to do so, we need to begin learning from neuroscience. The constructivist model teaches us that learners, intentions, and related attitudes will change but only insofar as they reflect changes in deep anchoring beliefs (Krueger, 2009a). Imagine how much richer our efforts would be if we embraced the neuroscientific approach. Consider the following evidence from recent neuroscience efforts.

Cognitive Adaptability: Learning and Adapting

Lawrence et al. (2008) *"propose that entrepreneurs represent an example of highly adaptive risk-taking behaviour, with positive functional outcomes in the context of stressful economic decision-making."* Sarasvathy (2001) argues that the entrepreneur should be put on center stage; that we *"go beyond explanations based on economic forces and evolutionary adaptation to entrepreneurial effectuation."* One particular area of interest that relates to the physiological drivers of adaptation is that key brain systems responsible for recognizing the familiar and negotiating the unfamiliar have been identified. These have been termed by different researchers *"System 1 and System 2"* (Camerer et al., 2005; Kahneman, 2003) and the *"C-system and X-system"* (Lieberman et al., 2002; Satpute & Lieberman, 2006). These systems are probably in play when it comes to adaptability. Put, the X-system recognizes patterns and symbols via a massively parallel processing, producing the continuous stream of consciousness we experience. When the X-system is confronted by sensory data that it does not recognize, it passes responsibility over to the C-system, which uses a set of standards or rules that attempt to harmonize this new data with what is already known.

Pattern Recognition and Transfer

These brain systems give insight into a complex thinking matrix and would seem to represent the neural substrates underpinning, for instance, analogical transfer (Magee, 2005) or conceptual combination analysis (Ward, 2004) where information and experiences, concepts, or images from what is known are used by the decisionmaker(s) in an attempt to find a solution for a new, unfamiliar situation. Simon (1997) writes, *"when the expert is confronted with a situation in his or her domain, various features of cues in the situation will attract attention,"* and the expert will act intuitively to come up with a solution. Simon argues that *"[i]ntuition, judgment, creativity is an expression of capabilities for recognition and response based upon experience and knowledge."* Each entrepreneur may experience this to varying levels when confronted with, for example, a stressful economic decision-making environment, which in turn might trigger opportunity recognition. For researchers, we need a better empirical understanding of how entrepreneurship-related cognitive phenomena are interrelated across Simon's (1963) three levels: Neurological, symbolic, and semantic. What are *"semantic"* level cues associated with *"symbolic"* level structures underlying opportunity perception? The rich cognitive science context on pattern recognition could be exploited most fruitfully to address this.

High Levels of Top-Down Attention Allocation and Recognizing Environmental Change

Individuals learn core concepts from their prior experiences, which then become part of their knowledge structures (Nadkarni and Narayanan 2007; Walsh 1995). Incremental environmental changes refer to changes in consumer preferences, design elements, competitive dynamics, and institutions that are in line with the firm's present trajectory and require few modifications in how product components are combined and connected into a *"big picture"* (Henderson and Clark 1990). Since incremental environmental changes generally take place where and when they are anticipated to do

so (Sirmon et al. 2007), individuals are likely to notice such changes when they allocate transient attention to them by top-down processing. For these managers, the complexity of their knowledge structures additionally improves their ability to detect incremental change as they draw on knowledge of their firm's current situation to allocate attention to environmental features they expect to be important. When individuals are told that the task at hand is only slightly important, they will attend to the prominent stimulus, while individuals who are told the task is highly important are less likely to do so. When individuals believe a task is only slightly important, they are more likely to ease up on top-down processing and engage in more bottom-up processing, which frees their transient attention to capture signals of unanticipated environmental change. Strategy scholars have dedicated a great deal of energy toward investigating how top-down processing decreases managers' ability to detect discontinuous change. For example, the top managers of Liz Claiborne effectively used top-down attention-allocation processes to respond to changes that matched their prevalent knowledge structures (i.e., incremental changes). However, these processes also blinded him to discontinuous changes:

- *Environmental changes had dropped down the value of a part of Liz Claiborne's set of choices (in particular, those concerning production and distribution). Small, incremental changes—exploring the local neighborhood of the current position—no longer sufficed. At the same time, more extensive, systematic changes lay outside the mental schematic plans of existing management. Different mental schematic plans of the changing performance landscape were required to move Liz Claiborne to a new performance peak. (Siggelkow 2001: 853)Context Matters: Entrepreneurial Environments.*

