

OPPORTUNITY ACKNOWLEDGEMENT AS A COGNITIVE PROCESS OF ALIGNMENT: EVIDENCE FROM VERBAL PROTOCOLS*

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INTRODUCTION

Following the works of Shane and Venkataraman (2000), the concept of *opportunity* has become the focus of a growing body of research at the interface of management, strategy and entrepreneurship (e.g., Eckhardt & Shane, 2003; Gartner et al., 2003). Interestingly, there is also a long tradition of research in managerial cognition that looks at the relationship between managers categorization of environmental stimuli as threats or opportunities, and the ensuing response of a firm (e.g., Barr, 1998; Chattopadhyay et al., 2001; Dutton & Jackson, 1987).

In both literatures, however, an important question remains as to what specific cognitive processes enable entrepreneurs/managers to interpret new information as signaling an opportunity. In a series of recent presentations and papers, Baron proposed that opportunity recognition involves the recognition of complex patterns (Baron, 2006). While the proposition is relevant, it remains that to date, no empirical research has been conducted on any particular form of pattern recognition. As a result, research at the interface of management, organizational cognition, strategy and entrepreneurship is still limited in its understanding of the cognitive processes that enable individuals to identify, recognize and/or discover promising opportunities.

To address this issue, we develop and test a model of opportunity acknowledgement as a cognitive process of structural alignment (Gentner, 1983; 1989). The model proposes that in reasoning about what to do with new technologies, entrepreneurs spontaneously seek to ‘align’ the superficial features and structural relationships of that technology to the superficial features and structural relationships of potential markets. We provide qualitative evidence in support of this model by conducting a verbal protocol experiment with two groups of expert entrepreneurs.

STRUCTURAL ALIGNMENT AND OPPORTUNITY ACKNOWLEDGEMENT

The model we develop in this research rests on three assumptions. First, we build on Venkataraman and Sarasvathy’s conception that “entrepreneurship consists in matching up the products of human imagination (as embedded in products, firms and other potential means of supply) with human aspirations (i.e., latent demand, as in market needs or problems that are poorly satisfied) to create markets for goods and services that did not exist before the entrepreneurial act (2001: 653).” In line with their work, we define entrepreneurial opportunities as the potential ‘*match-up*’ of means of supply with latent demand.

Second, we follow McMullen and Shepherd's (2006) proposition that the identification / recognition / discovery of potential opportunities by an individual is a distinct phenomenon, conceptually and empirically, from his or her decision to actively pursue the exploitation of a specific opportunity. Our paper focuses exclusively on the former.

Finally, we articulate our cognitive model on a third assumption, which stipulates that individuals naturally form mental representations of the world surrounding them, and of their position and action in this world (Ericsson & Simon, 1993). Building on Venkataraman and Sarasvathy's (2001) concept of opportunity, it follows that in opportunity-relevant situations, individuals spontaneously construct mental representations of markets and means of supply.

A Cognitive Process of Structural Alignment

Having established these assumptions, we turn to the implications of structural alignment research for understanding the cognitive processes of opportunity acknowledgment. One of the central findings from this research is that the formation of mental representations takes place at two distinct levels: one concerned with the *superficial features* of these representations, and a second concerned with the *structural relationships* that unite superficial features within a representation (Gentner, 1983; 1989). The following illustrates the distinction with respect to an opportunity reported in Shane (2000), i.e., the potential for applying the 3DP™ technology developed at MIT (a new means of supply) in the domain of industrial design (a market with latent demand). Examples of superficial features forming the representation of the technology include who developed the technology, the components of the technology, the material it uses, and what the technology produces. Examples of superficial features in the domain of industrial design include the designers, the objects they conceive, the materials that these objects are made of, or the tools that designers use. Examples of structural relationships include the particular capabilities of the 3DP™ technology, and the particular needs of industrial designers.

