



Are opportunities recognized or constructed? An information perspective on entrepreneurial opportunity identification

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ABSTRACT

Using a case study of ten SMEs the authors apply a model of human information processing which provides a frame to help understand the entrepreneur's use of information to identify opportunities. Their model integrates an algorithmic or pattern type of information processing and a heuristic or trial and error type of information processing into a pragmatic frame of the entrepreneur's opportunity recognition-construction mechanism. This article shows how human information processing can moderate entrepreneurial opportunity identification.

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1. Executive summary

Two streams of thought related to opportunity identification and human information processing can be found in the literature. They are the opportunity recognition or discovery viewpoint and the opportunity construction or enactment viewpoint. The first takes its source in cognitive psychology and the second in social constructionism or developmental psychology.

The cognitivist vision of information processing relies on a pattern-like or algorithmic model. Information shapes the entrepreneur's representation of reality in a normative way; entrepreneurs compare their representations of the environment in order to shape the logic of their network. Information is explicit, codifiable and thus formal. Linking patterns of information from various sources forms the basis of innovation and new business opportunities.

The constructionist perspective relies on a trial-and-error or heuristic model. Entrepreneurs process information in an interpretative way; they construct their reality by using information from their environment. In order to share information, create new knowledge and innovation and construct opportunities, the entrepreneur must justify the beliefs that are based on that information. Giving form to such information is the key to innovation and new business opportunities.

Based on a case study of ten SMEs we describe a model which can provide a frame for understanding the entrepreneur's use of information to identify opportunities. Our research posits that the entrepreneur's information processing is a dynamic combination of algorithmic and heuristic information treatment. In the interpretation, construction and enactment of their environment, entrepreneurs and their organization use a trial-and-error type of information processing for sensemaking and opportunity construction; this they combine with patterns of information based on their experience to identify opportunities.

This model integrates the constructionist- or trial-and-error type of information processing- and cognitivist- or pattern type of information processing-perspectives into this pragmatic frame of the entrepreneur's information processing and opportunity recognition-construction mechanisms. Entrepreneurs as information processors use more or less both approaches in order to identify opportunities; thus entrepreneurial opportunities can be recognized and constructed at the same time in a variety of combinations and recognized or constructed individually.

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2. Introduction

Information processing by entrepreneurs has been investigated by economists ever since Adam Smith's 'invisible hand'. In modern times it has been associated with problem solving and decision making (Simon, 1967a,b, 1991), innovation (Schumpeter, 1934), opportunity recognition and the entrepreneur's alertness (Kirzner, 1979). The creative destruction theory introduced by Schumpeter (1942) stresses that opportunities require new information and are innovative. Such is not the case for Kirznerian opportunities which may not require new information and are less innovative. The lifetime work of these two authors can add substantial nuances to Shane's interpretation (Shane, 2003: 21) of how they define opportunity based on market disequilibrium, but their work is fairly straightforward on the importance of information to help reduce marketplace inefficiencies. Hayek (1937: 45) proposed that opportunities are objective but their perception is subjective; his statement that if people have access to all pertinent information they are in equilibrium, is true "simply because that is how equilibrium is defined". This reflects a neo-classical economic tenet on the distribution of information and information processing by the entrepreneur. Noteboom's (2000: 65) entrepreneurial innovation is both Schumpeterian in that it creates forms that did not exist before and Kirznerian in that uncertainty is reduced and gaps between actual and possible use are lessened.

Kaish and Gilad (1991: 49) have identified problem-solving and disequilibrium opportunities. Problem-solving opportunities refer to assembling known information components into a coherent and anticipated whole and disequilibrium opportunities refer to an associative search linking unrelated information cues to form a picture of opportunity. Kaish and Gilad relate the question "how do entrepreneurs position themselves to encounter these opportunities?" to three information dimensions: sources of information, alertness to information and information cues. This exploratory research on entrepreneurial alertness has received little empirical support (Busenitz, 1996).

Today's perspectives on opportunity identification are based on the theories of the Austrian School; on work by Schumpeter and Kirzner. The Schumpeterian view follows the opportunities discovered ontology; the Kirznerian view leans toward the ontology proposed by the opportunities enacted view (Dutta and Crossan, 2005: 433). This dichotomy is also present in more recent research on entrepreneurship. According to Shane (2000) opportunities are discovered; Baron (2004, 2006) says that they are recognized; they are enacted through retrospective sensemaking according to Gartner et al. (2003); socially constructed say Sarason et al. (2005) and constructed and intentionally perceived according to Krueger (2000, 2003). Recent literature speaks to how entrepreneurs process information differently (Mitchell et al., 2000) but it does not address the issue of how human information processing moderates entrepreneurial opportunity recognition-discovery or opportunity construction-creation. This paper's aim is to examine entrepreneurial information processing in order to understand how entrepreneurs identify opportunities. It focuses on the contribution of an information processing view, which presents an algorithmic-heuristic continuum as a basis for integrating two apparently opposite viewpoints, namely: the opportunity discovery and the opportunity enactment perspectives. The latter reflects a constructionist view of opportunity enactment and a heuristic view of information processing; the former a cognitivist view of opportunity discovery and an algorithmic view of information processing.

In the following sections we recall definitions key to entrepreneurial information processing and examine existing research on the links that bind entrepreneurial information processing to opportunity identification. We limit the scope of this research and propose an integrative framework which connects and moderates the apparent distinction between objective and subjective opportunities, between opportunity discovery and opportunity creation. We then present the methodology, discuss the results of the research and conclude by assessing the framework's practical application, discuss limitations of the findings and present future directions for this research program.

3. Key definitions recalled

3.1. Intuition and insight

According to Simon (1991:324), intuition can be viewed as "analyses frozen into habit," a view not shared by Mintzberg (1989) nor by constructionists such as Weick (1995), and Von Krogh et al. (2000). Psychologists of the cognitive school define intuition in the context of insight. They define insight as seeing and understanding the inner nature of things, especially by intuition. They define intuition as the immediate knowing of something without the conscious use of reasoning. Knowing is having a range of information, while reasoning is thinking logically and analytically. An insight is typically said to occur when an individual is exposed to some new information that results in a new way of looking at a known problem or phenomenon in such a way that its essential features are grasped. According to Csikszentmihályi and Sawyer (1995) insight is part of an extended mental process. It is based on a previous period of conscious preparation, requires a period of incubation during which information is processed in parallel at a subconscious level, and is followed by a period of conscious evaluation and elaboration.

3.2. Knowledge

Knowledge can be defined as information combined with experience, context, interpretation, and reflection. It is a high-value form of information that can readily be applied to decision making and action. While knowledge and information may be difficult to distinguish at times, both are more valuable and involve more human input than raw data (Davenport et al., 1998). Knowledge is

rich information in an action-oriented context. It relies on experience to provide expertise and sensemaking in the interpretation of equivocal data about environmental change. This definition requires further clarification of the concept of information richness.

3.3. Information and information richness

Information is that which alters mental representations. Daft and Lengel (1986: 559) define information richness as “...the ability of information to change understanding within a time interval.” Communication transactions that can overcome different frames of reference or clarify ambiguous issues to change understanding in a timely manner are considered rich. Rich media, such as face-to-face discussion, enable people to interpret data and make sense of ambiguous information such as rich-information weak signals. Equivocality is integrated through extensive discussion and sensemaking in order to develop a common interpretation of the environment.

Nonaka and Takeuchi (1995) distinguish two philosophical dimensions related to information. The first, an ontological dimension, is a dialogical process of exchange between the individual, who synthesizes information and thus creates knowledge, and the group that acts as knowledge amplifier and disseminator. The second, an epistemological dimension inspired by Polanyi's (1966) work, distinguishes between tacit and explicit information. Whereas information reduces uncertainty, rich information helps make sense of ambiguous situations. It is conceptually closer to knowledge than to data. Polanyi and Nonaka do not define tacit information exactly the same way. Polanyi's tacit dimension refers to innate intelligence, perception and reasoning as opposed to Nonaka's definition which refers to memory and experience which can be made explicit through socialization.