Leo-Paul Dana has studied a dizzying array of economies around the world and finds that *"opportunity"* is very much culture-dependent (1995). One obvious effect is through the social norms antecedent of intentions (and self-efficacy), but social cues from community and family can also affect other cognitive phenomena, often in non-obvious fashion. Han and Northoff (2008) and others show that cultural differences can manifest in significant differences in cognitive processes, even at an early age. Family norms add another dimension to the cognitive appraisal in the intentions process but may also bring other aspects into bold relief. This is an exciting direction for family business research with broader implications for entrepreneurship (e.g., Carsrud et al., 2007; Stavrou, 1999). Likewise, high-tech opportunities merit more consideration; how do the processes differ in highly innovative organisation s (Brazeal, 1993; Corbett, 2002; Neck et al., 2007). However, the fundamental question here that has seen far too little research efforts is this. If the entrepreneurial potential of an organisation or a community is thus a function of the quantity and quality of its potential entrepreneurs, then should we not explore what kinds of environments support entrepreneurial activity by supporting and reinforcing entrepreneurial thinking (Day, 2002)? At the community level, there are visible differences in communities that are entrepreneurial (e.g., Audretsch, 2007; Peredo & Chrisman, 2004). What characterizes them?

Cognitive Infrastructure in Organisations

The expectations viewpoint bears us essential bits of knowledge into how to support the entrepreneurial capability of an association or a network. Once more:

Entrepreneurial potential relies upon the amount and nature of potential business people (Krueger and Brazeal, 1994). Increasing the quality and quantity of potential entrepreneurs requires enhancing the quality and amount of entrepreneurial thinking. Thus, the entrepreneurial organisation must operate in directions that support its members in perceiving more – and better – opportunities, such as beliefs and activities that foster internal entrepreneurs to see intrapreneurship as desirable and feasible (Brazeal & Herbert, 1999). It is reasonable to assume that modeling impacts are critical – that the effect of mentors and role models serve to enhance processes of modeling entrepreneurial behaviour and attitudes (Krueger, 2000; Shepherd & Krueger, 2002). The entrepreneurial organisation does require a solid infrastructure of resources and mechanisms that support entrepreneurial activities, yet field research shows that this is insufficient to yield significant levels of entrepreneurship. Instead, organisation members must perceive that solid infrastructure as a supportive one (Brazeal, 1993; Brazeal & Herbert, 2000; Brown & Wiklund 2001; Krueger & Brazeal, 1994). It is not enough to provide the *"proper"* reward system. What if organisation members perceive the existing reward system as being hostile to entrepreneurship? (Day, 2002; Shane & Kolvereid, 1995)

This implies that organisation s (or, for that matter, communities) need to provide and develop a *"cognitive infrastructure"* that nurtures entrepreneurial thinking. The intentions perspective implies mechanisms that increase the quantity and quality of perceived opportunities. This then requires mechanisms that broaden the set of possibilities that organisation members perceive as feasible and as desirable and suggest that organisation s seek to address each of the key antecedents: Personal attitude, social norms, self-efficacy, and collective efficacy (Krueger, 2000). Section *"Implications for Entrepreneurial Learning (and Education)"* above argues we can take these findings to design training programs and even coursework; Guth et al. showed how we could transform cognition research into successful practice (1991). How do we best train people to perceive themselves as entrepreneurial? How do we best train people to see personally credible opportunities? The contextual perspective also offers two additional, essential domains for ground-breaking research. First, as we better understand the *"why"* behind the entrepreneurial mindset, we can better understand the *"how"* of nurturing it (and the accompanying policy implications). Second, initial evidence is persuasive that studying social (and sustainable) entrepreneurs provides broad, deep insights into entrepreneurial thinking.

Cognitive Infrastructure in Communities

There is also immense potential in digging deeper into this cognitive infrastructure behind entrepreneurship within organisations and communities. This seems the most fruitful avenue for further study as scholars can test the effect of various strategic prescriptions on these key antecedents. Does the presence of strong champions enhance perceptions of efficacy (e.g., modeling successful behaviour) or increase social norms (e.g., by demonstrating that a community does support entrepreneurial activity)? We can diagnose shortfalls in entrepreneurial activity by testing these same antecedents. Similarly, highly entrepreneurial communities seem to share a cognitive infrastructure that rewards entrepreneurial activity and especially entrepreneurial thinking (Audretsch, 2007; Peredo & Chrisman, 2006).

Social and Sustainable Entrepreneurship

While a topic far beyond the scope of this paper, these twin domains have grown immensely in recent years with a corresponding proliferation of definitions – much like entrepreneurship itself in its early days (e.g., Bacq & Janssen, 2008). Nonetheless, social (and sustainable) entrepreneurship offers multiple opportunities to enlighten us about the entrepreneurial process writ large (Mair & Marti, 2005). Inconsistent definitions and dustball empiricism may dominate social entrepreneurship research, but it is already teaching us much about how we identify and evaluate opportunities (Krueger et al., 2008, 2009). Deep belief structures may be in play here as well, providing the additional potential for neuroscience methods.