But while the above speaks to the *formation* of mental representations as hierarchies of superficial features united by structural relationships, the importance of structural alignment research remains in the *processing* of those representations. A fundamental finding of this research is that while they may be processed by different reasoning mechanisms, both superficial features and structural relationships can be attended to, and may thus influence the reasoning outcome – in this case, one's acknowledgement of a potential opportunity. To the extent that individuals naturally form hierarchically-structured mental models of the stimuli they encounter, and that opportunities can be conceived as the alignment of mental models of new means of supply and mental models of latent demand conditions in a particular market, it follows that entrepreneurs' reasoning about potential opportunities could effectively seek to align the superficial features and structural relationships of the two. These considerations imply the following two hypotheses, formulated in light of the research design developed below:

H1: In their verbalized efforts to search for, identify and explain potential opportunities, entrepreneurs will make statements indicating that they are aligning the superficial features of new technologies they learn about with the superficial features of the markets where they consider applying these technologies.

H2: In their verbalized efforts to search for, identify and explain potential opportunities, entrepreneurs will make statements indicating that they are aligning the structural characteristics of new technologies they learn about with the structural characteristics of the markets where they consider applying these technologies.

In line with structural alignment research, however, we further postulate that in opportunity acknowledgement, structural considerations become particularly important. Several observations reinforce this postulate. For instance, scholars observed that even if considerations of superficial similarity play a particularly important role in memory-driven processes (Gentner et al., 1993), experts in a domain readily access mental models that emphasize deep structural relationships (Chi et al., 1981). In turn, cognitive scientists observed that if reliance on superficial features played an important role in influencing access and retrieval from memory, structural relationships proved particularly important for guiding the evaluation of candidate inferences (cf., Gentner, 1989; Gentner et al., 1993). In other words, structural similarity plays a key role in determining whether an insight is reasonably sound. Building on those observations, we propose that in their efforts to search for, identify and explain potential opportunities for a technology, entrepreneurs will emphasize considerations of structural similarity over considerations of superficial similarity. This is formalized in the following hypothesis.

H3: In their verbalized efforts to search for, identify and explain potential opportunities, entrepreneurs will emphasize the alignment of structural relationships, and that over the alignment of superficial features of markets and technologies.

RESEARCH METHODS

We test the above hypotheses by analyzing a series of verbal protocols (Ericsson & Simon, 1993). In practice, we developed an opportunity acknowledgement exercise, where we presented experienced entrepreneurs with short descriptions of new technologies, and asked them to ‘*think out-loud*’ as they answered the question “what business opportunity(ies) could you pursue with that technology?” We conducted the experiment with two groups of entrepreneurs: a first with experience in life-science technologies, and a second from the area of marketing services. Two rationales motivated the choice of these two groups. Because our research material draws from real technologies (NASA’s EASTTM technology and MIT’s 3DPTM technology), it became important to select entrepreneurs who were unlikely to know about the opportunities currently pursued with these technologies. In parallel, conducting the experiment with entrepreneurs sampled from two populations broadens the external validity of our observations. This sample size of nine entrepreneurs is comparable to other verbal protocols studies (e.g., Melone, 1994; Sarasvathy et al., 1998). It should also be noted that all entrepreneurs completed two opportunity exercises, generating a total of 18 protocols.

To test these hypotheses, we built a coding scheme integrating two sets of considerations at the basis of our model. On the one hand, we drew from Venkataraman and Sarasvathy’s (2001) conceptual definition of opportunities to infer that when searching for opportunities, entrepreneurs’ reasoning could be articulated in terms of four theoretical possibilities: (a) market considerations alone; (b) technology considerations alone; (c) considerations of the alignment between both market and technology; and (d) other considerations. On the other hand, we drew from the work of cognitive scientists who showed that comparison reasoning could proceed at two levels, namely in terms of superficial elements, and structural relationships.

The analyses below use two *absolute* measures of cognitive importance: the number of statements made for each type of consideration, and the total duration of these statements (in seconds). In addition, our observations include the percentage of time devoted to these statements relative to the total duration of each participant’s verbal protocol, highlighting the *relative* importance given to different types of consideration.

Two coders independently coded the raw data: the first author, and a graduate student who was blind to both the theoretical rationales underlying the study, and the particular hypotheses tested. The percentage of agreement value of 90.72% and Cohen's κ value of .822 indicate that the initial coding reached acceptable levels of inter-rater reliability. Both coders discussed the discrepancies and reached agreement on all statements before proceeding with the final tallying up of the results.