3.4. How schemata and scripts measure information processing

Keisler and Sproull (1982) submit that information has a greater impact if it can be embedded into existing, heavily organized, and interconnected knowledge structures. Because of the individual's limited information processing capacity, attention demanding information (i.e. salient information) will only be incorporated into organized knowledge structures and long-term memory if it seems relevant to those structures. Discrepant information, on the other hand, will tend to be discounted and forgotten.

Organization members, in other words, do not actively process all informational cues anew in order to decide how to behave. Rather, they usually depend on a set of personal and consensual schemata to understand (and sometimes fill the gaps in) existing scripts. This is what allows them to respond to organizational situations with relatively little active information processing. Implicit assumptions about the importance of information signals are part of such schemata.

Gioia (1986a) defines schemata as a built-up repertoire of tacit knowledge that is used to impose structure upon, and impart meaning to, otherwise ambiguous social and situational information in order to facilitate understanding. Well established schemata enable the individual to process information subconsciously, especially if a good match between current context and existing schema is achieved. This frees the person's cognitive capacity to handle other more pressing, novel or innovative demands. Gioia and Poole (1984) describe cognitive scripts as schematic knowledge structures, held in memory, that indicate the appropriate behavior or sequence of events in specific situations.

Information processing models are organized into such abstract structures. These knowledge structures are the constructs against which new information is tested for relevance. Schemata simplify information processing and storage but, in the process, introduce biases. Such associative thinking leads to information expectations that are both well organized and resistant to new evidence. In this fashion schema-based expectations affect judgment and memory, and also filter the use of new or innovative information in weak signals. Motivational processes – such as external, vicarious or self-applied reinforcements – can provide incentives to enact an information processing related script. In this sense an organization might be viewed as “a culture composed of a complex set of interrelated scripts that influence one another in both supportive and contrary ways” (Gioia and Manz, 1985).

3.5. Entrepreneurial opportunity

Casson (1982), Shane and Venkataraman (2000: 220) and others (Eckhardt and Shane, 2003:336) define entrepreneurial opportunities as: “situations in which new goods, services, raw materials, markets and organizing methods can be introduced through the formation of new means, ends or ends–means relationships... In addition, unlike optimizing or satisficing decisions, in which the ends that the decision maker is trying to achieve and the means that the decision maker will employ are given, entrepreneurial decisions are creative decisions. That is the entrepreneur constructs the means, the ends or both.” Innovation, market information, information about resources, information asymmetries, informational sources such as price, and information diffusion are also linked to this definition by these authors. An investigation of opportunity revolves around the information individuals possess and how they process it.

Shane and Venkataraman (2000: 222) state that the reasons some people will discover opportunities while others will not is contingent on two issues: “(1) the possession of prior information necessary to identify an opportunity and (2) the cognitive properties necessary to value it.”

Information processing, knowledge creation, innovation, and opportunity identification are closely related to one another (Noteboom, 2000; Ward, 2004) and opportunity is a critical attribute of entrepreneurship (Shane and Venkataraman, 2000).

4. Extant research

4.1. Information transformation

Audretsch and Feldman (1996) try to distinguish information from knowledge through proximity and communication, what some researchers (Julien, 2007) have called the economics of proximity. The authors posit (1996: 630) that “the cost of transmitting information may be invariant to distance, presumably the cost of transmitting knowledge rises with distance.”

Knowledge is created and put to use in at least four ways: accumulation, organizational proximity, social proximity, and recombination-transformation. Specifically, knowledge can be created and put to use by accumulating information, hence the importance of absorptive capacity; it can also be created through organizational proximity where co-located experts and novices rub elbows, enabling swift information exchange: physical proximity is enhanced by co-location and a smaller relative size mitigates barriers to information exchange and knowledge transfer. Knowledge can be created by putting in context new information acquired through social proximity provided by networks and social capital (Yli-Renko et al., 2001); finally it can be created by recombination-transformation, synthesizing and putting in context shared information through a shared culture, hence the importance of shaping common cognitive schemata stressing the value of rich information (Greve and Salaff, 2003). These are key elements of the economics of proximity which influence the sharing of information.

Innovative activity which relies on knowledge creation and information sharing tends to cluster spatially. Tacit knowledge sharing, normally transmitted by direct contact, makes this point vividly. Proximity and context, prior knowledge (Shane, 2000), trust (Lewicki and Benedict-Bunker, 1996) and information sharing help transform information into knowledge. For the entrepreneur, his network (Aldrich and Zimmer, 1986; Johannisson, 2000; Julien et al., 2004) and his organization's absorptive capacity (Cohen and Levinthal, 1990; Zahra and George, 2002) help transform information into knowledge. Knowledge in turn triggers innovation and opportunity identification, and supports decision making (Vaghely et al., 2007). Understanding guides action, but action also informs understanding. Although knowledge can thus be defined as contextual, relevant and actionable information, Zeleny (2005) provides a sharper albeit somewhat more controversial distinction: “knowledge is action and information is a description of action” somewhat altering the philosopher Habermas' (1981) definition as information sharing which triggers action and for that matter Venkatraman's conceptually dynamic and simple but practically messy DIKAR model (2002: 207) which establishes a chain of progression linking raw data to actionable knowledge. We would argue that know-how qualifies as action and that information sharing builds up knowledge which can trigger action.

4.2. Information and opportunity

Others present opportunity identification as it relates to information. Sarasvathy et al. (2003: 145) call the neo-classical economic tenet the ‘allocative’ process view where opportunities are recognized and supply and demand are brought together to exploit existing markets. Economic agents are perfectly informed through arbitrage. The authors present two other views of entrepreneurial opportunity: the ‘discovery’ view where opportunity consists in the exploitation of existing or latent markets with imperfect information about the supply or the demand factor; and the ‘creative’ view where no prior information exists, ignorance by most being the key to opportunity creation. In sum, perfect but randomly distributed information, imperfect information and absence of information respectively define information processing in the allocative, discovery and creative viewpoints on opportunity identification.

Opportunity requires a combination of creativity, innovation and market information. Time is not factored into these three views on opportunity identification. Opportunity construction and enactment take time. Information processing and maturation also require time so patterns of opportunity can emerge for discovery and recognition.

Acs et al. (2005:12) acknowledge that the entrepreneurship literature considers opportunity to exist exogenously, focusing on the cognitive context of the individual; here opportunities are discovered or recognized in the Kirznerian sense. The authors observe that in the economic literature opportunities are also systematically and endogenously created through the purposeful investment in new knowledge by a decision-making process of the firm; here opportunities are constructed according to Weick's (1995) enactment through sensemaking.

In the debate on entrepreneurial opportunity identification Krueger (2003: 106, 132), remarks that “If opportunities are enacted then we need to explore the cognitive processes by which we take signals from the environment and construct a personally-credible opportunity. Even if opportunities are discovered, they still need to be perceived and cognition research already offers key insights into entrepreneurial perceptions.” Baron and Ward (2004: 557) assert that the number one issue in relation to cognitive science is that of heuristic and systematic thinking by the entrepreneur; stating with foresight that “...it may be the case that successful entrepreneurs are more adept at switching between these two modes of thought as the need arises.” They (2004: 558) also pose the question: “Do entrepreneurs have greater capacity than other persons to focus their attention on pertinent information?” “How do entrepreneurs think?” and “Do entrepreneurs develop unique knowledge structures and become experts in processing information?” (Mitchell et al., 2007) are also interesting. In this regard, we, as others (Mitchell et al., 2007), note a recent definition by Baron et al. (2005) of social cognition “as the ways in which we interpret, analyze, remember, and use information about the social world”. This relates to subjective processing of information. Baron's (2006) opportunity recognition by connecting the dots, using cognitive frameworks, relates to objective information processing.