CONCLUSION

The suggestions offered above are just the beginning, but we look forward to the ongoing adventure of answering those questions (and the questions those answers will inevitably raise). The history of entrepreneurship research suggests that many surprises lie in store for researchers. As we discussed above, we know relatively little about how intentions change and even less about intentions about the timing of behaviour. Fortunately, the answers uncovered to date have, as always happens in science, also revealed even more intriguing questions – and right places to start the next frontier. In this paper, it has seemed useful to point out issues with great potential as we explored the disparate threads of entrepreneurial cognition. We hope this paper has helped the reader to see the potential for increasing our skillful, rigorous use of theory, and tools from cognitive science. We also hope that readers also see that the even faster growth of research using theories and methods inspired by neuroscience offers equally great potential for those of us intensely curious about entrepreneurial thinking.

NOTE

Results of the present paper are significantly connected with the Ph.D. dissertation of Mohammad Heydari, which was written at the Nanjing University of Science and Technology entitled: ***"A Cognitive Basis Perceived Corruption and Attitudes Towards Entrepreneurial Intention." Supervisor: Professor Zhou Xiaohu, School of Economics and Management, Nanjing University of Science and Technology, Nanjing, Jiangsu, China. For more information about this dissertation, you can contact [Mohammad_Heydari@njust.edu.cn] and [njustzxh@njust.edu.cn].*** There are some questions contained in this paper, which symbolize the purpose of further research. Also, it is necessary to mention that this paper is the result of the ten years of research in different countries on *"Human and Organizational Behavior".*

REFERENCES

1. Abrahamson, E., & Fairchild, G., 1999**.** Management fashion: Lifecycles, triggers, and collective learning processes. *Administrative Science Quarterly*, 44(4), 708–740.
2. Aimar, T., 2008. Self-ignorance: Towards an extension of the Austrian paradigm. *Review of Austrian Economics*, 23: 23–43.

3. Akinola, M., & Mendes, W., 2008. The dark side of creativity: Biological vulnerability & negative emotions lead to greater artistic creativity. *Personality and Social Psychology Bulletin*, 34(12): 1677–1686.
4. Allport, G., 1935. Attitudes. In C. Murchison (Ed.), *Handbook of social psychology.* Winchester: Clark University Press.
5. Audretsch, D., 2007. The Entrepreneurial Society. Oxford: *Oxford University Press*.
6. Bacq, S., & Janssen, F., 2008. From social entrepreneurship as a practice to a legitimate field of research: Literature review & classification. *European Summer University Conference on Entrepreneurship*, Bodø, Norway.
7. Bagozzi, R. P., Dholakia, U., & Basuron, S., 2003. How effortful decisions get enacted: the motivating role of decision processes, desires & anticipated emotions. *Journal of Behavioural Decision Making*, 16: 273–295.
8. Bagozzi, R., & Warshaw, P., 1990. Trying to consume. *Journal of Consumer Research*, 17(2): 127–140.
9. Bandura, A., 1986. *The Social Foundations of Thought and Action.* Englewood Cliffs, NJ: Prentice- Hall.
10. Bandura, A., 1995. *The exercise of personal & collective efficacy in changing societies.* In A. Bandura (Ed.), Self-efficacy in Changing Societies. New York: Cambridge University Press.
11. Baron, R. A. 2000b. Counterfactual thinking & venture formation: The potential effects of thinking about "what might have been." *Journal of Business Venturing*, 14(1): 106–116.
12. Baron, R. A., 2006. Opportunity recognition as pattern recognition: how entrepreneurs "connect the dots" to identify new business opportunities. *Academy of Management Perspectives*, 20(1): 104–119.
13. Baron, R. A., & Henry, R., 2006. The role of expert performance in entrepreneurship: how entrepreneurs acquire the capacity to excel. *Paper presented at the Babson Entrepreneurship Conference*, Bloomington, IN, June.
14. Bird, B., 1992. The operation of intentions in time: The emergence of the new venture. *Entrepreneurship Theory & Practice*, 17(1): 11–20.
15. Blair, E., 2010. *What you think is not what you think: Unconsciousness and entrepreneurial behaviour*. In A. Stanton, M. Day, & Welpe, I. (Eds.), Neuroeconomics & the Firm. Cheltenham, UK: Edward Elgar.
16. Brännback, M., & Carsrud, A., 2009. Cognitive maps in entrepreneurship. In A. Carsrud, and M. Brännback (Eds.), *The Entrepreneurial Mind*: 75–96. New York: Springer.
17. Brännback, M., Carsrud, A., Krueger, N., & Elfving, J., 2006. Sex, Drugs and Entrepreneurial Passion: An Exploratory Study. *Babson Entrepreneurship Research Conference*, Bloomington, IN.
18. Brännback, M., Carsrud, A., Krueger, N., & Elfving, J., 2007. "Trying" to be an Entrepreneur. *Babson Conference, Madrid.*
19. Bratman, M. E., 1987. Practical Intention. Cambridge, MA: *Harvard University Press*.
20. Brazeal, D., 1993. Organizing for internally developed corporate ventures. *Journal of Business Venturing*, 8: 75–100.
21. Brazeal, D., & Herbert, T. 1999 The genesis of entrepreneurship. *Entrepreneurship Theory & Practice*, 23(3): 29–46.