RESULTS

By and large, entrepreneurs in our study made very few statements emphasizing superficial features of the technologies, or of the markets. Across both samples and both technologies, such statements account for 13% or less of verbalization time, on average. This indicates that very little of participants' thinking was based on superficial considerations of technologies or of markets taken in isolation. If anything, superficial considerations appeared early in participants' efforts to understand the technology stimulus, or in their initial search for potential markets where to apply this technology. That said, *no* entrepreneurs made statements emphasizing the parallels between superficial features of technologies and markets, *taken together*. Support for Hypothesis 1 is thus denied.

By contrast, support for Hypotheses 2 and 3 is much stronger. At a first level, all the entrepreneurs in the study made statements emphasizing structurally-relevant considerations of the markets in which they proposed applying NASA's EAST™ technology: indeed, such statements account for an average of 51.9% of life-science entrepreneurs' idea-verbalization time, and for an average of 24.71% of marketing-service entrepreneurs' idea-verbalization time. Interestingly, entrepreneurs' acknowledgement of opportunities for MIT's 3DP™ technology appears to rest more squarely on their attention to the structural capabilities of the technology: all life-science entrepreneurs, and one from a marketing-service firm, made specific statements to that effect (for 33.5% and 14.5% of their verbalization time). Three life-science entrepreneurs also made statements emphasizing structurally-relevant considerations of markets where they proposed to apply the MIT technology (accounting for 16.0% of their verbalization time).

Over and above those differences, however, we observed that for both sets of protocols, *all* the statements where entrepreneurs emphasized the conjunction of markets and technology rested on structurally-relevant parallels. This observation is consistent for both groups of entrepreneurs, with average verbalization time percentages of 30.6% (life science) and 43.8% (marketing services). This reliance on structural considerations supports Hypothesis 2, and the importance given to structural considerations relative to superficial ones supports Hypothesis 3.

Interestingly, we observed that to the extent that they focused more on superficial features than on structural relationships, entrepreneurs could prove unable to acknowledge any opportunities for the technologies presented. This is as if the superficial features of the technologies were preventing those participants from seeing applications in market domains that were somewhat different from the ones in which the technologies originated. By contrast, we also noted that participants' focus on structurally-relevant parallels was highly associated with their ability to interpret the technology stimuli in light of domains they were more familiar with – an observation that is corroborated by post-experiment data about participants assessments of the prior knowledge they had of the markets they considered.

DISCUSSION AND CONCLUSION

The primary objective of this paper was to generate qualitative evidence to test our model of opportunity acknowledgement as a cognitive process of structural alignment. In that respect, our results indicate that entrepreneurs' efforts to search for, identify and explain potential opportunities for a new technology are primarily articulated in terms of the alignment not of the superficial features of markets and technologies, but of the structurally-relevant parallels between the relevant demand conditions and means of supply. Still, our study indicates that there is more to opportunity acknowledgement than the simple matching of technological solutions to market problems. While it may be practically sound to encourage entrepreneurs to focus on market problems, inefficiencies and other unsatisfied needs, the real challenge of opportunity acknowledgement may lie in transcending the superficial features of markets and technologies, and instead focus on the key structural parallels between the two.

Seen in this light, it is highly relevant to observe that virtually all entrepreneurs in our study attempted to go beyond the superficial features of markets and technologies, to acknowledge opportunities that they perceived as more insightful, more interesting to talk about. This observation is consistent with extant cognitive research showing that the superficial features of a new/unfamiliar stimulus may prime entrepreneurs to interpret the stimulus in light of a more familiar domain. Likewise, it is directly in line with studies showing that entrepreneurs' discovery of opportunities is largely influenced by their prior knowledge. Yet, our observations suggest that the central role of familiarity / prior knowledge might be to help trigger a reasoning cascade towards the more structurally-relevant information. By spontaneously interpreting the new stimulus in light of domains in which they are experts, entrepreneurs are able to forego superficial features. More importantly, they become able to literally transcend the superficial dissimilarities between the unfamiliar technologies and the more familiar markets, and zero-in on the key structural parallels between the two.

Important avenues for future research would be to explore in more depth the cognitive processes that govern superficial priming, familiarity, and one's ability to focus on and process structural information. These questions present us with interesting challenges. In the end however, we hope that by empirically testing a model of the cognitive processes that enable the acknowledgement of potential opportunities, we help address issues that have remained unaddressed in both the entrepreneurship and managerial cognition literatures.

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