Recent research provides some answers to these questions. In his essay on deeply held beliefs which support the entrepreneur's cognitive structures, Krueger (2007: 125, 133) relies on educational theory's two fundamental models of learning. He explores how behaviorist and constructivist models of learning help shape expert knowledge structures, knowledge content and help identify

and shape entrepreneurial opportunities. “Having a strong sense of how they connect the dots affords human beings the ability to direct their own learning.” He goes on: “Probably the most recognizable constructivist phenomenon in entrepreneurship is the identification and shaping of personally relevant opportunities...” which he rightly places at the heart of entrepreneurial intent. Krueger finally adds an interesting caveat “Given that human cognition often reflects dual cognitive processes, both rational and intuitive, it is then very likely that there are more than one set of cognitive structures that reflect the expert mind-set.” Expert entrepreneurs do process information differently than novice entrepreneurs: Their cognitive frameworks are clearer, richer and more focused according to Baron and Ensley (2006).

A complementary approach by Krueger and Kickul's (2006) work on self-efficacy seems to show promise. “Self-efficacy has proved to be a remarkable predictor of opportunity perception.” According to the authors the intuitive entrepreneur tends to formulate entrepreneurial intentions quite differently than an entrepreneur who is highly rational/analytic.”

Needless to say, the question of opportunity identification and, to a certain degree, its association with information processing, have been central to recent entrepreneurial research. This research has also extended to methodological questions in order to open up and shed some light on the entrepreneurial opportunity information processing relationship.

4.3. Observations about methodology

McMullen et al. (2007: 273) explore reasons for confusion about the opportunity construct. For instance: “some researchers argue that the subjective or socially constructed nature of opportunity makes it impossible to separate opportunity from the individual, others contend that opportunity is as an objective construct visible to or created by the knowledgeable or attuned entrepreneur”. The unit of analysis can be the entrepreneur for the objective point of view and the entrepreneur and his organization and social network for the subjective point of view. From the information processing point of view an all encompassing epistemological perspective is required wherein the entrepreneur, his organization and his network, all have their place.

Mitchell et al. (2004) introduce a “boundaries and exchange” concept in order to benefit from the inclusion of various research domains such as leadership, cognitive psychology and sociology and human information processing which are close to entrepreneurial cognition. The resulting contributions in the exchange can help to articulate concepts that have previously gone undetected. The authors reintroduce this methodology in a 2007 special issue. Such openings provide opportunity and compel combined research on human information processing and entrepreneurial opportunity identification.

The literature reveals the importance of information processing by the entrepreneur in order to identify opportunities. It does so by discussing opportunity related questions and the necessary information input without elaborating on the latter. An answer to the question: *How do entrepreneurs process information in order to identify opportunities?* should fill this gap.

5. Scope: The venture as unit of analysis

The entrepreneur can be the fundamental unit of analysis, if we consider opportunity from the objective point of view or as endogenous discovery (McMullen et al., 2007). The entrepreneur and his environment which includes his organization and his information network, can also represent the unit of analysis, if we consider opportunity from the subjective point of view or as an (exogenous) enactment (McMullen et al., 2007). In Fig. 1 we attempt to illustrate these options and propose the venture as the unit of analysis.

We are looking at opportunity identification from a human information processing perspective where information schemata are shaped by the entrepreneur's environment. The information processing perspective is designed around the *individual in context* and not solely around individuals. Recall that socialization and externalization (Nonaka and Takeuchi, 1995) provide the basis for information exchange and knowledge creation. The venture, namely the entrepreneur, his organization and his network, is the unit of analysis.

6. Key propositions

6.1. Entrepreneurial opportunity

Synthesizing the survey of the literature on opportunity identification we note the dichotomous interpretations concerning entrepreneurial opportunity: for some, entrepreneurial opportunity is objective; endogenous; discovered; exclusive; centered on the entrepreneur and the way he processes information as an individual, albeit contextualized in order to develop knowledge. For others, it is subjective; exogenous; enacted; inclusive and social cognition based; centered on the entrepreneur, his information network and how information is shared in context within the network in order to develop knowledge. This dichotomy is further complicated by its ontological and epistemological substrates centered on the individual for one, and on the individual in context for the other. Taking our cue from the boundaries and exchange concept (Mitchell et al., 2004) we have used human information processing and knowledge management to guide us in the selection of our unit of analysis.

Other assumptions about opportunity relate to their nature, their timeliness and their ends-means relationship. Most opportunities have a small impact on the organization, they are the result of a cumulative and complex information processing, having their origins in information asymmetries which are not arbitrated by markets; these opportunities can be associated with Kirznerian disequilibria due to market imperfections. Most are not based on innovations, or if they are, the innovations are small and/or incremental and diffuse rapidly as do creativity or taste related opportunities in fashion items. Here, information and speed-to-market are the key success factors. Other opportunities are based on brake-trough innovations; access to information about such opportunities requires specific know-how and specialized knowledge. These opportunities can be associated with

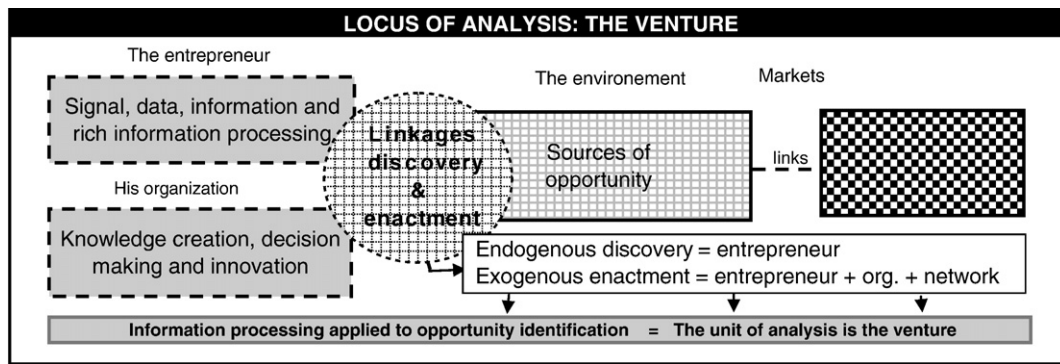


Fig. 1. Locus of analysis.

Schumpeterian disequilibria and as such their base innovation tends to be disruptive with time such as technology related opportunities where change and leapfrogging are common. Know-how, knowledge, information and timing are the key success factors here. Opportunity identification is also process and therefore time-sensitive/time-dependant (Bruyat and Julien, 2001: 170). Time has a cumulative effect on experience, builds absorptive capacity and incubates intuition. Time can mean speed-to-market, it can also mean maturation or time required to allow rich market-relevant information to percolate. And finally, as indicated in Fig. 1, opportunities require markets in an ends–means relationship.

From a human information processing point of view, the perspectives surveyed in the literature review on entrepreneurial opportunity are grouped into two streams of opportunity identification: the opportunity discovery or recognition viewpoint and the opportunity enactment or construction viewpoint. The first stream takes its source in cognitive psychology (Matlin, 2005; Baron, 2006) and the second stream in cognitive (Piaget, 1975) and social (Vygotski, 1986) constructionism which is also identified as developmental psychology.

6.2. Entrepreneurial information processing

From an epistemological point of view, cognitivists use formal models or algorithms. The constructionist perspective uses interpretative or heuristic models. This algorithmic–heuristic duality forms an information processing continuum.

Cognitivist information processing is characterized by information which shapes the representation of reality. Entrepreneurs compare their representations of the environment in order to shape the dominant logic of their network. On the basis of available information, the entrepreneur tries to shape a model of reality which is as accurate as possible. In this sense, the entrepreneur may be compared to an information processing machine: artificial intelligence, expert systems and environmental scanning all use such processes. According to the cognitivist vision of information processing, knowledge is explicit, codifiable and thus formal; such as, for instance, in multistage models of insight and innovation based on the entrepreneur's intuitive patterns which “connect the dots” to identify new business opportunities.