22. Brown, T., 1996. *Resource orientation, entrepreneurial orientation, and growth: How the perception of resources availability affects small firm growth.* Unpublished doctoral dissertation, Rutgers University.
23. Brown, T., Davidsson, P., & Wiklund, J., 2001. An operationalization of Stevenson's conceptualization of entrepreneurship as opportunity-based firm behaviour. *Strategic Management Journal*, 22(1): 953–968.
24. Camerer, C. L., Loewenstein, G., & Prelec, D., 2005. Neuroeconomics: How can neuroscience inform economics? *Journal of Economic Literature*, 43(1): 9–64.
25. Capello, R., 1999. Spatial transfer of knowledge in high technology milieux: Learning versus collective learning processes. *Regional Studies,* 33(4), 353–365.
26. Cardon, M. S., Wincent, J., Singh, J., & Drnovsek, M., 2009. The nature and experience of entrepreneurial passion. *Academy of Management Review*, 34(3): 511–532.
27. Carsrud, A. L., & Brännback, M., 2009. *The Entrepreneurial Mind.* New York: Springer.
28. Carsrud, A. L., & Krueger, N., 1996. *Entrepreneurship and social psychology.* In J. Katz J (Ed.), Advances in Entrepreneurship, Firm Emergence and Growth. Greenwich: JAI Press.
29. Carsrud, A. L., Brännback, M., Krueger, N., & Kickul, J., 2007. Family Business Pipelines. Philadelphia, PA: *Academy of Management*.
30. Carsrud, A. L., Gaglio, C. M., & Olm, K. W., 1987. Entrepreneurs-Mentors, networks, and successful new venture development: An exploratory study. *American Journal of Small Business*, 12(1): 13–18.
31. Chen, C., Greene, P., & Crick, A., 1998. Does entrepreneurial self-efficacy distinguish entrepreneurs from managers? *Journal of Business Venturing*, 13(4): 295–316.
32. Colas, H., 2005. *In search of new organisation al values: the irruption of beauty in an entrepreneurial creation.* Corporate Governance, 5(2): 78–88.
33. Cooper, S., & Lucas, W., 2007. Developing entrepreneurial self-efficacy and intentions: Lessons from two programmes. *Paper presented at the ICSB World Conference*, Turku, June.
34. Corbett, A., 2002. Recognizing high-tech opportunities: A learning & cognitive approach. *Babson- Kauffman Entrepreneurship Research Conference*, Boulder, CO.
35. Cox, L., 1996. The goals and impact of educational interventions in the early stages of entrepreneur career development. *Paper at the Int-ENT Conference*, Nijmegen, Netherlands.
36. Cross, K. P., 1981. *Adults as learners. Increasing participation and facilitating learning.* ERIC. San Francisco, CA: Jossey-Bass, Inc.
37. Davidsson, P., 1991. Continued entrepreneurship. *Journal of Business Venturing*, 6(6): 405–429.
38. Davies, F., 2005. Review of the book: Creative business: Achieving your goals through creative thinking and action. *International Journal of Entrepreneurship & Innovation*, 6(1): 69.
39. Day, M., 2002. *Organisation ecology or contingency theory: An analysis of new venture performance across regional environments and gender.* (Doctoral Dissertation). UMI Microfilms.
40. De Carolis, D., & Saparito, P., 2006. Social capital, cognition, and entrepreneurial opportunities: A theoretical framework. *Entrepreneurship Theory and Practice*, 30(1), 41–56.

