# **DRAFT**

## THE REPRESENTATION AND COMPREHENSION OF OPPORTUNITY IN CORPORATE ENTREPRENEURSHIP

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*Dear Classmates,*

*This draft is the culmination of ongoing research and questioning in the areas of corporate entrepreneurship, distributed cognition, and the role of information technology. Be warned, numerous linkages are incomplete or in need of further development.*

*All comments are welcome. I appreciate your feedback!*          *– Erik*

*"Organizations react to imperfect representations of the environment, rather than to the environment itself."*

- Karl Weick

## ABSTRACT

This paper applies distributed cognition theory to corporate entrepreneurship and specifically opportunity representation within the firm. Distributed cognition research examines the instrumental role of representations in ongoing meaning making, viewing organizations as socio-cognitive systems which are activated and united by different "information interfaces" (Boland and Te'eni 1994, Hutchins 1995).

Broadly speaking, corporate entrepreneurship has been examined as dedicated environment scanning, the spawning and growth of corporate ventures, as well as one of several mechanisms of organizational learning (Burgelman 1983, Bhave 1994, Campbell 2003). Process-focused theories of "realized strategy" in corporate entrepreneurship (Bower 1970, Noda and Bower 1996) emphasize the interaction of *strategic context* (what management frames as desirable) and *structural context* (what the organization will accommodate). This suggests 1) a need for management to characterize the emerging environment as well as "opportunity areas" for the firm, and 2) a related demand for mid-level managers to champion strategic initiatives and refine opportunities on behalf of the firm. This information interface, its artifacts, and implications for IT are the central topic of this paper.

According to Bower, resource allocation, and specifically staged investment, signals what opportunities are congruent with the objectives of management and the firm. Of interest here, different representations of opportunity (e.g. new industries, emerging market categories) may have certain strengths and weakness with respect to comprehension and inference ability at the individual, group, and organizational level. IS research in multimedia (Lim and Benbasat 2002), as well as other studies of information presentation (Tufte 1990, Horn 2000), have shown that information form can significantly impact comprehension and inference of organizational information.

This paper asks: In corporate entrepreneurship, how do organizations represent and comprehend opportunity? What representations maximize group inference ability? Lastly, given known social-cognitive demands of corporate entrepreneurship, can the current use of information technology in corporate entrepreneurship be considered "rational"?

The paper is structured as follows: First a brief review of empirical findings in information representation is presented. Next, different forms and key processes of corporate entrepreneurship are examined. This is followed by a brief presentation of distributed cognition theory and research. The paper concludes by considering implications for IT and ways to research opportunity representation and comprehension in corporate entrepreneurship.

**Empirical Findings in Information Representation**

Before examining the different forms and processes of corporate entrepreneurship, it is first useful to consider empirical findings in information representation.

*1. IS studies of multimedia*

Lim and Benbasat have shown that multimedia systems, by increasing the comprehension of *explanative information*, enable individuals to make correct inferences about new organizational situations [*The Influence of Multimedia on Improving the Comprehension of Organizational Information*, Journal of Management Information Systems, 2002]. In a comparison of two intranet presentation systems - one multimedia, one text-only, each with equivalent verbal information content - they conclude "results show that multimedia facilitates the [individual] retention and subsequent recall of *explanative information* (organized facts connected by their underlying functional relationships), but not of *descriptive information* (isolated facts without an explanation of the relationships between these facts)." Therefore, if given a choice - and technology is not cost prohibitive - managers are advised to use multimedia systems, ceteris paribus, when posing a challenge to organization members that requires superior comprehension and inference.