Constructionist information processing is characterized by the following treatment of information by entrepreneurs: They process new information in an interpretative way; they construct their reality by using information from their environment. Information, in turn, leads to knowledge based action. Entrepreneurs use two types of information: *explicit* information resulting from sensemaking with members of their organizations and information network, and *tacit* information based on the entrepreneur's reconstruction, with his organization, of his own environment and on his innate abilities. According to constructionists, in order to share information, and create new knowledge, innovation and construct opportunities, the entrepreneur must justify the beliefs that are based on that information. Formalization of such information is the key to innovation and new business opportunities.

6.3. Research framework

In this research we use a working model of information processing which can provide a framework for understanding the entrepreneur's information processing and opportunity identification. It posits that the entrepreneur's information processing is a dynamic combination of algorithmic and heuristic information treatment combining opportunity discovery with opportunity enactment.

The model is divided into two distinct areas identified as (1) and (2) in Fig. 2. The first area represents an algorithmic–heuristic continuum made up of seven stages of human information processing. The algorithmic end treats the processing of information as “pattern recognition” which is associated with the use of information schemata and scripts of cognitive psychology. The heuristic end posits that information processing is a trial-and-error process of interpretation associated with cognitive psychology's and sociology's constructionism.

Both ends show intuition as part of typical information processing. In the first case intuition is a process of “connecting the dots” by entrepreneurs using cognitive frameworks acquired through experience (Gioia, 1986a,b; Csikszentmihályi and Sawyer, 1995; Baron, 2004, 2006). In the second case intuition is constructed by interpretation (Daft and Weick, 1984; Nonaka, Takeuchi, 1995; Von Krogh et al., 2000) of the entrepreneurs' environment through sensemaking and discussions with members from the

entrepreneur's information network and his organization. Uncertainty at the algorithmic end can be reduced or eliminated by the acquisition of information; on the other hand, ambiguity on the heuristic side is a state of nature, requires sensemaking and will remain in the environment; it can be “integrated” only through choice of one signal over another by the entrepreneur.

The intermediate steps are used to illustrate typical algorithmic or heuristic information processing behavior: strong signals from archived information in filing cabinets or on computer hard disks or weak signals from tacit information associated with know-how, for instance. The middle position represents the entrepreneur's information quality check mechanism which in this case is a feedback loop.

The model's second area (2) represents contextual factors or environmental determinants which are the main factors shaping the entrepreneur's information processing scripts at the cognitive–algorithmic end and his interpretation of the environment at the constructionist–heuristic end. Factors such as culture (Creed and Miles, 1996; Kramer and Tyler, 1996) and structure (Galbraith, 1977, 1995; Stinchcombe, 1990) have been scrutinized in numerous research papers and their impact on human information processing in organizations is clearly established. But other factors such as the level of competition within the entrepreneur's industry (Porter, 1985), the impact of ‘boundary spanners’ (Tushman and Scanlan, 1981a,b), the recognition of information sources within or without the entrepreneur's information network (Julien, 2007), the level of information sharing within that network and the availability of ‘rich information’ (Daft and Lengel, 1984) to the entrepreneur have not been, to our knowledge, closely linked to the level of human information processing by the entrepreneur.

7. Methodology

Our aim is to gain a deeper understanding of entrepreneurial information processing by examining the proposed model's ability to integrate the entrepreneurial opportunity discovery–enactment dichotomy using the model's algorithmic–heuristic continuum.

In the model, five contextual factors come from field interviews and are based on the frequency of mentions: level of competition, impact of boundary spanners, the recognition of information sources, the level of information sharing and the availability of rich information. The two other environmental determinants: culture of trust and organizational structure were developed together with the information processing continuum using grounded theory (Glaser and Strauss, 1967) over a 24 month action-research (Vaghely, 2005) preceding interviews to “uncover and understand what lies behind phenomenon about which little is known” (Strauss and Corbin, 1990: 19). In order to measure the strength of the relation of these contextual factors to the information processing variables additional interviews are required.

A purposeful sampling strategy (Creswell, 1998:118) was designed to generate a variety of levels of technology firms, cultures, structures and information styles in SMEs of different sizes. In order to implement this strategy, we chose ten SMEs to fit along the diagonal axis of Porter and Millar's (1985) information-intensity matrix. This matrix measures the information-intensity content of the product's or service's value chain on the vertical axis, and the information-intensity content of the firm's product/service on the horizontal axis. The matrix's diagonal axis is where the information value-added and the information content of the firm's products are more or less in balance. High information content and information value-added SMEs such as consulting firms, financial brokers or banks are in the right-hand corner of Quadrant 3, and low information content with little information value-added SMEs such as commodity manufacturing firms, mills or cement factories, are in the left-hand corner of Quadrant 1. The organizations were selected on the basis of our a priori perceptions of the firm's level of information intensity. They are shown in Fig. 3, using Porter and Millar's (1985) information-intensity matrix.

This sampling has allowed for the contrasting of results from these varied sources and provided a finer grain appraisal of our model's process variables and contextual factors.

We used in-depth interviews with entrepreneurs to gather data from the sample SMEs. The entrepreneurs were also CEOs of their organizations. We also interviewed three to ten staff members per SME. The interviews lasted on average over 90 min.

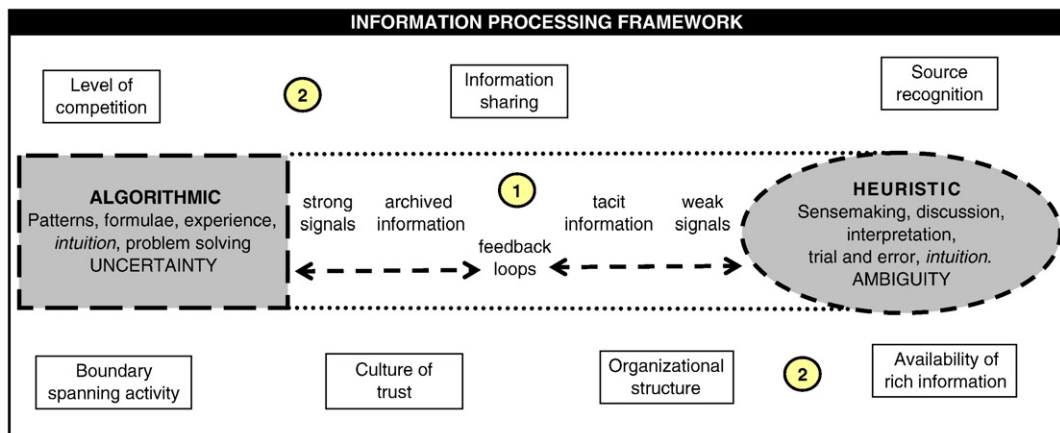


Fig. 2. The entrepreneurial information processing framework.

The ten organizations represent a variety of perceived levels of information intensity. They were initially grouped under two identification tags: SME 1 and SME 2 which are shown with dotted line circles in Fig. 3; their post-interview positions are shown with solid line circles. They comprise eight manufacturing SMEs (SME 2: A, C, D, E, F, G, H and I) and two service SMEs (SME 1: B and J). This ascending order along the diagonal of the matrix from SME 2 to SME 1 group reflected our hypothesis that service SMEs may be more efficient information processors than their manufacturing counterparts. Table 1 provides details of the participating SMEs.

The protocol for the interviews was designed to help measure the contextual factors and process variables in the model. Cues were used to start a dialogue and to establish a level of trust necessary for the exchange of rich information. Thus the basic concepts of the model, namely the initially two contextual dimensions and the seven process variables were operationalized by using triggers and indicators. Their relationship to the different dimensions of the information processing framework is shown in Table 2. These triggers and indicators are:

- Success stories (in order to introduce innovative opportunities)
- Handling of major customer complaints (market opportunities)
- New ideas or innovations, if they were identified as such (internal opportunity enactments)
- The definition of personal and organizational information (information processing)
- Information sharing (externalization and combination in order to transform information)
- Changes in the gross margin (positive outcomes of information processing).