41. DeNoble, A., Jung, D., & Ehrlich, S. 1999. Entrepreneurial self-efficacy: The development of a measure and its relationship to entrepreneurial action. *Babson Entrepreneurship Research Conference*, Columbia, SC.
42. Dholakia, U., & Bagozzi, R., 2002. Mustering motivation to enact decisions: How decision process characteristics influence goal realizations. *Journal of Behavioural Decision Making*, 15: 167–188.
43. Douglas, E., 2009. Perceptions – Looking at the world through entrepreneurial lenses. In A. Carsrud, & M. Brännback (Eds.), *The Entrepreneurial Mind*: 3–22. New York: Springer.
44. Dunn, R., Griggs, S. A., Olson, J., Beasley, M., & Gorman, B. S., 1995. A meta-analytic validation of the Dunn and Dunn model of learning-style preferences. *The Journal of Educational Research*, 88(6), 353–362.
45. Elfving, J., Brännback, M., Carsrud, A. L., & Krueger, N. 2009. *Passionate, entrepreneurial cognition: Illustrations from multiple Finnish cas*es. Working Paper under review.
46. Ericsson, K., & Charness, N., 1994. Expert performance. *American Psychologist*, 49(8): 725 774.
47. Erikson, E., 1980. *Identity and the Life Cycle.* New York: Norton.
48. Fuchs, D., Fuchs, L. S., Mathes, P. G., & Simmons, D. C., 1997. Peer-assisted learning strategies: Making classrooms more responsive to diversity. *American Educational Research Journal*, 34(1), 174–206.
49. Gaglio, C., & Katz, J. A., 2001. The psychological basis of opportunity identification: Entrepreneurial alertness. *Small Business Economics*, 16(2): 95–111.
50. Gilad, B., 1984. Entrepreneurship: Creativity in the marketplace. *Journal of Creative Behaviour*, 18: 151–161.
51. Gollwitzer, P., & Brandstätter, V., 1997. Implementation intentions and effective goal pursuit. *Journal of Personality Social Psychology,* 73: 186–199.
52. Gollwitzer, P., & Sheeran, P., 2006. Meta-analysis of implementation intentions. In M. P. Zanna (Ed.), *Advances in Social Experimental Psychology*, 38: 69–119.
53. Gregoire, D., Corbett, A., & McMullen, J., 2009. The value-added contribution of entrepreneurship cognition research: A critical review of three decades of research. *Babson Entrepreneurship Conference*, Babson Park, MA.
54. Gustavsson, V., Smith, J. B., & Mitchell, R. K. (2006). *To Find or not to Find: How Do Opportunity Identification Cognitions Differ by Task?* Letter from the President, 41.
55. Han, S., & Northoff, G., 2008. Culture-sensitive neural substrates of human cognition. *Nature Reviews in Neuroscience*, 9: 646–654.
56. Hansen, D. J., Hills, G. E., & Lumpkin, G. T., 2006. *Testing the creativity model of opportunity recognition. Frontiers of Entrepreneurship.* Wellesley, MA: Babson College.
57. Hayek, F., 1952. *The Sensory Order: An Inquiry into the Foundations of Theoretical Psychology*. Chicago, IL: The University of Chicago Press.
58. Haynie, J. M., Shepherd, D. A., & Patzelt, H., 2012. Cognitive adaptability and an entrepreneurial task: The role of metacognitive ability and feedback. *Entrepreneurship Theory and Practice*, 36(2), 237–265.
59. Haynie, J. M., Shepherd, D. A., Mosakowski, E., & Earley, P. C., 2010. A situated metacognitive model of the entrepreneurial mindset. *Journal of Business Venturing*, 25(2), 217–229.

60. Henderson, R. M., & Clark, K. B., 1990. Architectural innovation: The reconfiguration of existing product technologies and the failure of established firms. *Administrative Science Quarterly*, 35, 9–30.
61. Hindle, K., Klyver, K., & Jennings, D. 2009. *An "Informed Intent" model.* In A. Carsrud, M. Brännback (Eds.), The Entrepreneurial Mind: 35–50. New York: Springer.
62. Honig, B., 2004. Entrepreneurship education: Toward a model of contingency-based business planning, *Academy of Management Learning and Education*, 3(3): 258–273.
63. Iakovleva, T., & Kolvereid, L., 2009. An integrated model of entrepreneurial intentions. *International Journal of Business and Globalisation*, 3(1): 66–80.
64. Jack, S., & Anderson, A., 1999. Entrepreneurship education in the enterprise culture: producing reflective Practitioners. *International Journal of Entrepreneurial Behaviour and Research*, 5: 110–121.
65. Jenkins, M., & Johnson, G., 1997. Entrepreneurial intentions and outcomes: A comparative causal mapping study. *Journal of Management Studies*, 34(6): 895–920.
66. Kahneman, D., 2003. Maps of bounded rationality: Psychology for behavioural economics. *American Economic Review*, 93(5): 1449–1475.
67. Kamp, M. T., Admiraal, W., Drie, J., & Rijlaarsdam, G., 2015. Enhancing divergent thinking in visual arts education: Effects of explicit instruction of meta-cognition. *British Journal of Educational Psychology*, 85(1), 47–58.
68. Kirzner, I. 1982. *The theory of entrepreneurship in economic growth.* In C. Kent et al. (Eds.), The Encyclopedia of Entrepreneurship: 272–276. Englewood Cliffs, NJ: Prentice-Hall.
69. Klaukien, A., & Patzelt, H., 2009. Fear of failure & opportunity exploitation. *Babson Entrepreneurship Conference*, MA.
70. Kolvereid, L., 1996. Prediction of employment status choice intentions. *Entrepreneurship Theory & Practice*, 21(1): 47–57.
71. Koppl, R., & Minniti, M., 2003. *Market processes & entrepreneurial studies*. In Z. Acs, & D. Audretsch (Eds.), Handbook of Entrepreneurship Research. New York: Springer.
72. Krueger, N. 1989. *The Role of Perceived Self-Efficacy in the Formation of Entrepreneurial Risk Perceptions and Strategic Risk Taking.* Unpublished Dissertation, The Ohio State University.
73. Krueger, N. 1993a. The impact of prior entrepreneurial exposure on perceptions of new venture feasibility and desirability. *Entrepreneurship Theory and Practice*, 18(1): 5–21.
74. Krueger, N. 1993b. Growing up entrepreneurial? Proceedings, *Academy of Management*, Atlanta.
75. Krueger, N. 2000. The cognitive infrastructure of opportunity emergence. *Entrepreneurship Theory & Practice*, 24(3): 5–23.
76. Krueger, N. 2001. Adapt or select? *Babson-Kauffman Entrepreneurial Research Conference*, Jonkoping.
77. Krueger, N. 2007. What lies beneath? The experiential essence of entrepreneurial thinking. *Entrepreneurship Theory and Practice*, 31(1): 123–138.
78. Krueger, N. 2009a. *The microfoundations of entrepreneurial learning and education.* In E. Gatewood, & G. P. West (Eds.), The Handbook of University-Wide Entrepreneurship. Cheltenham, UK: Elgar.