*2. Information visualization/information representation*
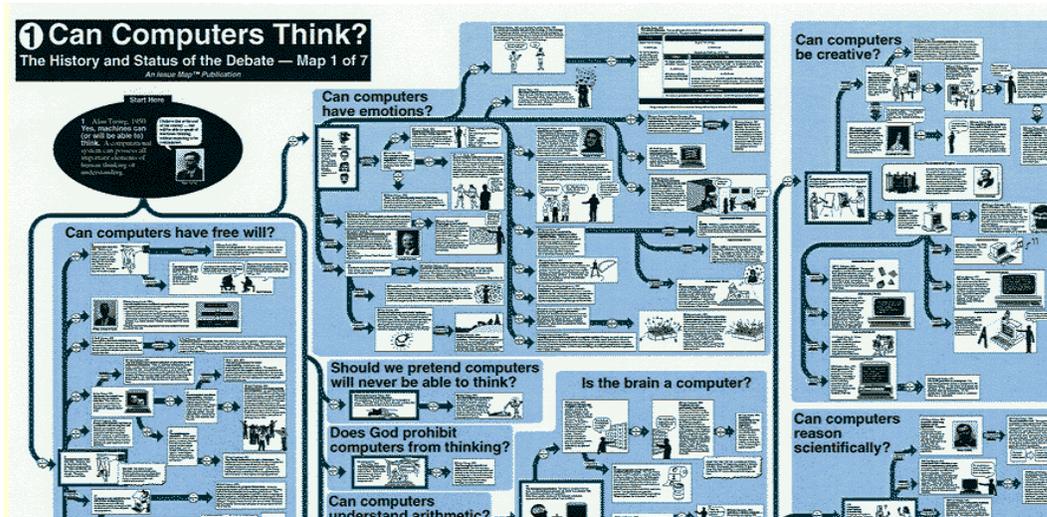


In other studies in the area of information visualization, Horn of Stanford University's *People and Computers* human-computer interaction laboratory has demonstrated that

poster-size "argumentation maps" - which connect shapes, text, and images - facilitate faster information transfer and superior comprehension compared to traditional "stacked" information forms (books and documents)(see above). He has created and tested detailed overviews, capturing the great philosophical debates of Western civilization (i.e. 7 poster-size "maps", versus tens of thousands pages of text). In similar, wall-size posters, he has also mapped the pros and cons of developing the National Missile Defense System. In repeated studies, he has found that information form influences comprehension, the rate of information transfer, and inference ability. In spite of these findings, educators, policy-makers, and corporate entrepreneurs continue to use "stacked", versus poster-dimension, representations.

*3. PowerPoint*

Given the paper's emphasis on corporate entrepreneurship and the information interfaces employed to represent opportunity in an organization, it is essential to consider the ubiquity of Microsoft PowerPoint, arguably the dominant communication platform for the sharing of strategic ideas. An estimated 400 million copies of PowerPoint are in use globally, with several billon slides produced annually (Tufte 2001) for use in "live" or stand-alone presentations.

Known weaknesses of PowerPoint, some of which were identified in Tufte's recent examination of contributing factors to the recent space shuttle disaster (noted on CNN News, December 15, 2003) include: important information is often obscured by the standardized format and intendedly multi-associative information is generally presented in serial form. Concepts are sequentially "delivered to" and removed from the visual field. This presents a challenge to cognitive processes such as memory and pattern recognition. Furthermore, PowerPoint does not explicitly support the linking of multiple interpretations.

*4. Summary*

Given compelling experimentation and results in the area of information design and presentation, one question is: What are the respective strengths and weaknesses of

different information forms employed in corporate entrepreneurship? Also, can information technology use in corporate entrepreneurship, and specifically the representation of opportunity, be said to "rational"? More specifically, do existing information forms and systems used to represent opportunity fit with known cognitive and social requirements of the corporate entrepreneurship process?

**The focus of corporate entrepreneurship**

Existing studies of corporate entrepreneurship have pointed to the variety of forms corporate entrepreneurship can take (Burgelman 1983, Bhave 1994, Campbell 2003). These include, but are not limited to, dedicated environmental scanning, corporate venturing to develop new capabilities and pursue new markets, and strategic renewal, namely, experimentation to refresh or recast the purpose of the firm. It is quite apparent some treatments of corporate entrepreneurship are broader than others, with strategic renewal standing out as the most far-reaching interpretation of the process and function of corporate entrepreneurship.

For purposes here, three primary lenses are considered: corporate entrepreneurship as dedicated scanning of the environment for opportunities, the allocation of resources for corporate ventures in new, emerging markets (Bower 1970, Noda and Bower 1996, Gilbert 2004), and the internal selection of promising strategic initiatives (Aldrich 1979). Although a full treatment of definitional issues and debates in corporate entrepreneurship is beyond the scope of this paper, below an effort is made to highlight the distributed nature of opportunity representation within the firm as well as to discuss how ongoing meaning making is negotiated.

*1. The locus of environment scanning*

Research in environmental scanning has shown that the locus of scanning in organizations is diffuse and not hierarchical (Hambrick 1981). In a variety of studies, observed scanning activity of upper-level executives is no greater than middle-level executives, irrespective of planning prescriptions. Summing up findings, Hambrick

concludes, "If we appropriately view scanning as the first step in the chain of perceptions and actions leading up to the organization's adaptation to its environment, the possibility of scanning voids seems particularly risky."