These indicators led us to discuss how opportunities were identified (discovered or constructed) and disseminated within the organization. The interview guide was tested with a variety of people (two senior executives and six department heads and managers) within a division of a large organization, in different departments, in a participative research. The guide was later adjusted within a single SME. The latter's results were contaminated and thus not used.

The analysis of the in-depth interview data consisted of an initial review of notes taken during the interviews, listening to the recordings of the interviews and taking note of the salient facts. Based on the interviews and this initial review, five-point measures were finalized for each of the seven variables and contextual factors. This scale was used in order to provide depth combined with simple result feedback to participants. A value was assigned for each process variable and contextual factor for each interview. The aggregate results for each firm were then discussed and validated with the firm's entrepreneur. We thus generated a benchmark coding for the SMEs and had the opportunity to further explore the entrepreneur's information processing behavior and the nature of his links to his *milieu*. Three independent coders were used during the coding and recoding process. Other aspects of the methodology are:

- Respondents were selected on the basis of their information processing functions in sales, purchasing, credit, R&D and pricing after validation with the entrepreneur. For this sample, care was taken to obtain input from the entrepreneurs as well as representatives from the organization's strategic, functional and operational levels. As shown in Table 3, 65 subjects in 10 SMEs with a range of four to eleven interviews per firm were conducted for this sample.
- In order to determine the significance of the respondents' overall level of information processing performance, their performance for each variable and contextual factor was measured on a five-point scale. These individual measurements had to be made in order to generate an aggregate result for each organization.
- We further refined the five-point measures on the basis of discussions at a meeting with the entrepreneurs and of a subsequent review of the interview transcripts when they became available six months later. The elapsed time allowed us to take a critical

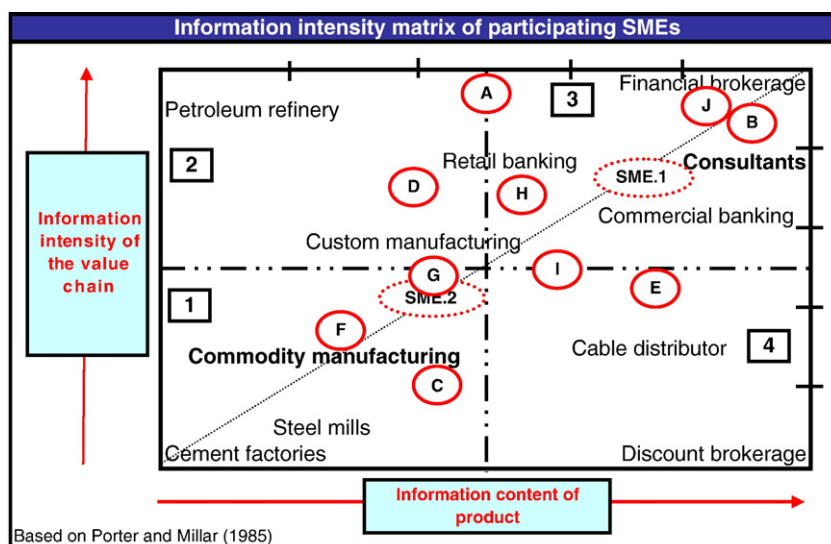


Fig. 3. Information-intensity matrix of participating SMEs.

Table 1
Participating SMEs.

Participants				
SME	Product/process/service	000,000	Emp.	Remarks
A	Plastic parts, blow moulding and casting	65 \$	140	Manufacturing
B	Customs broker, forwarder and freight agent with warehousing	45 \$	450	service
C	Industrial parts and speciality painting	35 \$	90	Manufacturing
D	Plastics packaging	11 \$	42	Manufacturing
E	Pressure moulding and machining of aluminum parts	30 \$	110	Manufacturing
F	Die casting, foundry and machine shop	18 \$	78	Manufacturing
G	Construction materials manufacturer with 8 product lines	80 \$	250	Manufacturing
H	Machine shop: thermal treating, welding, transmission assay	15 \$	120	Manufacturing
I	Transmission systems manufacturer	20 \$	110	Manufacturing
J	Consultants in freight and data management	12 \$	35	service

distance from the benchmark coding and to present these results to the participants for a final discussion and validation. We made further refinements to the measures before a second phase of coding. The second phase comprised three successive adjustments to the results of the benchmark coding, as well as a forced-choice adjustment in order to eliminate all decimals from the final scores.

The results of the analysis for the ten organizations are based on this double review, the rating process, the interpretation of salient facts, the two successive coding phases and the comparison to the interview notes. This process contributed to refine our ongoing interview methods; as noted earlier, five contextual factors were added after field interviews based on repeated mentions. A more substantive database will allow parametric analysis to evaluate their level of correlation to the information processing variables.

8. Application and results

8.1. The entrepreneur and his organization as information processors

In this sample we have found organizations with individuals that have a special ability to process information. They process information in an algorithmic fashion as well as in a heuristic one. They are fully at ease in either mode and can switch rapidly from one to the other. They can quickly assimilate pattern-like information and accommodate themselves to new information by trial

Table 2
Operationalization of concepts.

Operationalization of Concepts								
<div>Information processing triggers and indicators</div> <div>Dimensions of human information processing</div>		Success stories	Changes in the gross margin	Handling of customer complaints	Innovations	Personal/organizational information	Information sharing	Information processing
Contextual factors		Facts			Process			
Organizational structure	X					X	X	
Boundary spanning activity	X	X	X	X	X	X	X	X
Use of rich information		X	X			X		X
Information sharing	X	X	X	X	X	X	X	X
Recognition of information sources	X							
Industry competition		X					X	X
Information alert and trust building culture			X	X			X	X
Information processing variables								
Algorithmic processing (use of formulae)	X						X	X
Strong signal processing	X					X	X	X
Archived information use	X							X
Use of feedback loops		X	X	X	X	X	X	
Tacit information processing			X	X				X
Weak signal processing				X	X	X		X
Heuristic processing (use of trail and error)		X	X	X				

and error. They tolerate uncertainty and equivocality equally well. In this sample we found entrepreneurs, boundary spanners and information catalysts with this ability.

We found that four out of the ten entrepreneurs had this special ability with two boundary spanners and four people whom we now call *information catalysts* who synthesize and process information and stimulate information exchange. We can refer to Von Krogh et al. (2000) who also use the term catalyst for their so-called knowledge creation activist, or to Anderson and Jack's (2002) terminology. In their terms, the catalyst acts as both the glue that reinforces interpersonal relationships, and the lubricant that facilitates intercommunication throughout the firm. In some organizations, we found that the catalyst had a somewhat meaningless title, such as director of one thing or another, while his actual job was to be wherever he was needed to facilitate the information transformation process. In the organizations we studied they complement the entrepreneur and boundary spanners as the third leg of the firm's vital information processors. The organization's level of information alertness is determined by these three categories of information processors and, to a larger extent, by the information catalyst's propensity to stimulate information sharing. It is important for the organization to recognize this special ability of the information catalyst by reinforcing his role as a rich-information disseminator, and by using his special ability to insert such rich information into product or process innovations and strategy formation to recognize or even generate nascent opportunities. (Vaghely et al., 2007)

Using results from Table 3, the three types of information processors that have this special ability are four entrepreneurs who use this ability to identify opportunities in organizations A, B, D and H; two boundary spanners, one a senior sales and marketing manager and the other a senior purchasing and R & D manager, they interpret and adapt environmental information for the organization, in organizations where there is a high level of boundary spanning activity, A and B; and four information catalyst who provide critical information at the right time and thus provide rich information for decision making in organizations A, B, C and E.