79. Krueger, N. 2009b. Entrepreneurial intentions are dead; Long live entrepreneurial intentions. In A. Carsrud, & M. Brännback (Eds.), *The Entrepreneurial Mind*: 97–140. New York: Springer.
80. Krueger, N., & Brazeal, D. 1994. Entrepreneurial potential and potential entrepreneurs. *Entrepreneurship Theory and Practice*, 18(3): 91–104.
81. Krueger, N., & Carsrud, A. L. 1993. Entrepreneurial intentions: Applying the theory of planned behaviour. *Entrepreneurship and Regional Development* 5: 315–330.
82. Krueger, N., & Day, M., 2009. Neuroentrepreneurship: Can entrepreneurship learn from neuroscience? *It is presented at the United States Association of Small Business & Entrepreneurship Conference,* Anaheim, CA.
83. Krueger, N., & Dickson, P., 1994. How believing in ourselves increases risk-taking. *Decision Sciences*, 25(3): 385–400.
84. Krueger, N., & Hamilton, D., 1996. *Constructivistic entrepreneurship education. Proceedings, Project for Excellence in Entrepreneurship Education*, Berea OH.
85. Krueger, N., & Kickul, J., 2006. So, you thought the intentions model was simple? Navigating the complexities and interactions of cognitive style, culture, gender, social norms and intensity on the pathways to entrepreneurship. *USASBE Conference*, Tucson, AZ.
86. Krueger, N., & Welpe, I. 2007. Experimental entrepreneurship: A research prospectus. SSRN: Abstract, 1146745.
87. Krueger, N., Brannback, M., Carsrud, A., & Kickul, J. 2007. "Informed intent." *Paper presented at the ICSB Conference,* Turku, June.
88. Krueger, N., Grichnik, D., & Welpe, I. 2009. *Anticipated outcome emotions and cognitive appraisal: Assessing social and economic dimensions of social entrepreneurial opportunities.* Babson Entrepreneurship Conference, MA.
89. Krueger, N., Kickul, J., Gundry, L., Wilson, F., & Verma, R. 2009. *Discrete choices, trade-offs, and advantages:Modeling social venture opportunities &intentions.* In Robinson, J., Mair, J., & ockerts, K. (Eds.), International Perspectives on Social Entrepreneurship, UK: Palgrave.
90. Krueger, N., Reilly, M., & Carsrud, A. 2000. Competing models of entrepreneurial intentions. *Journal of Business Venturing*, 15(5/6): 411–532.
91. Krueger, N., Schulte, W., & Stamp, J. 2008. Beyond intent: Antecedents of resilience and precipitating events for social entrepreneurial intentions and action. *USASBE Conference*, San Antonio, TX.
92. Lawrence, A., Clark, L., Labuzetta, J. N., Sahakian, B., & Vyakarnum, S. 2008. *The innovative brain.* Nature, 456: 168–169.
93. Lee, S., Florida, R., & Acs, Z., 2004. Creativity and entrepreneurship. *Regional Studies*, 38: 879–891.
94. Levie, J., & Autio, E., 2008. Theoretical grounding and test of the GEM model. *Small Business Economics*, 31(3): 235–263.
95. Libet, B., Freeman, A., & Sutherland, K., 2004 [1999]. *The Volitional Brain: Towards a Neuroscience of Free Will. Imprint Academic*, Exeter, UK.
96. Libet, B., Gleason, C.,Wright, E.,&Pearl, D. 1983. Time of conscious intention to act about onset of cerebral activity: Unconscious initiation of a freely voluntary act. *Brain*. 106: 623–642.
97. Lieberman, M., Gannt, R., Gilbert, D., & Trope, Y. 2002. Reflexion and reflection: Social cognitive neuroscience approach to attributional influence. In M. Zanna (Ed.), *Advances in Experimental Social Psychology*, 34: 199–249.