In the context corporate entrepreneurship, scanning is a necessarily social process where interpretations of the environment are represented and negotiated. As Karl Weick (1969) writes, "organizations react to representations of the environment versus to the environment itself." While the mental models and framing effects of organization members have been studied (Tripsas 2002, Porac 1990), to the best knowledge of the author, few studies have assessed the visual representation and comprehension of the environment and opportunities in scanning. Some questions include: What information forms foster (and discourage) organizational comprehension and inference? Also, given the diffuse non-hierarchical structure of scanning, how do different information forms differ with respect to: ease-of-sharing/ease-of-distribution, ease-of-creation/ease-of-modification, ease-of-connection (among different opportunities), and other metrics such as bias.

*2. Corporate entrepreneurship as a resource allocation process*

One broadly accepted definition of entrepreneurship promulgated by Howard Stevenson of Harvard is: *entrepreneurship is the pursuit of opportunities without regard to the resources currently controlled* [by the firm] (Stevenson 1990). Adopting this definition to the domain of corporate entrepreneurship, Nado and Bower suggest management's role is to set the *strategic context* for the firm. By identifying general objectives and priorities, i.e. what "fits" with, and is irrelevant to, the future growth of the firm, management creates an internal environment where certain strategic initiatives become attractive (or untenable) to lower-level organization members. In the so-called Bower-Burgelman model (Burgelman 1983), mid-level managers compete for scarce firm resource, and the acquisition of outside resources, betting career success on the definition and pursuit of certain opportunities.

Gilbert has described this process as "realized strategy" because equally important to *strategic context* is the *structural context* in which corporate entrepreneurship occurs (2004). Namely, while management may identify opportunity areas, actual action derives from the flexibility or rigidity of the firm. *Structural context* describes what the organization is both willing and capable of doing. In this frame, corporate entrepreneurship is "bottom-up" because internal champions are needed to define and advance specific opportunities.

Combining strategic context and structural context the model suggest corporate entrepreneurship is a process of resource allocation, and more specifically staged investment, where internally-developed opportunities are selected for their overall promise to the firm. Intermediate processes include what the Noda and Bower call *impetus*, where other organization members are actively promoted to and enlisted. The intrafirm process of resource allocation serves the function of selection (Aldrich 1979) to reward and support champions of strategic initiatives that adhere to organizational objectives. Of interest here are the various information representations used to give strategic context to the organization, as well as evolving representations of opportunity employed to compete for scarce firm resources.

Representations of opportunity might include CAD/CAM renderings, PowerPoint slides, business plans, as well as physical prototypes. Relevant literatures not explored here due to space limitations include von Hippel's research on boundary-spanning in innovation, Carlile's examination of boundary objects (2002), as well as Nunamaker's work on group decision support systems.

Of greatest interest to the author is the relationship between the *breadth* of given opportunities (multi-business vs. product-level) and the overall abstractness and precision of representation. Most interesting examples of opportunity include: new industries, the emergence of new market categories, and other types of discontinuous change. One intended facet of the broader research effort is to compare the level of abstraction of

different opportunities as captured in the artifacts of environment scanning, internal selection, and resource allocation.

The following section presents an overview of distributed cognition theory and research. The goal is to begin to link the various representations of opportunity in corporate entrepreneurship with distributed cognition theory and other empirical findings in information representation.

**Distributed Cognition Theory and Research**

Originally treated by Roberts in 1964, distributed cognition has appealed to a growing audience of researchers. According to Hutchins (2000),

"Anthropologists and sociologists studying knowledge and memory, artificial intelligence researchers building systems to do distributed problem solving, social psychologists studying small group problem solving and jury decision-making, organizational scientists studying organizational learning, philosophers of science studying discovery processes, and economists and political scientists exploring the relations of individual rationality, all have taken stances that lead them to a consideration of the cognitive properties of societies and individuals."

Distributed cognition shifts the boundaries of traditional cognitive studies to consider the social interactions and work materials of groups as part of a broader cognitive system. As studied by Hutchins, such small socio-technical systems include the cockpit of an airplane, the bridge of a Navy ship, or other organizational environments where social coordination and the use of distributed resources are critical to performance (Hutchins 1995). Unlike traditional inquiries into cognition, which focus almost exclusively on processes inside the mind, distributed cognition aims to explore how intellectual teamwork between people and technology plays out "in the wild."