We are interested in the entrepreneur as the opportunity identification oriented information processor and the social ties he establishes with his organization's high-level information processors in order to help him shape his organization's culture and structure. Where the scores related to these factors (culture and structure) are high we should have a strong information-processor-entrepreneur. Such is the case for A, B, D and H. Boundary spanners arbitrage information between their organization and the environment. Level of boundary spanning activity and recognition of information sources are factors which relate to their activity. Information catalysts share information within the organization; they synthesize this information and provide timely, rich information for input into the decision process. In A and B boundary spanners and information catalysts are linked to the entrepreneur and provide him with rich information; not so for organizations D and H where the entrepreneur does not have such links.

In organizations D and H we have found that when processing information, for instance the entrepreneur with an engineering background, as in D, tends to refer to established scripts and patterns of an algorithmic nature. When the situation called for innovation and opportunity identification, however, this entrepreneur's problem-solving approach rested on experience-based patterns of creative intuition. Opportunities are recognized as patterns with the help of algorithmic information processing. Conversely, for example, a former artist turned entrepreneur, as in H, tends to construct creations by trial and error relying on sensemaking and insight which are mostly heuristic types of information processing at the other end of the information processing

Table 3
Results.

Results										
Likert scale (1 = none, 5 = extensive)	A	B	C	D	E	F	G	H	I	J
Number of interviews = 65	6	7	5	11	4	11	8	5	4	4
Contextual factors										
Level of influence of organizational structure	4	3	4	4	3	4	3	3	4	4
Level of boundary spanning activity	4	4	3	2	4	2	4	3	3	2
Level of use of rich information	4	4	4	4	4	2	4	3	3	3
Level of information sharing	4	4	4	4	2	4	2	4	2	2
Level of recognition of information sources	4	3	4	4	2	2	2	2	2	3
Level of competition in industry	4	4	3	4	4	4	3	3	2	1
Level of information alert and trust building culture	3	4	3	4	3	3	2	3	2	2
Information catalyst	1 catal.	1 catal.	1 catal.		1 catal				2	
Process variables										
Level of algorithmic processing (use of formulae)	4	4	4	4	4	4	4	4	4	4
Level of strong signals processing	5	4	4	4	4	4	4	3	4	4
Level of archived information use	5	3	3	4	3	4	4	3	4	4
Level of use of feedback loops	4	4	4	3	4	3	3	2	3	2
Level of tacit information processing	4	3	4	2	3	2	2	3	3	3
Level of weak signal processing	4	4	2	3	3	2	3	2	3	2
Level of heuristic processing (use of trial and error)	4	3	3	3	4	3	3	3	2	2
Entrepreneur as an exceptional information processor	Entr.	Entr.		Entr.				Entr.		

model. These entrepreneurs use a process of social construction based on the communication of new information (insight) in combination with existing tacit information (intuition). Opportunities are constructed by retrospective sensemaking of new information with the help of heuristic, trial-and-error information processing. What is missing in D and H is the rich information from the boundary spanners and information catalysts to adapt structure and shape culture.

The results for both organizations (D and H) show low levels of heuristic processing (see shaded areas in Table 3). The entrepreneurs are aware of this situation. D's entrepreneur, who processes more on the systematic side, recognizes the need for a more trial-and-error approach to information processing. The entrepreneur for H accepts that his organization has a low level of tolerance for ambiguity. He feels that one "artist" is enough in a sophisticated manufacturing environment. Neither D nor H has strong boundary spanners and both organizations lack an information catalyst to compensate for the low level of heuristic information processing.

From the interviews with the entrepreneurs we found that algorithmic information processing helped them to recognize opportunities based on existing problem–solution pairs and heuristic processing helped them to recognize opportunities based on new problem–solution pairs. In the interpretation, construction and enactment of their environment, all four entrepreneurs in organizations A, B, D and H, used a heuristic type of information processing for sensemaking and opportunity construction, which they combined with algorithmic pattern processing related opportunities based on their experience. The strength of the level of information processing in A and B is attributable to the algorithmic–heuristic information processing of their entrepreneurs. This is sustained by the social links that these entrepreneurs have established with their boundary spanners and information catalysts. This strength provided the entrepreneur with the appearance of ease and self-confidence when using information.

8.2. Information processing to identify opportunities

We now examine more closely a new result in this area of research, namely the role of the entrepreneur as a high-level information processor.

As noted earlier, we have identified four entrepreneurs as exceptional information processors within this sample. These individuals facilitate information transformation and exchange; they process and synthesize rich information effectively along an implicit algorithmic–heuristic continuum in accordance with our model.

The organizations where we found such an entrepreneur linked to an information catalyst (A and B) outperformed the information processing level of those without such an entrepreneur and catalyst. For comparison purposes, to help interpretation and discussion and to show differences between firms, Table 4 below presents the two highest scoring firms of the sample (A and B) and the two lowest scoring firms of the sample (I and J) for information processing.

Interpretation of results regarding the environment or milieu:

- A and B live in symbiosis with their environment, not as much for I and J; compare perceived levels of activity of boundary spanners and the levels of use of rich information, which is strategic information made available when required
- A and B have a culture of sharing information, not as much for I and J; compare results for the level of recognition of information sources, for a trusting culture and for information sharing.

Table 4
Highest and lowest results compared.

Results Compared				
Likert scale (1 = none, 5 = extensive)	A	B	I	J
Number of interviews = 55	6	7	4	4
Contextual factors				
Level of influence of organizational structure	4	3	4	4
Level of boundary spanning activity	4	4	3	2
Level of use of rich information	4	4	3	3
Level of information sharing	4	4	2	2
Level of recognition of information sources	4	3	2	3
Level of competition in industry	4	4	2	1
Level of information alert and trust building culture	3	4	2	2
Information catalysts	1 catal.	1 catal.		
Process variables				
Level of algorithmic processing (use of formulae)	4	4	4	4
Level of strong signals processing	5	4	4	4
Level of archived information use	5	3	4	4
Level of use of feedback loops	4	4	3	2
Level of tacit information processing	4	3	3	3
Level of weak signal processing	4	4	3	2
Level of heuristic processing (use of trial and error)	4	3	2	2
Entrepreneur as information processor	Entr.	Entr.		

Interpretation of results regarding information processing:

- A remarkable result is that I and J have lower results in heuristic information processing which seem to be the underpinnings of their overall performance (See shaded areas in Table 4.). The heuristic-strong organizations have a dual advantage for processing information in an algorithmic and heuristic fashion which becomes a single dimension for the algorithmic-only information processor. We caution that this sample does not include ventures which are high in heuristic and low on algorithmic processing.
- The entrepreneurs in A and B are strong information processors helped by catalysts, but not so for I and J; hence the low impact of common schemata to develop an information alert and trust building culture within their organizations.

From a marketing point of view, these entrepreneurs are knowledgeable enough about customer needs to recommend alternative and novel product solutions. They are very well apprised of their organization's capabilities to satisfy customers' expectations. They are one of the organization's most influential information processors. With the information catalyst, they often take direct responsibility for the preparation of competitive bids. In a manufacturing environment they are closely associated with R&D or job-cost estimates, so that they have a major impact on the organization's gross margin. What distinguishes them from other entrepreneurs is their use of this particular ability: first, to identify opportunities, second, with the help of boundary spanners, to translate environmental information for the organization and third, with information catalysts, to use rich information in the firm's decision process.

9. Implications

The conceptual model of information processing integrates both epistemological perspectives into a pragmatic frame of the entrepreneur's information processing and opportunity recognition-construction mechanisms. From an information perspective entrepreneurs use both approaches in order to identify opportunities; thus entrepreneurial opportunities can be recognized and constructed at the same time and recognized or constructed individually. Witness the results for A and B in both algorithmic and heuristic information processing.

Along the entrepreneur's information processing continuum, the process that comes before and after insight/intuition is heavily dependant on social interaction. Cognitivists and constructionists agree on this. It is this process that transforms information into innovation and finally into entrepreneurial opportunity. Witness the links between the entrepreneurs, boundary spanners and information catalysts in A and B supported by results in their individual activities.