98. Magee, G., 2005. Rethinking invention: cognition and the economics of technological creativity. *Journal of Economic Behaviour & Organisation*, 57(1): 29–48.
99. Mair, J., & Marti, I. 2005. Social entrepreneurship research: A source of explanation, prediction, and delight. *Journal of World Business*, 41(1): 36–44.
100. Mauer, R., Neergaard, H., & Kirketerp, A., 2009. Self-efficacy: Conditioning the entrepreneurial mindset. In Carsrud, A., & Brännback, M. (Eds.), *The Entrepreneurial Mind*: 233–258. New York: Springer.
101. McCall, M., Lombardo, M., & Morrison, A., 1988. *The Lessons of Experience: How Successful Executives Develop on the Job.* Lexington: Lexington Books.
102. McGrath, R., & MacMillan, I. 2000. The Entrepreneurial Mindset: Strategies for Continuously Creating Opportunity in an Age of Uncertainty. Cambridge, MA: *Harvard Business School Press*.
103. McMullen, J., & Shepherd, D. A., 2006. Entrepreneurial action and the role of uncertainty in the theory of the entrepreneur. *Academy of Management Review*, 31(1): 132–152.
104. McMullen, J., Plummer, L., & Acs, Z., 2007. What is an entrepreneurial opportunity? *Small Business Economics*, 28(4): 273–283.
105. Meyers, C., & Jones, T. B., 1993. *Promoting active learning: Strategies for the college classroom.* San Francisco, CA: Jossey-Bass Inc.
106. Michl, T., Welpe, I., Sporrle, M., & Picot, A., 2009. The role of emotions in entrepreneurial decision making. In Carsrud, A., & Brännback, M. (Eds.), *The Entrepreneurial Mind*: 167–190. New York: Springer.
107. Mitchell, R. K., 2005. *Tuning up the global value creation engine: Road to excellence in international entrepreneurship education.* In J. Katz, & D. Shepherd (Eds.), Advances in Entrepreneurship, Firm Emergence and Growth, Vol. 8: 185–248. Greenwich: JAI Press.
108. Mitchell, R. K., & Chesteen, S., 1995. *Enhancing entrepreneurial expertise: Experiential pedagogy and the new venture expert script*. Simulation and Gaming, 26(3): 288–306.
109. Mitchell, R. K., Smith, B., Morse, E., Seawright, K., Peredo, A., & McKenzie, B. 2002. Are entrepreneurial cognitions universal? *Entrepreneurship Theory and Practice*, 27(2): 93.
110. Mitchell, R. K., Smith, B., Seawright, K. & Morse, E., 2000. Cross-cultural cognitions and the venture creation decision. *Academy of Management Journal*. 43(5): 974–993.
111. Monroy, T., 1995. Getting closer to a descriptive model of entrepreneurship education. In T. Monroy, J. Reichert, F. Hoy (Eds.), *The Art and Science of Entrepreneurship Education*, Vol. III: 205–217, Ballinger, Cambridge, MA.
112. Monsen, E., & Urbig, D., 2009. Perceptions of efficacy, control, and risk: A theory of mixed control. In A. Carsrud, & M. Brännback (Eds.), *The Entrepreneurial Mind*: 259–284. New York: Springer.
113. Nadkarni, S., & Narayanan, V. K., 2007. Strategic schemas, strategic flexibility, and firm performance: The moderating role of industry clockspeed. *Strategic Management Journal*, 28(3), 243–270.
114. Neck, H., Corbett, A., & DeTienne, D. 2007. How corporate entrepreneurs learn from fledgling innovation initiatives: cognition and the development of a termination script, *Entrepreneurship Theory and Practice*, 31(6): 829–852.
115. Peredo, A. M., & Chrisman, J., 2006. Toward a theory of community-based enterprise. *Academy of Management Review*, 31: 309–328.