For decades, cognition has been studied as a black box problem. Experiments have been devised to explore information-processing rules within the brain. The dominant model

has been that the brain is a piece of computational "wet-ware." Therefore, scientists mostly have studied how specific inputs lead to select outputs based on certain internal, invisible mechanisms. Hutchins and others, partially inspired by advances in traditional cognitive studies, have aimed to messy up these time-honored distinctions to better understand the broader nature of cognitive phenomena in real-world settings. Because cognition does not occur inside well-defined boundaries and cognitive processes have effects in the physical/social world, Hutchins and others have challenged the traditional scope of cognitive studies to expand the frame of research. Hutchins states, "Distributed cognition looks for cognitive processes, wherever, they may occur, on the basis of the functional relationships of elements that participate together in the process." Social interactions, work materials, aspects of the physical environment and information interfaces are all central to the study of distributed cognitive systems.

Working inside new battle lines, Hutchins has researched the way human-machine systems coordinate to complete complex tasks. In this vein, Hutchins made an extensive study of the bridge (command center) of a U.S. Navy ship. Attempting to understand the distributed process of navigation (how a military ship staff sets and maintains a course) he examined the physical and conceptual spaces relevant to navigation. This inquiry included the study of "traditional" human-machine interface objects (i.e. course plotting displays, navigational dials), but also extended to include group communication systems (i.e. special language, specialized media), as well as individual and shared cognitive spaces (i.e. varying representations of objectives and procedures). The end product is a rich mosaic illuminating not only the detailed collaboration between people, processes, and technologies, but also a convincing demonstration of how a ship crew is a cognitive system that can only be understood by its diffuse, interrelated cognitive processes.

In sum, according to Hutchins, the study of distributed cognition focuses on the following three questions, each of which arguably pertain to the distributed process of opportunity comprehension in corporate entrepreneurship:

- How are the cognitive processes we normally associate with an individual mind implemented in a group of individuals?

- How do the cognitive properties of groups differ from the cognitive properties of the people who act in these groups?
- How are the cognitive properties of individual minds affected by participation in group activities?

**Other Defining Ideas of Distributed Cognition**

Before turning to possible strengths of different representations of opportunity, the following section briefly considers other defining ideas of distributed cognition. Topics include: social interaction, physical space as cognitive space, and cognitive work.

*1. Social interaction*

As highlighted above, distributed cognition considers social interactions as part of a broader cognitive system. In Hutchins' cognitive ethnographic study of shipboard navigation, he observed that social relations between officers and related work materials are inseparable from the core task being performed by the group. In essence, basic human relations, communication, and information-sharing are all required to execute coordinated cognitive work.

In this framework, it is fruitless to limit study to the inner worlds of individual brains. Instead, cognition is to be found between individuals and technologies, as well as across membership of a social network. Hutchins states, "Social organization is itself a form of cognitive architecture…. If this view is accepted, it has an odd consequence: we can use the concepts, constructs, and explanatory models of social groups to describe what is happening in a mind." In short, in a distributed cognition framework, social interactions, and specifically communication acts, are key synapses in the broader cognitive system.

*2. Physical space as cognitive space*

Because social cognitive systems operate "outside" of individual cognitive processes, all physical space is viewed as cognitive space. More specifically, groups draw upon representational media to coordinate activity and drive communication. Given this framework, distributed cognition researchers afford special importance to the role of

representations in accomplishing tasks. According to Hutchins, "One key focus of research based on distributed cognition is the nature of representations and the ways that people use representations to do work." For this reason, some suggest that distributed cognition researchers are leading the redefinition of human-computer interaction, with various interesting possible impacts to the organization.

*3. Cognitive work*

As the concept of the cognitive system expands, new methods appear for managing and offloading cognitive work. More specifically, individuals and groups use the physical environment to simplify cognitive tasks and to free themselves up for other challenges. Nearly every person at some time has left a note by the door so as not to forget something important. Similarly, organizations devise elaborate associative and pneumonic systems to increase efficiency. According to Hutchins, "The material world also provides opportunities to reorganize the distributed cognitive system to make use of a different set of internal and external processes."