10. Some limitations and a research agenda

The limitations of this study relate to biases attributable to the small size of the database which is presently at 65 interviews made in ten SMEs. The entrepreneurs participated in the initial, follow-up and coding interviews. The data base is not yet large enough for meaningful statistical analysis which would, for instance, measure the impact of some contextual factors and provide a tangible tool to shape information processing habits of participating SMEs. Another limitation is that we do not have ventures which are high in heuristic and low on algorithmic information processing in the data base; this, we feel, can be attributed to the manufacturing nature of surveyed SMEs and related service organizations. In view of these limitations, results are not robust as yet for generalization albeit some concepts and results were introduced into entrepreneurship classes where they were well received.

This research program is past the exploratory stage as results were presented to participating and non-participating SMEs over a three year period. Elements of best practice in information transformation and processing were identified and a number of information processing variables can now be used to monitor an organization's level of information alertness.

In order to increase the data base, obtain high-heuristic low-algorithmic results by varying the subjects and obtain statistical results, we are developing a psychometric questionnaire to replace existing interview guides. This will accelerate data collection and provide an opportunity to move into new industries focused on the knowledge economy, and perhaps find high-heuristic and low-algorithmic information processing SMEs. We will do this by further research into questionnaire related topics such as cognitive styles, unit of analysis related issues such as the social cognition approach and specific information processing related areas such as the makeup of entrepreneurial expertise.

11. Conclusion

In conclusion, the application of the conceptual framework on information processing to opportunity identification provides an answer to Krueger's question: entrepreneurs discover and enact opportunities. It also answers Baron and Ward's concern that successful entrepreneurs are more adept at switching between algorithmic and heuristic modes of thought as the need arises.

In the sample, four out of the ten entrepreneurs are strong information processors and are at ease with both types of information treatment. Entrepreneurs in A and B are exemplars of the dynamic combination of heuristic and algorithmic processing. They use problem-solving and sensemaking information applications which they combine with social interaction with their boundary spanners and information catalysts in order to identify opportunities. They combine opportunity construction with opportunity recognition and enactment.

References

- Acs, Z.J., Audretsch, D.B., Braunerhjelm, P., Carlsson, B., 2005. The knowledge spillover theory of entrepreneurship. CEPR Discussion paper 5326, Center for Economic Policy and Research, London.
- Aldrich, H.E., Zimmer, C., 1986. Entrepreneurship through social networks. In: Sexton, D., Smilor, R. (Eds.), *The Art and Science of Entrepreneurship*. Ballinger, Cambridge, MA.
- Anderson, A.R., Jack, S.L., 2002. The articulation of social capital in entrepreneurial networks: a glue or a lubricant. *Entrepreneurship & Regional Development* 14 (3), 193–210.
- Audretsch, D.B., Feldman, M.P., 1996. R&D spillovers and the geography of innovation and production. *The American Economic Review* 86 (3), 630–640.
- Baron, R.A., 2004. Opportunity recognition: insights from cognitive perspective. In: Butler, J.E. (Ed.), *Opportunity Identification and Entrepreneurial Behaviour*. Information Age Publishing, Greenwich, CT.
- Baron, R.A., 2006. Opportunity recognition as pattern recognition: how entrepreneurs 'connect the dots' to identify new business opportunities. *Academy of Management Perspective* 20 (1), 104–119.
- Baron, R.A., Ward, T.B., 2004. Expanding entrepreneurial cognition's toolbox: potential contributions from the field of cognitive science. *Entrepreneurship Theory and Practice* 26 (6), 553–573.
- Baron, R.A., Ensley, M.D., 2006. Opportunity recognition as the detection of meaningful patterns: evidence from comparisons of novice and experienced entrepreneurs. *Management Science* 52 (9), 1331–1344.
- Baron, R.A., Byrne, D., Brascombe, N.R., 2005. *Social Psychology*, 11th ed. Allyn & Bacon, Boston.
- Bruyat, C., Julien, P.A., 2001. Defining the field of research in entrepreneurship. *Journal of Business Venturing* 16 (2), 17–27.
- Busenitz, L.W., 1996. Research on entrepreneurial alertness. *Journal of Small Business Management* 34 (4), 35–45.
- Casson, M., 1982. *The Entrepreneur*. Barnes & Noble Books, Totowa, N.J.
- Cohen, W.M., Levinthal, D.A., 1990. Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly* 35 (2), 128–152.
- Creed, W.E.D., Miles, R.E., 1996. Trust in organizations: a conceptual framework linking organizational forms, managerial philosophies, and the opportunity cost of controls. In: Kramer, F.M., Tyler, T.R. (Eds.), *Trust in Organizations*. Sage, Thousand Oaks, pp. 16–39.
- Creswell, J.W., 1998. *Qualitative Inquiry and Research Design*. Sage, Thousand Oaks.
- Csikszentmihályi, M., Sawyer, K., 1995. Creative insight: the social dimension of a solitary moment. In: Sternberg, R.J., Davidson, J.E. (Eds.), *The Nature of Insight*. MIT Press, Cambridge Mass, pp. 329–363.
- Daft, R.L., Lengel, R.H., 1984. Information richness: a new approach to managerial behavior and organization design. In: Cummings, L.L., Staw, B.M. (Eds.), *Research in Organizational Behavior*. JAI Press, Homewood, pp. 191–233.
- Daft, R.L., Weick, K.E., 1984. Toward a model of organizations as interpretation systems. *Academy of Management Review* 9 (2), 284–295.
- Daft, R.L., Lengel, R.H., 1986. Organizational information requirements, media richness and structural design. *Management Science* 32 (5), 554–571.
- Davenport, T.H., DeLong, D.W., Beers, M.C., 1998. Successful knowledge management projects. *Sloan Management Review* 39 (2), 43–57.
- Dutta, D.K., Crossan, M.M., 2005. The nature of entrepreneurial opportunities: understanding the process using the 4I organizational learning framework. *Entrepreneurship Theory and Practice* 29 (4), 425–449.
- Eckhardt, J.T., Shane, S.A., 2003. Opportunities and Entrepreneurship. *Journal of Management* 29 (3), 333–349.
- Galbraith, J.R., 1977. *Organization Design*. Addison-Wesley, Reading.
- Galbraith, J.R., 1995. *Designing Organizations*. Jossey-Bass, San Francisco.
- Gartner, W.B., Carter, N.M., Hills, G.E., 2003. The language of opportunity. In: Steyaert, C., Hjorth, D. (Eds.), *New Movements in Entrepreneurship*. Edward Elgar, Northampton, MA, pp. 103–124.
- Gioia, D.A., 1986a. Symbols, scripts and sensemaking. In: Sims Jr., H.P., Gioia, D.A. (Eds.), *The Thinking Organization: Dynamics of Organizational Social Cognition*. Jossey-Bass, San Francisco, pp. 49–74.
- Gioia, D.A., 1986b. Introduction. In: Sims Jr., H.P., Gioia, D.A. (Eds.), *The Thinking Organization: Dynamics of Organizational Social Cognition*. Jossey-Bass, San Francisco, pp. 1–9.
- Gioia, D.A., Manz, C.C., 1985. Linking cognition and behavior: a script processing interpretation of vicarious learning. *Academy of management Review* 10 (3), 527–539.
- Gioia, D.A., Poole, P.P., 1984. Scripts in organizational behaviour. *Academy of Management Review* 9 (4), 449–459.
- Glaser, B.G., Strauss, A.L., 1967. *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Aldine, Chicago.
- Greve, A., Salaff, J.W., 2003. Social networks and entrepreneurship. *Entrepreneurship Theory and Practice* 28 (1), 1–22.
- Habermas, J., 1981. *Théorie de l'agir communicationnel*. Fayard, Paris.
- Hayek, F.A., 1937. Economics and knowledge. *Economica* 4 (13), 33–54.
- Johannisson, B., 2000. Networking and entrepreneurial growth. In: Sexton, D., Lanström, H. (Eds.), *Handbook of Entrepreneurship*. Blackwell, London.
- Julien, P.A., 2007. A Theory of Local Entrepreneurship in the Knowledge Economy. Edward Elgar, Cheltenham, UK.
- Julien, P.A., Andriambeloson, E., Ramangalahy, C., 2004. Networks, weak signals and technological innovations among SMEs in the land-based transportation equipment sector. *Entrepreneurship and Regional Development*, 16 (4), 251–270.
- Kaish, S., Gilad, B., 1991. Characteristics of opportunities search of entrepreneurs versus executives: sources, interest, general alertness. *Journal of Business Venturing* 6, 45–61.
- Keisler, S., Sproull, L., 1982. Managerial responses to changing environments: perspectives on problem sensing from social cognition. *Administrative Science Quarterly* 27 (4), 548–570.
- Kirzner, I., 1979. *Perception, Opportunity, and Profit*. University of Chicago Press, Chicago.
- Kramer, F.M., Tyler, T.R., 1996. *Trust in Organizations*. Sage, Thousand Oaks.
- Krueger, N.F., 2000. The cognitive infrastructure of opportunity emergence. *Entrepreneurship Theory and Practice* 24 (3), 5–23.
- Krueger, N.F., 2003. The cognitive psychology of entrepreneurship. In: Acs, Z.J., Audretsch, D.B. (Eds.), *Handbook of Entrepreneurship Research*. Springer, USA.
- Krueger, N.F., 2007. What lies beneath? The experiential essence of entrepreneurial thinking. *Entrepreneurship Theory and Practice* 31 (1), 123–138.
- Krueger, N.F., Kickul, J., 2006. So you thought the intentions model was simple? Proceedings of the 2006 USASBE Conference, Tucson, Az.
- Lewicki, R., Benedict-Bunker, J.B., 1996. Developing and maintaining trust in work relationships. In: Kramer, R.M., Tyler, T.R. (Eds.), *Trust in Organizations: Frontiers of Theory and Research*. Sage, Thousand Oaks, pp. 114–140.
- Matlin, M.W., 2005. *Cognition*. John Wiley & Sons, USA.
- McMullen, J.S., Plummer, L.A., Acs, Z.J., 2007. What is an entrepreneurial opportunity? *Small Business Economics* 28, 273–283.
- Mintzberg, H., 1989. *Mintzberg on Management*. Free Press, p. New York.
- Mitchell, R.K., Smith, B., Seawright, K.W., Morse, E.A., 2000. Cross-cultural cognitions and the venture creation decision. *Academy of Management Journal*, 43 (5), 974–993.
- Mitchell, R.K., Busenitz, L.W., Bird, B., Gaglio, C.M., McMullen, J.S., Morse, E.A., Smith, J.B., 2004. The distinctive and inclusive domain of entrepreneurial cognition research. *Entrepreneurship Theory and Practice* 28 (6), 505–518.
- Mitchell, R.K., Busenitz, L.W., Lant, T., McDougall, P.P., Morse, E.A., Smith, J.B., 2007. The central question in entrepreneurial cognition research 2007. *Entrepreneurship Theory and Practice* 31 (1), 1–27.
- Nonaka, I., Takeuchi, H., 1995. *The Knowledge Creating Company*. Oxford Press, New-York.
- Noteboom, B., 2000. *Learning and Innovation in Organizations and Economies*. Oxford Press, New-York.
- Piaget, J., 1975. *L'équilibration de structures cognitives*. Presses Universitaires de France, Paris, France.
- Polanyi, M., 1966. *The Tacit Dimension*. Doubleday, Garden City.