116. Poettschacher, E., 2005. Strategic creativity: How values, beliefs, and assumptions drive entrepreneurs in the creative industries. *International Journal of Entrepreneurship and Innovation*, 6(3): 177–183.
117. Rae, D. 2005. Cultural diffusion: A formative process in creative entrepreneurship? *International Journal of Entrepreneurship and Innovation*, 6(3): 185–192.
118. Recognition cognitions differ by task? Babson Entrepreneurship Conference, *ICSB World Conference*, Turku, Finland.
119. Robinson, P., Stimpson, D., Huefner, K., & Hunt, K. 1991. An attitude approach to the prediction of entrepreneurship. Entrepreneurship Theory and Practice, 15 (4): 13–31.
120. Santos, Susana C., Sílvia F. Costa, Xaver Neumeyer, and António Caetano. 2016. *Bridging Entrepreneurial Cognition Research and Entrepreneurship Education: What and How. In Annals of Entrepreneurship Education and Pedagogy* – 2016, ed. Michael H. Morris and Eric Liguori, 83–108. Cheltenham: Edward Elgar Publishing.
121. Sarasvathy, S., 2001. Causation and effectuation: Toward a theoretical shift from economic inevitability to entrepreneurial contingency. *Academy of Management Review*, 26(2): 243–263.
122. Satpute, A., & Lieberman, M., 2006. Integrating automatic and controlled processing into neurocognitive models of social cognition. *Brain Research*, 1079:86–97.
123. Scherer, R., Adams, J., Carley, S., & Wiebe, F. 1989. Role model performance effects on the development of entrepreneurship. Entrepreneurship Theory and Practice, 13(3), 53 72.
124. Schraw, G., & Dennison, R., 1994. Assessing metacognitive awareness. *Contemporary Educational Psychology*, 19: 460–475.
125. Shane, S., 2000. Prior knowledge and discovery of entrepreneurial opportunities. *Organisation Science*, 11: 448–469.
126. Shane, S., & Kolvereid, L., 1995. National environment, strategy and new venture performance: A three-country study. *Journal of Small Business Management*, 33(2), 37–50.
127. Shapero, A., 1975. The displaced, uncomfortable entrepreneur. *Psychology Today*, 8: 83–88.
128. Shapero, A., 1985. Why entrepreneurship? Journal of Small Business Management, 23(4): 1–5.
129. Shapero, A., & Sokol, L., 1982. *Some social dimensions of entrepreneurship.* In C. Kent, D. Sexton, & K. Vesper (Eds.), The Encyclopedia of Entrepreneurship. Englewood Cliffs, NJ: Prentice- Hall.
130. Shaver, K., & Scott, L. 1991. A person, process, choice: The psychology of new venture creation. *Entrepreneurship Theory & Practice*, 16(2): 23–45.
131. Shepherd, D. A., & Krueger, N., 2002. Cognition, entrepreneurship, and teams: An intentions-based perspective. Entrepreneurship Theory and Practice, 27(2): 167–185. Emotional costs of business failure. *Journal of Business Venturing,* 24(2): 134–148.
132. Siggelkow, N., 2001. Change in the presence of fit: The rise, the fall, and the renaissance of Liz Claiborne. *Academy of Management Journal*, 44(4), 838–857.
133. Simon, H. 1997/1963. *Administrative Behaviour* (4th ed.). New York: Free Press.
134. Sirmon, D. G., Hitt, M. A., & Ireland, R. D., 2007. Managing firm resources in dynamic environments to create value: Looking inside the black box — *Academy of Management Review*, 32(1), 273–292.

135. Stanton, A., Day, M., & Welpe, I. (Eds.) 2010. *Neuroeconomics and the Firm*. Cheltenham, UK: Edward Elgar.
136. Stanton, A., Day, M., Krueger, N., Welpe, I., Acs, Z., & Audretsch, D. 2008. The questions (not so) rational entrepreneurs ask Decision-making through the lens of neuroeconomics. *Academy of Management Conference*, Anaheim.
137. Stavrou, E., 1999. Succession in family businesses: Exploring effects of demographic factors on offspring intentions to join and take over the business. *Journal of Small Business Management*, 37(3): 43–61.
138. Stevenson, H., & Jarillo, J. C. 1990. A paradigm of entrepreneurship: Entrepreneurial management. *Strategic Management Journal*, 11, 17–27.
139. Walsh, J. P., 1995. Managerial and organisation al cognition: Notes from a trip down memory lane. *Organisation Science,* 6(3), 280–321.
140. Westhead, P., Ucbasaran, D., & Wright, M., 2005. Decisions, actions, and performance: Do novice, serial and portfolio entrepreneurs differ? *Journal of Small Business Management*, 43(4): 393–417.
141. Whiting, B., 1988. Creativity and entrepreneurship: Do they relate? *Journal of Creative Behaviour*, 22: 178–183.
142. Zimmerman, B. J., & Pons, M. M., 1986. Development of a structured interview for assessing student use of self-regulated learning strategies. *American Educational Research Journal*, 23(4), 614–628.
143. Zohar, A., & Barzilai, S., 2013. A review of research on metacognition in science education: Current and future directions. *Studies in Science Education*, 49(2), 121–169.
144. Zohar, A., & Dori, Y. J. 2003. Higher order thinking skills and low-achieving students: Are they mutually exclusive? *The Journal of The Learning Sciences*, 12(2), 145–181.