*4. Summary*

The point that physical space is a resource for cognitive work is intuitive when considering a dense cluster of instruments in a plane cockpit alongside the structured roles of pilot and co-pilot. However, this is far less obvious when considering distributed opportunity comprehension in the context of corporate entrepreneurship. Information representations, either on the wall or online, help shift attention and direct the distributed cognitive resources of an organization.

**Empirical Predictions to Test**

Based on the discussion presented above, I offer the following propositions for empirical testing:

    i.      For the same opportunity, corporate entrepreneurs in competing organizations will employ different representations to capture the key characteristics of that opportunity.

    ii.     Innovators will use more abstract representations of opportunity:
        a.  to demonstrate "fit" with *strategic context* set by management and,
        b.  to facilitate ongoing meaning-making and connection-making in the organization

    iii.    Innovators will also use more specific/detailed representations of opportunity to facilitate resource allocation

    iv.    Innovators will represent opportunities using information forms that facilitate comprehension and inference.

**Implications for IT**

The discussion above presents a range of potential implications for IT. One question concerns the possible need to support new information forms in the workplace.  To be clear, in no way does the author argue for technology adoption for its own sake or any stance in line technological determinism. In fact, the emphasis on opportunity *representation,* rather than broader information systems or technologies, demonstrates a conscious attempt to focus on core cognitive processes involved in opportunity comprehension and to avoid technology issues, at least for the present moment.

IT researchers like Boland have made limited forays into information technology intended to support distributed cognition (Boland and Te'eni 1994). Boland's beta system SPIDER provides a text-focused platform to note and connect "subjective interpretations" among organization members. The discussion presented here has emphasized compelling empirical findings in the area information representation, comprehension and inference

ability. There are several acknowledged problems with leaps between individual, group, and organizational levels.

This stated, for the identified socio-cognitive processes of corporate entrepreneurship, and the specific sub-processes of environment scanning, internal selection, and resource allocation, the role and potential importance of opportunity representation has been addressed. The application of distributed cognition theory to corporate entrepreneurship has allowed for the critical evaluation of questions such as:

- Do current information representations of opportunity support comprehension an inference?
- More specifically, is current IT use (e.g. PowerPoint) a "rational" communication platform for the sharing and negotiation of opportunity?, and lastly,
- How might distributed cognition research aide in the evaluation of human-computer interface (at various levels of analysis) in the context of corporate entrepreneurship?

**Conclusion**

In summary, this paper has raised more questions than answers. By applying distributed cognition theory to corporate entrepreneurship, the aim has been to identify the information interfaces related to opportunity representation and comprehension within the firm. The starting point for this research is compelling experimentation and results in the area of information representation, specifically findings in organizational contexts requiring inference.

In certain ways this paper has examined if information form can impact bounded rationality, and specifically opportunity comprehension, in the context of "distributed" entrepreneurship. Given the size, geographic span, and multi-business nature of certain organizations (and opportunities) it seems reasonable to question the efficacy of different information forms employed in corporate venturing. Sub-fields of IT which are relevant to this general examination include, but are not limited to: information

visualization/business visualization (Tufte 1990, Tegarden 1999, Swabb 2002), the organizational use of multimedia (Lim and Benbasat 2000), and human-computer interaction (Hollan and Hutchins 2000). One idea advanced in the paper is that it is possible to measure the impact and efficiency of different information forms considering the aims and processes of corporate entrepreneurship.

The paper has several severe limitations and omissions, nonetheless, it is intended as part of a broader effort to: analyze socio-cognitive interfaces associated with corporate entrepreneurship (using the framework of distributed cognition), conduct field studies to explore the diversity of opportunity representations (with possible cross-cultural comparison), run controlled experiments with different information forms (different executions of the same opportunity), and examine the "scalability" of different representations (i.e. how different representations accommodate either more complex opportunities or larger scale input and collaboration).

Questions for future empirical study include: What information forms lend themselves to, or fail to address, key information processing goals in corporate entrepreneurship including: ease-of-comprehension, ease-of-inference, ease-of-sharing, and ease-of-connection across multiple organizational levels? Are information forms "instrumental" or "incidental" to opportunity comprehension and inference within the firm? Is the ubiquitous use of PowerPoint rational, or ill advised, considering the social-cognitive requirements of corporate entrepreneurship (environment scanning, resource allocation and selection)? By focusing on one core processes in corporate entrepreneurship, opportunity representation, the aim is to explore the use and importance of IT in opportunity recognition and development.

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