- Porter, M.E., 1985. *Competitive Advantage: Creating and Sustaining Superior Performance*. Free Press, New-York.
- Porter, M.E., Milar, V.E., 1985. How information gives you competitive advantage. *Harvard Business Review* 63 (4), 149–160.
- Sarason, Y., Dean, T., Dillard, J.F., 2005. Entrepreneurship as the nexus of individual and opportunity: a structuration view. *Journal of Business Venturing* 21, 286–305.
- Sarasvathy, S.D., Dew, N., Velamuri, S.R., Venkataraman, S., 2003. Three views of entrepreneurial opportunity. In: Acs, Z.J., Audretsch, D.B. (Eds.), *Handbook of Entrepreneurship Research*. Springer, USA, pp. 141–160.
- Schumpeter, J., 1934. *The Theory of Economic Development*. Harvard University Press, Cambridge MA.
- Schumpeter, J., 1942. *Capitalism, Socialism and Democracy*, Fifth edition. Allen & Unwin, London.
- Shane, S., 2003. A General Theory of Entrepreneurship, the Individual-Opportunity Nexus. Edward Elgar, UK.
- Shane, S., 2000. Prior knowledge and the discovery of entrepreneurial opportunities. *Organization Science* 11 (4), 448–469.
- Shane, S., Venkataraman, S., 2000. The promise of entrepreneurship as a field of research. *Academy of Management Review* 25, 217–226.
- Simon, H.A., 1967a. A behavioural model of rational choice. In: Alexis, M., Wilson, C.Z. (Eds.), *Organizational Decision Making*. Prentice Hall, New-Jersey, pp. 174–185.
- Simon, H.A., 1967b. Theories in decision making in economics and behavioural science. In: Alexis, M., Wilson, C.Z. (Eds.), *Organizational Decision Making*. Prentice Hall, New-Jersey, pp. 201–222.
- Simon, H.A., 1991. Making management decisions: the role of intuition and emotion. In: Kelly, J., Prince, J.B., Asfort, B. (Eds.), *Organizational Behaviour*, 2nd edition. Prentice Hall, New-Jersey, pp. 314–324 (Also, 1987. *The Academy of Management Executive* 1/1, 57–64).
- Strauss, A.L., Corbin, J., 1990. *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. Sage, CA.
- Stinchcombe, A.L., 1990. *Information and Organizations*. University of California Press, Berkeley.
- Tushman, M.L., Scanlan, T.J., 1981a. Characteristics and external orientations of boundary spanning individuals. *Academy of Management Journal* 24 (1), 83–98.
- Tushman, M.L., Scanlan, T.J., 1981b. Boundary spanning individuals: their role in information transfer and their antecedents. *Academy of Management Journal* 24 (2), 289–305.
- Vaghely, I. P., 2005. Une exploration du processus de traitement de l'information par l'individu dans les organisations. Doctoral Thesis, Université du Québec à Trois-Rivières. Also: http://www.irec.net/01fr_rechercheaffiche.php37575.
- Vaghely, I.P., Julien, P.A., Cyr, A., 2007. Information transformation: some missing links. *Human Systems Management* 26 (3), 157–172.
- Von Krogh, G., Ichijo, K., Nonaka, I., 2000. *Enabling Knowledge Creation*. Oxford University Press, pp. New-York.
- Vygotski, L.S., 1986. *Thought and Language*. MIT Press, Cambridge, Mass.
- Ward, T.B., 2004. Cognition, creativity, and entrepreneurship. *Journal of Business Venturing* 19 (2), 173–188.
- Weick, K., 1995. *Sensemaking in Organizations*. Sage, Thousand Oaks.
- Yli-Renko, H., Autio, F., Sapienza, H.J., 2001. Social capital, knowledge acquisition, and knowledge exploitation in young technology-based firms. *Strategic Management Journal* 22 (6), 587–613.
- Zahra, A.S., George, G., 2002. Absorptive capacity: a review, reconceptualization, and extension. *Academy of Management Review* 27 (2), 185–203.
- Zeleny, M., 2005. *Production of knowledge: moving from data and information to knowledge and wisdom*. *Human System Management: Integrating Knowledge, Management and Systems*, USA. World Scientific Publishing, USA, pp. 1–77.